United States Department of Agriculture

Rim Fire Recovery (43033)

Draft Environmental Impact Statement

Forest Service

Stanislaus National Forest

R5-MB-270

May 2014

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Stanislaus National Forest

Lead Agency: USDA Forest Service

Cooperating Agencies: None

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Abstract: This Draft Environmental Impact Statement (DEIS) describes a proposal by the Stanislaus National Forest which would include: salvage of dead trees; hazard tree removal along low standard roads; fuel reduction for future forest resiliency to fire; and, road improvements for proper hydrologic function. The DEIS discloses the direct, indirect and cumulative environmental effects that would result from the proposed action, a no action alternative and two additional action alternatives. The Responsible Official has not identified a preferred alternative at this stage.

Mail comments to: Stanislaus National Forest
Attn: **Rim Recovery**
19777 Greenley Road
Sonora, CA 95370

E-mail Comments to: comments-pacificsouthwest-stanislaus@fs.fed.us [Subject: **Rim Recovery**]

Comment Period: Comment period starts the day after the Environmental Protection Agency publishes a Notice of Availability for the DEIS in the Federal Register.

Reviewer's Note: It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative review or judicial review.

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Summary

The Forest Service prepared this Draft Environmental Impact Statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This DEIS discloses the environmental impacts that would result from the proposed action, a no action alternative and 2 additional action alternatives developed in response to issues raised by the public. The Responsible Official has not identified a preferred alternative at this stage.

Background

The Rim Fire started on August 17, 2013 in a remote area of the Stanislaus National Forest near the confluence of the Clavey and Tuolumne Rivers about 20 miles east of Sonora, CA. Over several weeks it burned 257,314 acres, or 400 square miles including 154,530 acres of National Forest System (NFS) lands. The fire also burned within Yosemite National Park (78,895 acres), Sierra Pacific Industries private timberland (16,035 acres), other private land (7,725 acres) and Bureau of Land Management (BLM) land (129 acres).

The Rim Fire Recovery (Rim Recovery) project is located within the Rim Fire perimeter in the Stanislaus National Forest on portions of the Mi-Wok and Groveland Ranger Districts. The project boundary includes all NFS lands within the fire plus a few locations where road and roadside improvements extend slightly outside the perimeter.

Purpose and Need

The Forest Service identified the following needs for this project.

1. ***Capture Economic Value through Salvage Logging***

   The tremendous number of dead trees across this large landscape creates the need for the removal of this perishable commodity in a timely manner. Leaving the dead trees on site would create a large and dangerous fuel load in this vast area, and future removal of the down material if desired, would be very difficult, costly, and time consuming.

2. ***Provide Worker and Public Safety***

   The Rim Fire significantly increased the risk to human life, safety and property. Providing a safe environment for both public use and the administration of affected roads and facilities is critical.

3. ***Reduce Fuels for Future Forest Resiliency***

   Harvesting dead timber reduces the existing fuel load of standing dead trees to protect multiple resources including soils and watersheds from future high-intensity fires. In order to reintroduce fire into these areas as soon as possible, the current fuel load needs to be reduced.

4. ***Improve Road Infrastructure to Enhance Hydrologic Function***

   Road sediment increases are likely to occur in high soil burn severity areas and to a lesser extent in moderate soil burn severity areas. Ensuring that water is properly funneled through these systems to drainages that can move and utilize this resource is critical for protection of watersheds and soils, and also to provide the best aquatic habitat within these systems.

5. ***Enhance Wildlife Habitat***

   Because the fire burned through 46 California spotted owl PACs, as well as thousands of acres of other critical habitat, retaining old forest structures (large snags and downed logs) is important at this time since future recruitment of these old forest features is not expected to occur until decades to centuries into the future.

Proposed Action

The Forest Service proposed action, within the Rim Fire perimeter on NFS lands includes:

- Salvage of dead trees and fuel reduction (28,326 acres)
- Hazard tree removal and fuel reduction along low standard roads (341 miles or 16,315 acres)
- Road reconstruction (319.9 miles) and road maintenance (216.1 miles)
- New road construction (5.4 miles)
- Temporary road construction (13.2 miles)
- Rock quarry sites (7)
- Water sources (81 locations)

Significant Issues

Scoping identified issues which are a point of discussion, dispute, or debate with the Proposed Action. An issue is an effect on a physical, biological, social, or economic resource. An issue is not an activity; instead, the predicted effects of the activity create the issue. Significant Issues are used to formulate alternatives, prescribe mitigations measures, or analyze environmental effects. Issues are significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflicts. Significant issues listed are based on public comments.

1. ***Health and Safety***
   a. Existing conditions do not provide a safe environment for administration and public use of roads because hazard trees pose a threat to health and safety.
   b. Public conflicts with logging operations along roads and worker conflicts along power lines and Highway 120 pose threats to worker and public safety.
2. ***Snag Forest Habitat***
   a. Proposed activities may affect black-backed woodpecker (BBWO) populations because the woodpeckers may occur at higher densities in areas treated and the project does not include avoidance measures or limited operating periods for nesting BBWO.
   b. Proposed activities may affect spotted owls because remapping of existing Protected Activity Centers (PACs) and Home Range Core Areas (HRCAs) burned in the fire would damage this still viable and important owl habitat.
3. ***New Road Construction***
   a. Proposed new road construction may affect roadless areas and destroy habitat because these areas are currently undisturbed and inaccessible to motor vehicles.
4. ***Wildlife Habitat***
   a. Proposed activities may affect critical deer winter range as well as oak and green island habitat because the project does not include specific protection or enhancement measures.
   b. Proposed management requirements seem excessive (i.e., a one mile buffer for suitable frog habitat and 20 down logs within streams every mile) because these measures are not necessary and the cost of implementation is high.
5. ***Salvage Logging***
   a. Proposed activities may reduce biodiversity, threaten rare plants, and impact the outstandingly remarkable values and integrity of the Clavey River due to impacts from salvage logging.
   b. Application of sporax may affect implementation of the logging because it is not necessary and adds costs.
6. ***Soil and Watershed Impacts***
   a. Proposed activities may affect streams with significant sedimentation and soil loss because of the already compromised condition of these areas and insufficient buffers.

Alternatives Considered in Detail

The action alternatives (Alternatives 1, 3 and 4) and the no action alternative (Alternative 2) are considered in detail. The no action alternative, as required by the implementing regulations of NEPA, serves as a baseline for comparison among the alternatives (73 Federal Register 143, July 24, 2008; p. 43084-43099). The following sections describe each of the alternatives considered in detail (see Map Package and project record for detailed maps of each alternative).

Table S.01-1 provides a summary of the proposed activities included in each alternative and Appendix E (Treatments) provides detailed information for each specific treatment unit.

Alternative 1 (Proposed Action)

Alternative 1 includes salvage logging on up to 28,326 acres including 24,127 acres of ground based, 16 acres of ground based/skyline swing, 2,930 acres of helicopter, and 1,253 acres of skyline treatments. Proposed fuel treatments include 7,626 acres of biomass removal, 24,143 acres of machine piling and burning and 4,199 acres of jackpot burning. Fell and remove hazard trees (green and dead) adjacent to 341 miles of forest roads outside of proposed salvage units, amounting to 16,315 acres. Some non-merchantable trees may be felled and left in place. Alternative 1 includes 5.4 miles of new road construction, 319.9 miles of route reconstruction and 216.1 miles of road maintenance along low standard roads. Within Critical Winter Deer Range and adjacent to Yosemite National Park, units (totaling 1,351 acres) were identified for salvage and/or biomass removal to achieve desired forage/cover ratios and to provide for deer passage and access.

Alternative 2 (No Action)

Alternative 2 (No Action) provides a baseline for comparison with the other alternatives (Table S.01-1). Under Alternative 2 (No Action), general salvage and hazard tree abatement and removal adjacent to lower standard roads would not occur. None of the viable timber would be removed from this area leaving tens to hundreds of tons of fuel per acre once these trees fall down and rendering access for firefighting virtually impossible. No hazard tree removal would occur adjacent to lower standard roads, leaving thousands of existing hazard trees to fall on their own as a result of natural forces.

Alternative 3

Alternative 3 responds to issues and concerns related to Snag Forest Habitat, New Road Construction, Wildlife Habitat, and Soil and Watershed Impacts (Chapter 1.08). Compared to Alternative 1, it addresses those issues by proposing additional wildlife habitat enhancement including biomass removal in Critical Deer Winter Range and the Forest Carnivore Connectivity Corridor (FCCC) Forest Plan Amendment, additional soil and watershed protection (mastication and drop and lop), and less new road construction. It also includes research to help answer wildlife, fuels, watershed, and soils questions.

Alternative 4

Alternative 4 is similar to Alternative 3 except that it replaces new road construction with temporary roads and drops 2,500 acres of salvage logging in highly suitable BBWO habitat. Alternative 4 responds to issues and concerns related to Snag Forest Habitat, New Road Construction, Wildlife Habitat, and Soil and Watershed Impacts (Chapter 1.08) by proposing the same action items as Alternative 3 for wildlife habitat enhancement (including biomass removal in Critical Deer Winter Range and the FCCC Forest Plan Amendment) and, soil and watershed protection (mastication and drop and lop). It also includes research to help answer wildlife, fuels, watershed, and soils questions. Compared to Alternative 3, Alternative 4 further addresses the Snag Forest Habitat issue with additional BBWO habitat retention and the New Road Construction issue with no new road construction.

Alternatives Considered but Eliminated from Detailed Study

NEPA requires that federal agencies rigorously explore and objectively evaluate all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments and internal scoping suggested the alternatives briefly described below. Chapter 2.04 provides the reasons for eliminating them from detailed study.

a. ***Remove the Maximum Amount of Timber Value***
Salvage all NFS lands; produce 5,000 board feet or more per acre; eliminate expensive logging systems to maximize returns; minimize snags retained; and, limit biomass removal costs.

b. ***Hazard Tree Removal Only***
Cut and remove only dead trees adjacent to low standard roads.

c. ***Retain 100 Percent Black-Backed Woodpecker Modeled Pairs***
Retain 100 percent of BBWO pairs on NFS lands; reduce salvage by 7,500 acres; and, reduce hazard tree removal by 1,000 acres.

d. ***Retain 75 Percent of the Black-Backed Woodpecker Modeled Pairs***
Retain 75 percent of BBWO pairs on NFS lands; and, reduce salvage by half.

e. ***Retain Pre-Fire Spotted Owl PAC Boundaries, No PAC Remapping or Retiring***
Retain the 46 burned spotted owl PACs in their original location.

f. ***Natural Succession***
Allow natural recovery; decommission roads; and, reduce erosion, sedimentation and grazing.

Comparison of Alternatives

Table S.01-1 compares the alternatives with a summary of proposed activities.

Table S.01-1 Comparison of Alternatives: Proposed Activities

Proposed Treatments[1]	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Salvage ground based (acres)	24,127	0	26,252	24,176
Salvage ground based/skyline swing (acres)	16	0	16	16
Salvage aerial based helicopter (acres)	2,930	0	3,035	2,568
Salvage skyline system (acres)	1,253	0	1,096	1,066
Subtotal Salvage (acres)	**28,326**	**0**	**30,399**	**27,826**
Hazard Tree Removal (miles)	341	0	314.8	324.6
Subtotal Hazard Tree Removal (acres)	**16,315**	**0**	**15,253**	**15,692**
Total Hazard Tree and Salvage (acres)	**44,641**[2]	**0**	**45,652**[2]	**43,518**[2]
Biomass Removal	7,626	0	8,379	7,975
Mastication	0	0	1,309	1,309
Drop and Lop	0	0	2,228	1,798
Machine Piling and Burning	24,143	0	22,036	20,320
Jackpot Burning	4,199	0	4,147	3,650
Total Fuels (acres)	**35,968**[2]	**0**	**38,099**[2]	**35,052**[2]
New Construction (miles)	5.4	0	1.0	0
Reconstruction (miles)	319.9	0	323.6	315.0
Maintenance (miles)	216.1	0	200.6	209.3
Subtotal Construction and Maintenance (miles)	**541.4**	**0**	**525.2**	**524.3**
Temporary Road (new miles)	3.9	0	9.5	8.4
Temporary Road (existing miles)	9.3	0	22.7	22.1
Temporary Use – Revert (miles)	8.4	0	3.3	3.3
Subtotal Temporary Roads (miles)	**21.6**	**0**	**35.5**	**33.8**
Total Roads (miles)	**563.0**	**0**	**560.7**	**558.1**
Private Roads Needing Right-of-Way (miles)	11.2	0	11.2	11.2
Rock Quarry Sites	7	0	7	7
Potential Water Sources	81	0	81	81

[1] Salvage includes removal of dead trees and fuel reduction; Hazard Tree includes removal of hazard tree and fuel reduction.
[2] Salvage and Hazard Tree acres overlap with Fuel Reduction acres and do not total.

Summary of Environmental Consequences

Table S.01-2 compares the alternatives with a summary of selected environmental effects.

Table S.01-2 Comparison of Alternatives: Summary of Selected Environmental Effects

Resource/Indicator		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Air Quality	Smoke Emissions from Machine Pile Burning	effects to local communities and Yosemite would be minimal due to controlled emissions	none from pile burning, but under uncontrolled circumstances this amount of material would cause issues for sensitive groups	same as alternative 1	same as alternative 1
Aquatics	Foothill yellow-legged frog, Western pond turtle, hardhead, California red-legged frog, Sierra Nevada yellow-legged frog	may affect individuals but not likely to lead to a trend toward federal listing or loss of viability	none	similar to alternative 1	similar to alternative 1
Cultural	Cultural Resources	none	no direct effects, moderate indirect and cumulative effects; may affect resources	same as alternative 1; however, watershed treatments will benefit cultural sites	same as alternative 3
Fire and Fuels	Fire Behavior	fire effects in treated units significantly reduced	future fires would burn with increasingly higher intensities	similar to alternative 1; treatments provide break in fuel profiles	same as alternative 3
	Fire Suppression Capability	high capability; reduced fuel continuities; increased safety; reduced potential for resource damage; potential for reduced costs	capability dramatically declines over time; fire effects exceed firefighter capabilities; fireline production rates decline over time	same as alternative 1	same as alternative 3
	Fuel Loading	surface fuel loading reduced to 10 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	Increased surface fuel loading over time, to an estimated 98 tons/acre in 30 years; future reburn likely to lead to substantial erosion and sedimentation	surface fuel loading reduced to 10-20 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	same as alternative 3
Invasive Species	Habitat Alteration and Vectors	high risk for habitat alteration; high risk of increased vectors	none	moderate risk for habitat alteration and moderate to high risk of increased vectors because of additional management requirements	same as alternative 3
Range	Rangeland Vegetation	no long term changes to vegetation types; beneficial effect on rangeland vegetation condition	no direct effects; potential for negative indirect effects from falling dead trees	same as alternative 1	same as alternative 1
Recreation	Recreation Access and Opportunities	negative effects on some developed recreation sites; short term negative impacts to dispersed recreation; positive effects to public safety and recreation access	negative long-term effects to recreation access and public safety; closure of some developed recreation sites is likely to result in over-use of open developed sites	same as alternative 1	same as alternative 1

Resource/Indicator		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Sensitive Plants	Sensitive Plants	management requirements would protect sensitive plants	no direct effects; negative indirect effects might occur from falling dead trees	similar to alternative 1	same as alternative 1
Society	Social and Cultural Impacts	administrative access enhanced, dispersed recreation open, and public firewood gathering allowed	administrative access constrained, dispersed recreation closed, and public firewood gathering not allowed	same as alternative 1	same as alternative 1
	Temporary Employment Generation	6,659 jobs supported	none	6,318 jobs supported	5,511 jobs supported
Soils	Soil Stability and Effective Soil Cover	slight improvements to erosion	erosion rates remain high, slightly higher than alternative 1	improves cover, erosion hazard ratings, and erosion rates in WSAs	similar to alternative 3
Watershed	Riparian Vegetation	beneficial effects to riparian obligate trees and shrubs; management requirements protect fens and meadows	none	same as alternative 1	same as alternative 1
	Stream Condition	no measurable changes in stream flow or channel incision; stream banks not degraded; increases LWD and sediment storage	no measurable changes in stream flow or channel incision; initially less ground cover along stream banks; large levels of LWD and sediment storage over time	no measurable changes in stream flow or channel incision; stream banks not degraded; increases LWD and sediment storage, but less than alternative 2	same as alternative 3
	Water Quality (Beneficial Uses of Water)	water temperature not affected; some sedimentation; limited potential for registered borate compound to contaminate surface waters; no effects to beneficial uses	none	same as alternative 1	same as alternative 1
Wildlife	Valley elderberry longhorn beetle	may affect but not likely to adversely affect	no effect	same as alternative 1	same as alternative 1
	Bald eagle, American marten, Pacific fisher, Pallid bat and fringed myotis	may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability	no effect	same as alternative 1	same as alternative 1
	California spotted owl, Great gray owl, Northern goshawk	may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability	no effect	same as alternative 1	same as alternative 1
	Black-Backed woodpecker	lowest predicted pair density; retains 41 percent of modeled pairs	none; retains 100 percent of modeled pairs	second lowest predicted pair density; retains 46 percent of modeled pairs	highest predicted pair density of the action alternatives; retains 54 percent of modeled pairs
	Mule deer	improves 1,352 acres of Critical Deer Winter Range	none	improves 4,416 acres of Critical Deer Winter Range	same as alternative 3

LWD=Large Woody Debris; WSA= Watershed Sensitive Area

1. Purpose of and Need for Action

The Forest Service prepared this Draft Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Draft EIS discloses the direct, indirect and cumulative environmental impacts that would result from the proposed action and alternatives.

1.01 Document Structure

The document is organized into the following chapters and sections:

- **Chapter 1** (Purpose of and Need for Action): briefly describes the proposed action, the need for that action, and other purposes to be achieved by the proposal. It also details how the Forest Service informed the public of the proposed action and how the public responded.
- **Chapter 2** (The Alternatives): provides a detailed description of the proposed action as well as alternatives developed in response to comments raised by the public during scoping and information gained after the formulation of the proposed action and public scoping period. It includes a summary comparison of the action and effects of the alternatives.
- **Chapter 3** (Affected Environment and Environmental Consequences): describes the environmental impacts of the proposed action and alternatives.
- **Chapter 4** (Consultation and Coordination): provides a list of preparers and others consulted during the development of the EIS.
- **Index**: provides page numbers by document topic.
- **References**: provides a list of references and literature cited in the EIS.
- **Appendices**: provide more detailed information to support the analyses presented in the EIS.
- **Map Package**: the separate map package includes large scale maps showing treatment units and other information included in each alternative.

Additional documentation, including detailed analyses of project area resources, may be found in the project record located at: Stanislaus National Forest, 19777 Greenley Road, Sonora, CA 95370.

1.02 Background

The Rim Fire started on August 17, 2013 in a remote area of the Stanislaus National Forest near the confluence of the Clavey and Tuolumne Rivers about 20 miles east of Sonora, CA. Exhibiting high to extreme fire behavior with multiple flaming fronts, the fire made runs of 30,000 to 50,000 acres on two consecutive days. It quickly spread up the Tuolumne River watershed and its main tributaries: Clavey River, North Fork Tuolumne, Middle Fork Tuolumne, South Fork Tuolumne and Cherry Creek. It also overlapped into the North Fork Merced River. Overall, 98% of the Rim Fire occurred in the Tuolumne River watershed. Over several weeks it burned 257,314 acres, or 400 square miles including 154,530 acres of National Forest System (NFS) lands. The fire also burned within Yosemite National Park (78,895 acres), Sierra Pacific Industries private timberland (16,035 acres), other private land (7,725 acres) and Bureau of Land Management (BLM) land (129 acres)[1].

The Rim Fire is the third largest wildfire in California history and the largest wildfire in the recorded history of the Sierra Nevada. It is also California's largest forest fire, burning across a largely conifer dominated forest landscape. The two larger fires were wind driven brush fires near San Diego in 2003

[1] All acreage figures are based on fire perimeter and land ownership information as of October 24, 2013.

and in Lassen County in 2012. Figure 1.02-1 shows the location of the Rim Fire within the boundaries of the Stanislaus National Forest, Yosemite National Park and the local counties (Mariposa and Tuolumne).

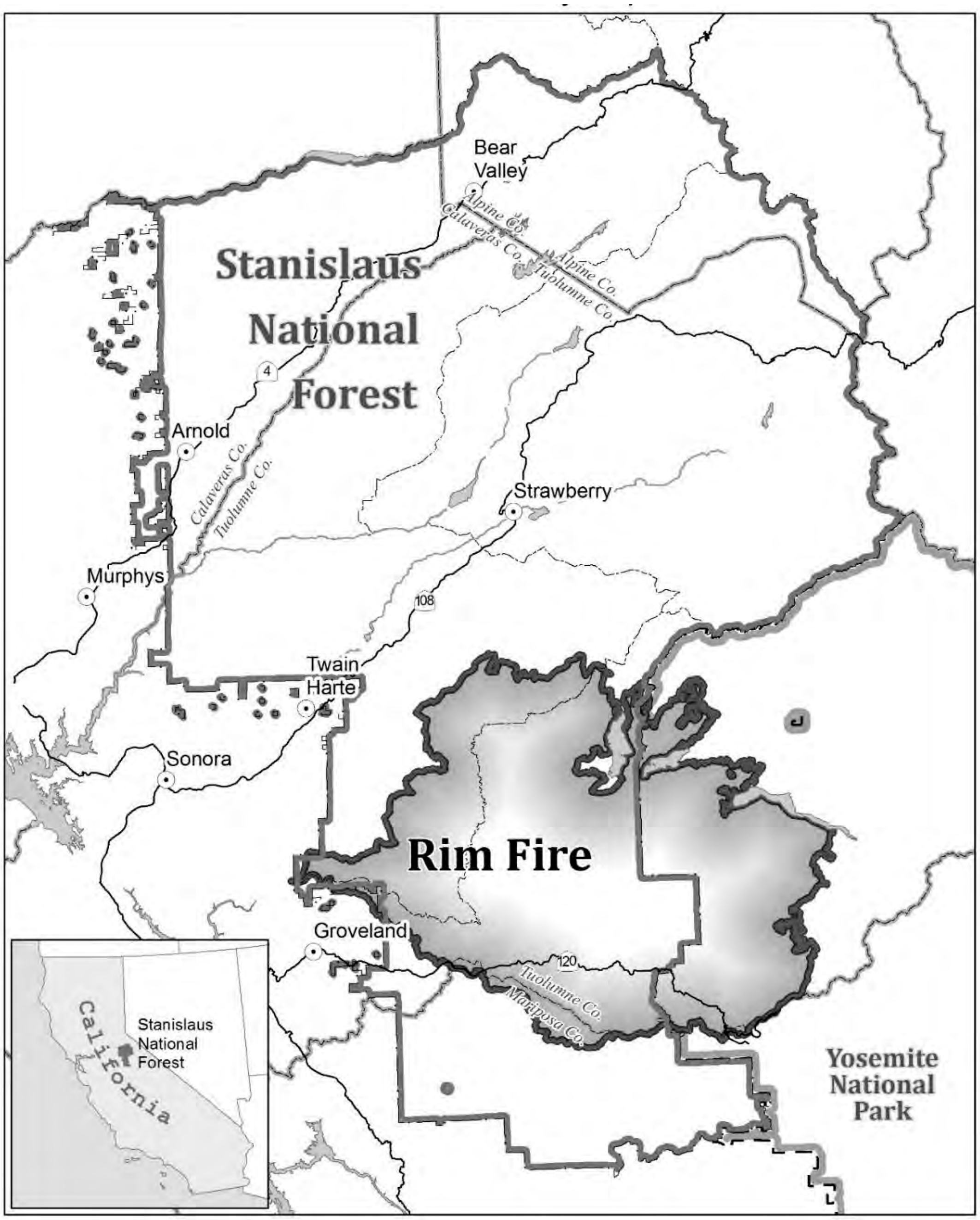

Figure 1.02-1 Rim Fire Vicinity Map

The Rim Fire burned between about 1,000 to 7,000 feet in elevation in a mixed severity mosaic pattern through all the principal vegetative communities within it. The fire impacted a range of California Wildlife Habitat Relationships (CWHR) vegetation classes including grass-oak woodlands, chaparral, lower westside ponderosa pine, mixed conifer forests and high elevation true fir and lodgepole pine. The mosaic pattern of the fire resulted in areas of high, moderate and low vegetation burn severity (Figure 1.04-2) and soil burn severity (Figure 1.04-3).

In addition, part of the land was unburned as fire went around some of the natural features and moist riparian areas. Ground fire stayed out of the tree crowns in some areas with more widely-spaced trees and slight amounts of understory. Weather and timing played key roles in vegetation burn severity; where fire entered during the night or at a time when humidity was higher and the weather calmer, the fire behavior was less volatile. In these and other low soil and vegetation burn severity areas, the result was an underburn that consumed some of the woody fuels on the forest floor leaving green, lightly burned trees in its path. In the moderate severity burn areas much of the canopy was killed, but some over-story trees survived. In the high vegetation and soil burn severity areas, the fire engulfed nearly all of the chaparral, conifer plantations and forests that previously covered the landscape, in some locations continues for miles. Plume-driven fire episodes were the primary driver for much of the high mortality areas where thinning and under burning occurred in the recent years, but with little effect on severity or intensity. In these areas, the fire consumed the vegetation, which serves as a barrier to erosion during winter rains and food or cover for wildlife, leaving only ash behind. All that remain are severely damaged trees that are not expected to survive and standing charred trees with few limbs or needles, or no needles either on the tree or ground beneath.

Due to dangerous conditions from trees damaged or killed by the Rim Fire, access to the project is currently closed to the general public. After determining that circumstances within the burn area presented unsafe conditions for public travel, Stanislaus Forest Supervisor Susan Skalski issued a temporary Forest Order (STF 2013-08) prohibiting public use within the burn area on August 22, 2013. The Forest Supervisor issued several updates changing the closure area in response to current conditions for public safety (2013-09 on 8/23/2013; 2013-10 on 8/31/2013; 2013-11 on 9/12/2013; 2013-14 on 9/27/2013; 2013-15 on 11/18/13). On April 14, 2014, the Forest Supervisor issued the current temporary Forest Order (STF 2014-01), opening portions of the previous closure area and prohibiting public use within the remaining portions of the burn area until November 18, 2014.

Project Location

The Rim Fire Recovery (Rim Recovery) project is located within the Rim Fire perimeter in the Stanislaus National Forest on portions of the Mi-Wok and Groveland Ranger Districts. The project boundary includes all NFS lands within the fire plus a few locations where road and roadside improvements extend slightly outside the perimeter.

Project Development

An event as large as the Rim Fire provides an opportunity to consider restoration at a landscape scale, considering the many ecological structures, processes, and functions that are desirable and sustainable for future forested conditions. The Forest Plan (USDA 2010a, p. 5-15) includes goals to create a fire resilient forest where fire is an integral part of the ecosystem, not a landscape altering force. To sustain forests into the future, natural and prescribed fire will be an important tool to protect this area from another stand replacing event. To that end, Stanislaus National Forest Fire and Fuels managers together with Researchers from the Pacific Southwest Research Station (PSW) compiled a strategy for the Rim Fire area outlining conditions along with features on the landscape that could help reduce the size and severity of future fires. The goal is not to prevent fires within the forest, but to modify fire behavior to lower severity, and to bring these areas back to a more historic heterogeneous structure where fire complements and sustains the system instead of destroying it. The proposed structures include shaded fuel breaks along roads, large blocks of forest with lower densities adjacent to critical areas (i.e., private property and wildlife emphasis areas), heterogeneous forest structure throughout the area (planting in clumps and variable spacing of trees), limited amounts of plantations on southern and southwestern slopes where natural fire return intervals are high and the tree growing ability is low, and prescribed and natural fire occurs within stands every 5 to 20 years. Such features located across the landscape provide safe locations for firefighters to work from during wildfires and to utilize during prescribed burning activities. The fire and fuels strategy fits well with the overarching objective of sustainable old forests for wildlife and timber production. Several critical wildlife species lost habitat within the Rim Fire; therefore, providing opportunities to return forests to this area is critical for sustainable populations and connectivity of habitat for wildlife movement and expansion.

Simultaneously, Forest wildlife biologists and PSW subject matter scientists evaluated the post-fire Protected Activity Center (PAC) conditions to determine viability of each one and options for those no longer providing the desired habitat. In addition, foresters verified the vegetation burn severity and identified economically feasible timber harvest of dead trees estimated to be a minimum of 5,000 board feet (BF) per acre of trees 16 inches diameter at breast height (dbh) and greater per acre. These three efforts, along with Interdisciplinary (ID) Team review of the area and identification of the potential issues, led to the formation of the Proposed Action and associated Management Requirements.

PSW researchers met with the Forest’s Interdisciplinary Team (ID Team) several times during the fall and winter to identify research questions and opportunities across this landscape. This effort proposed several areas within burned spotted owl PACs to be left intact for long-term research on fire effects on spotted owls, black-backed woodpeckers, and other species. In addition, a multitude of other wildlife, watershed, and forestry studies are proposed within the burn area. Using satellite imagery, the ID Team conducted a unit by unit review of the proposed action in December and identified desired changes. The two additional action alternatives also incorporate public scoping comments, input from collaborative partners (Rim Fire Technical Team and Yosemite Stanislaus Solutions), Tuolumne County officials, and local California Fish and Wildlife Service biologists.

In March 2009, PSW released General Technical Report 220, “An Ecosystem Management Strategy for Sierran Mixed-Conifer Forests” (GTR 220) (North et al. 2009a). GTR 220 emphasized the importance of learning from historic conditions to determine sustainable desired conditions. This report summarized recent scientific literature suggesting that land managers produce different stand structures and densities across the landscape using topography and historic fire behavior to guide treatments. Historically, both topography and fire influenced forest structure and composition in the Sierra Nevada. Management that creates and mimics those historic stand structures and fire-mediated processes will help restore the natural role of fire on the landscape, create structural heterogeneity at multiple scales, and improve habitat quality by providing multilayered canopies and other key structures associated with sensitive wildlife species, such as the Pacific fisher, California spotted owl, and northern goshawk. Although there are no known occurrences of the Pacific fisher on the Stanislaus National Forest, nor is there specific management direction on the Forest to manage for fishers, the fisher is imperiled. Because of this, the ID Team identified habitat connectivity for potential future expansion of forest carnivore populations for the purpose of restoring and enhancing their habitat. In addition, critical deer winter range exists within the Rim Fire area. Yosemite Deer Herd travel, into and through the area, is important for this species to access lower elevation forage, such as grass, oaks, and nutritious acorns, needed for winter survival.

Forest Service direction and intent, recent science summarized by GTR 220, and the Rim Fire Vegetation Resiliency Strategy (project record) provide an extensive foundation of information to draw from during the Rim Recovery planning effort. The analysis in this document focuses on restoring ecosystem function, process, and resiliency by addressing issues related to vegetative composition and structure, forest health, fuels, hardwood and wildlife habitat improvement, and socio-economic objectives. Although these are long-term goals, how and where salvage logging is conducted, if conducted at all, will set the stage for future activities in this area and provide some habitat components within the burn that will not be naturally available for decades to come (i.e., large down woody material).

Figure 1.02-2 shows high soil burn severity and high vegetation burn severity. Figure 1.02-3 shows moderate soil burn severity and high vegetation burn severity. Figure 1.02-4 shows low soil burn severity and low vegetation burn severity.

Figure 1.02-2 High Soil Burn Severity and High Vegetation Burn Severity Photo

Figure 1.02-3 Moderate Soil Burn Severity and High Vegetation Burn Severity Photo

Figure 1.02-4 Low Soil Burn Severity and Low Vegetation Burn Severity Photo

The Rim Fire is not the first wildfire that occurred in this area. Since 1950, ten large fires burned fully or partially within the Rim Fire area leaving portions of the area now burned up to four times over that period. Figure 1.02-5 shows the large fire history of this wildfire dominated landscape.

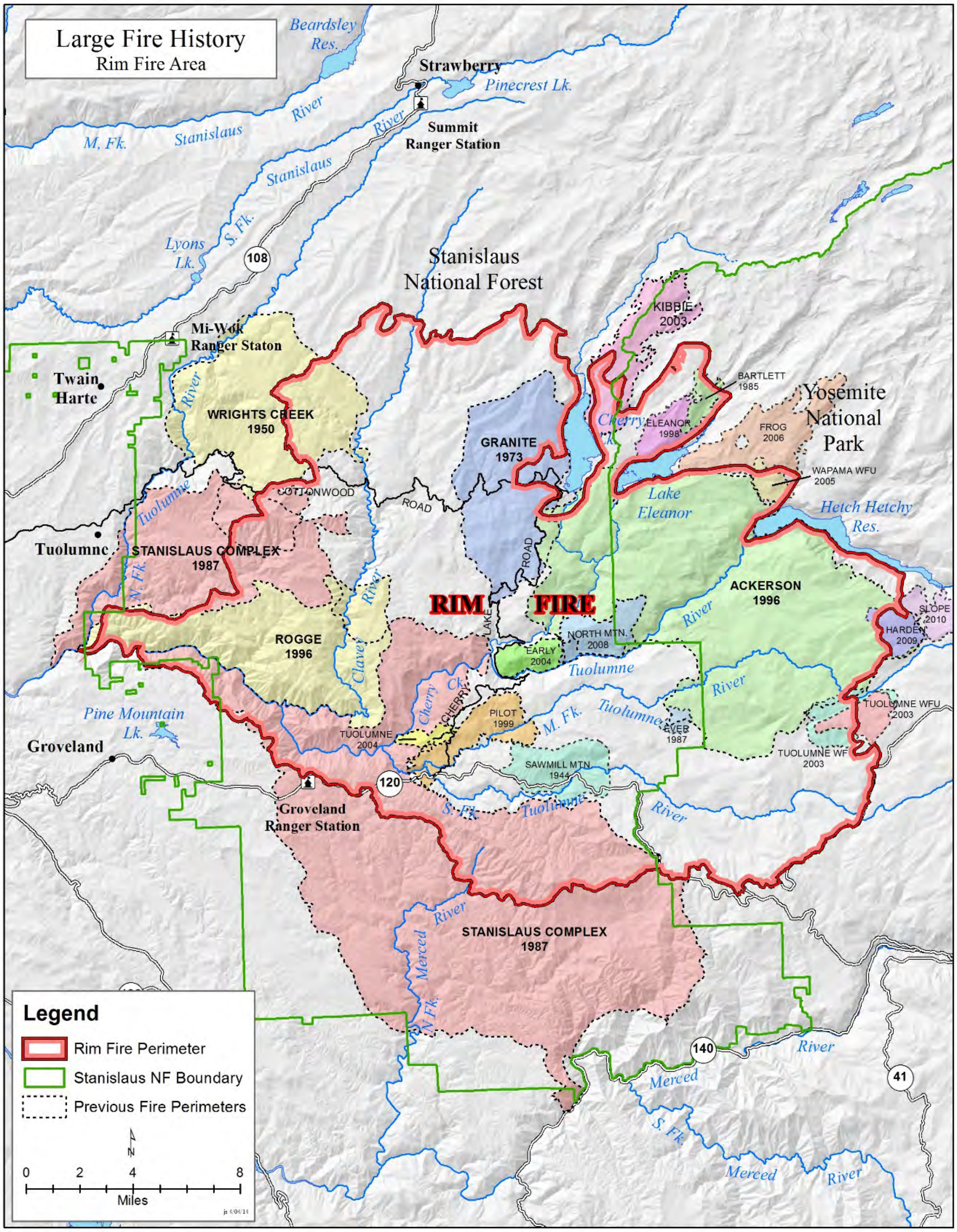

Figure 1.02-5 Large Fire History Map

Salvage logging of burned trees and roadside hazard trees is the first step in the process of long-term forest recovery. In order to provide critical structures within the recovering forests over time, retention of snags (dead standing trees) and down logs are necessary initial components for rebuilding wildlife habitat and healthy soils and watersheds. Snags provide short term benefits for many species of wildlife, and long-term down woody structure. Most of the burned forested stands were over-stocked due to decades of fire exclusion and now have far more dead trees within them than would have occurred naturally. In addition, the vast area of high severity burn is far larger than historic gap sizes would have been in the Sierra Nevada, setting up another severe fire scenario if not treated. In the short-term, while the dead trees are still standing and before the vegetation re-grows, the fire intensity would be low. Over time, if the dead trees and logs were left in place impacts to multiple resources including severe soil damage (hydrophobic soils) would result and be far more damaging than the Rim Fire (Monsanto and Agee 2008).

Forest Plan Direction

The Forest Service completed the Stanislaus National Forest Land and Resource Management Plan (Forest Plan) on October 28, 1991 (USDA 1991). The Stanislaus National Forest "Forest Plan Direction" presents the current Forest Plan management direction, based on the original Forest Plan, as amended (USDA 2010a). The Forest Plan Compliance Checklist (project record) provides additional details.

Relation to Other Rim Fire Projects

The Rim Fire Hazard Tree (Rim HT) project is the first of multiple recovery and restoration projects that may be proposed over the next several years. The April 25, 2014 decision approved removal of both hazard trees and trees felled during fire suppression or rehabilitation to provide a safe environment for administration and public use within and adjacent to high use roads and developed facilities. The Rim HT project has independent utility and will be undertaken regardless of any further recovery actions.

The Rim Recovery project is the second Rim related project in progress. The Forest Service published a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) in the Federal Register on December 6, 2013 (78 Federal Register 235, December 6, 2013; p. 73498-73499). The Rim Recovery proposed action includes salvage of dead trees; removal of hazard trees and dead trees along lower use roads open to the public; fuel reduction for future forest resiliency to fire; and road improvements for proper hydrologic function. The Rim Recovery treatment areas do not overlap with the Rim HT project treatment areas. The Rim Recovery project does not include any roads or facilities included under the Rim HT project.

Future projects may address reforestation, ecosystem restoration, fuels treatments, and other forest restoration activities; however, no specific proposals or details are available and it would be speculative to address them at this time.

1.03 PURPOSE AND NEED

The Forest Service identified the following needs for this project.

1. Capture Economic Value through Salvage Logging

The tremendous number of dead trees across this large landscape creates the need for the removal of this perishable commodity in a timely manner. If removed within the next 2 years, the value of the dead trees would pay for their removal from the forest and potentially for other future restoration treatments. Leaving the dead trees on site would create a large and dangerous fuel load in this vast area, and future removal of the down material if desired, would be very difficult, costly, and time consuming. The value of these trees is short lived, and will continue to decline over time. Even with implementation within the first year, it is estimated that trees below 16-inch diameter at breast height (dbh) would no longer have value. The diameter size of a tree with economic value will only increase over time as the trees deteriorate with time.

2. Provide Worker and Public Safety

Currently, the area contains excessive stretches of fire-killed and structurally compromised trees along low standard forest roads not included in the Rim HT project. The dramatic change in forest condition as a result of the Rim Fire significantly increased the risk to human life, safety and property. Miles of hazard trees now comprise much of the overall forest structure. Providing a safe environment for both public use and the administration of affected roads and facilities is critical, and the reason for the removal of dead and damaged trees that could fall onto roads. In addition, fighting future fires in these areas would be dangerous, due to the multiple dead trees and fuel loading. The Chief of the Forest Service and the Regional Forester stress that the safety of the public and our employees is our central concern. Within the transportation corridors, hazard tree management is vital to everyone's safety (USDA 2012c).

3. Reduce Fuels for Future Forest Resiliency

Harvesting dead timber supports the objectives of the Rim Fire Vegetation Resiliency Strategy (project record) by reducing the existing fuel load of standing dead trees to protect multiple resources including soils and watersheds from future high-intensity fires. Key areas identified as treatments needed for resiliency may be less economical to log, but are critical for creating greater fire resiliency of future forests. Removing burned trees and fuels where tree mortality exceeds the needs for snag and log recruitment is the first step to meet desired fuels conditions. The goal is to leave no more than 20 tons per acre and 10 tons per acre in Strategically Placed Landscape Area Treatments (SPLATS) while working with other resources to ensure soil and hydrologic stability. Higher levels would make this area more prone to future high-intensity fires, burning through the recovering forest before it could mature. In order to reintroduce fire into these areas as soon as possible, the current fuel load needs to be reduced to a level where fire would burn in patchy mostly low, and some moderate, vegetative burn severities.

4. Improve Road Infrastructure to Enhance Hydrologic Function

One of the most potentially damaging factors for watershed and soils resources is the improper movement of water from the road system within the burn. Road sediment discharge increases are expected as a result of the Rim Fire. Most increases are likely to occur in high soil burn severity areas and to a lesser extent in moderate soil burn severity areas. Problems include areas where road drainage is not fully functional and culverts at road-stream crossings are undersized or damaged. The undersized culverts cannot handle post-fire flow volume and the additional woody debris and sediment it carries. Ensuring that water is properly funneled through these systems to drainages that can move and utilize this resource is critical for protection of watersheds and soils, and also to provide the best aquatic habitat within these systems.

5. Enhance Wildlife Habitat

Because the fire burned through 46 California spotted owl PACs, as well as thousands of acres of other critical habitat, retaining old forest structures (large snags and downed logs) is important at this time since future recruitment of these old forest features is not expected to occur until decades to centuries into the future. The fire also burned through critical deer winter range. Deer migration access to winter foraging areas is essential for a thriving deer herd. Downed trees and the potential for more dead trees to fall would continue to inhibit herd access to critical winter habitat and browse. Additional needs within the burn area to promote various species in the short and long-term include:

- Unlogged burned forest areas across the landscape to provide sufficient habitat for wildlife species dependent on post-fire environments (i.e. black-backed woodpecker).
- A forest carnivore connectivity corridor linking Yosemite National Park wildlife populations to future habitat providing opportunities for these species to move north into the Stanislaus National Forest.
- Areas within critical winter deer range for salvage and non-merchantable material removal to achieve desired forage and cover ratios and deer migration access to critical winter range.
- Enhancement of native vegetation cover, stabilization of channels by non-structural means, and minimization of adverse effects from existing roads and exposed bare soil within Riparian Conservation Areas (RCAs) and the Clavey River Critical Aquatic Refuge (CAR).

1.04 Proposed Action

This is the Proposed Action, as described in the Notice of Intent (78 Federal Register 235, December 6, 2013; p. 73498-73499), with corrections based on updated data and map information and completion of PAC remapping as stated in the scoping package. These corrections and refinements provide additional resource protection and a more accurate and informed proposed action.

The Forest Service proposed action, within the Rim Fire perimeter in the Stanislaus National Forest, includes: salvage of dead trees; removal of hazard trees along roads open to the public and roads used to access and implement proposed treatments; fuel reduction for future forest resiliency to fire; and, road improvements for proper hydrologic function. Implementation is expected to begin summer 2014 and continue up to 5 years. Roadside hazard trees will be designated for removal using the Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region, April 2012 (Report RO-12-01). Dead trees in salvage units will be designated for removal based on “no green needles visible from the ground”. Proposed treatments in the project area include:

- Salvage of dead trees and fuel reduction (28,326 acres) including ground based mechanized equipment such as harvesters and rubber tired skidders (24,127 acres), ground based/skyline swing (16 acres) and aerial based helicopter (2,930 acres) or cable systems (1,253 acres).
- Removal of hazard trees and fuel reduction along existing low standard forest roads (341 miles or 16,315 acres).
- Reconstruction (319.9 miles) and maintenance (216.1 miles) for proper hydrologic function and stream protection.
- New construction (5.4 miles) to allow for salvage removal and long-term access for future activities.
- Temporary road construction (13.2 miles). Temporary roads will be decommissioned following completion of project activities.
- Rock quarry sites (7 sites) identified to accommodate road needs.
- Water sources (81 locations) identified for road construction, reconstruction and maintenance as well as long-term resource needs.

No salvage treatments are proposed within Wilderness or Inventoried Roadless Areas. No salvage treatments are proposed within the wild classification segments of the Wild and Scenic Rivers. Hazard tree removal is considered within all river segment classifications. Project design will incorporate water quality and other Best Management Practices (BMPs) according to regional and national guidance.

Merchantable trees [likely those dead trees greater than 16 inches diameter at breast height (dbh) by the time of harvest] would be removed as sawlogs and non-merchantable trees of smaller diameters may be removed as biomass, masticated (shredded), felled and lopped, or machine piled and burned. Harvest would occur in a timely manner to minimize loss of value; dead trees lose their value within 2 years, or even less for smaller diameter material. It is anticipated salvage harvest operations would begin as soon as August 2014 and continue for up to 5 years. Figure 1.04-1 shows the treatment units included in the Proposed Action.

Chapter 2.02 includes a detailed description of this proposal under Alternative 1 (Proposed Action).

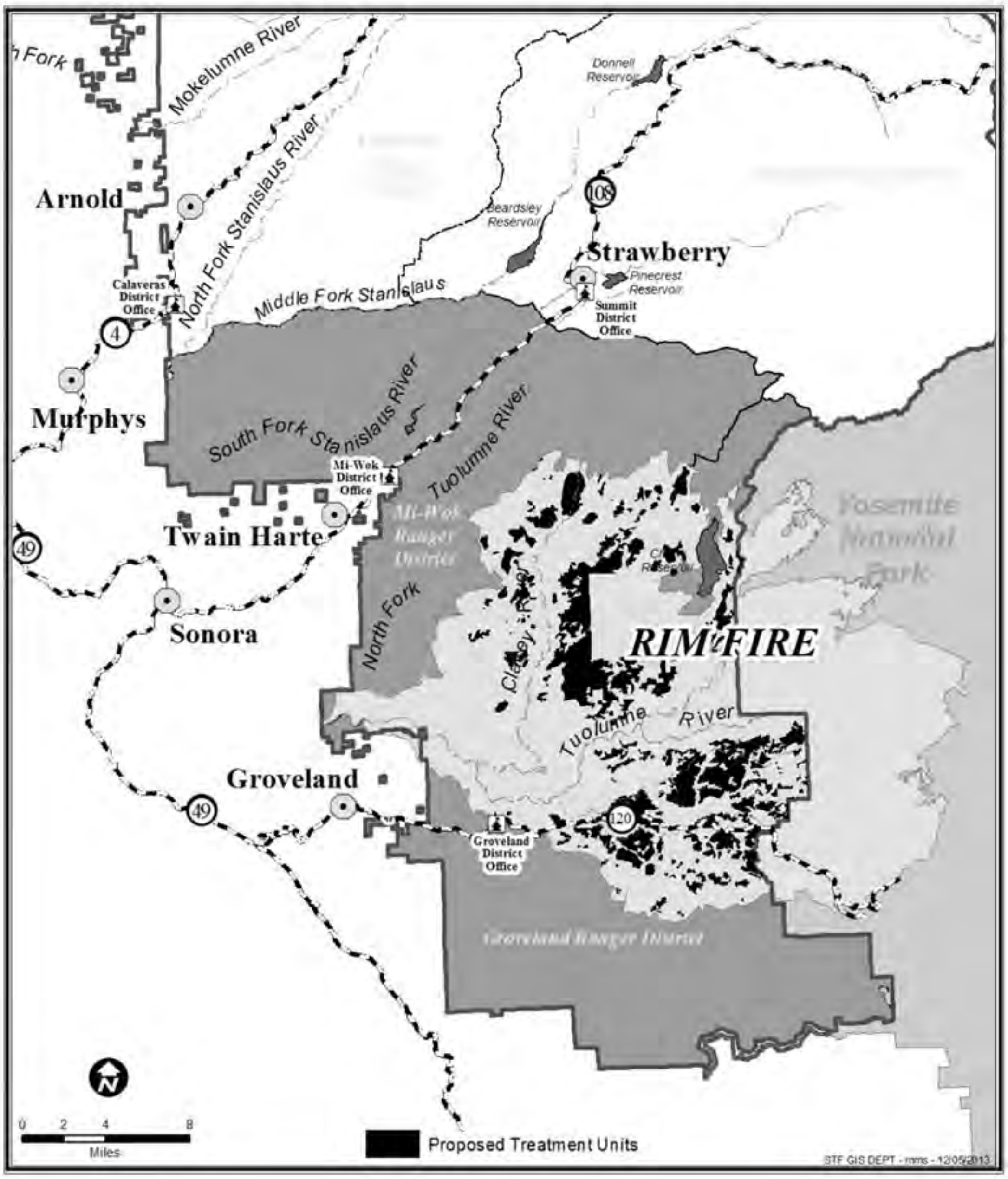

Figure 1.04-1 Rim Fire Recovery Proposed Action Treatment Units

Figure 1.04-2 shows vegetation burn severity mapped with the proposed action treatment units.

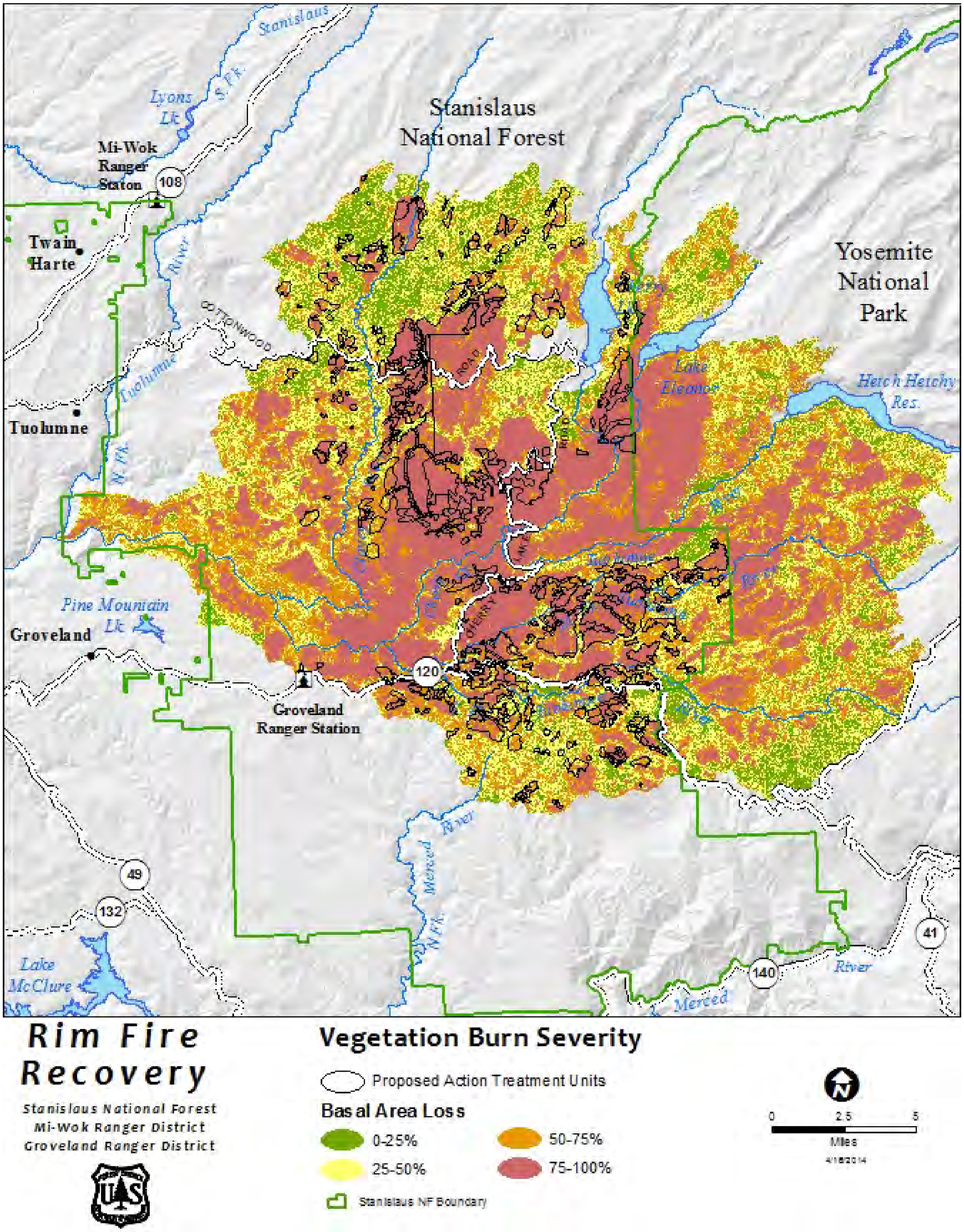

Figure 1.04-2 Vegetation Burn Severity Map

Figure 1.04-3 shows soil burn severity mapped with the proposed action treatment units.

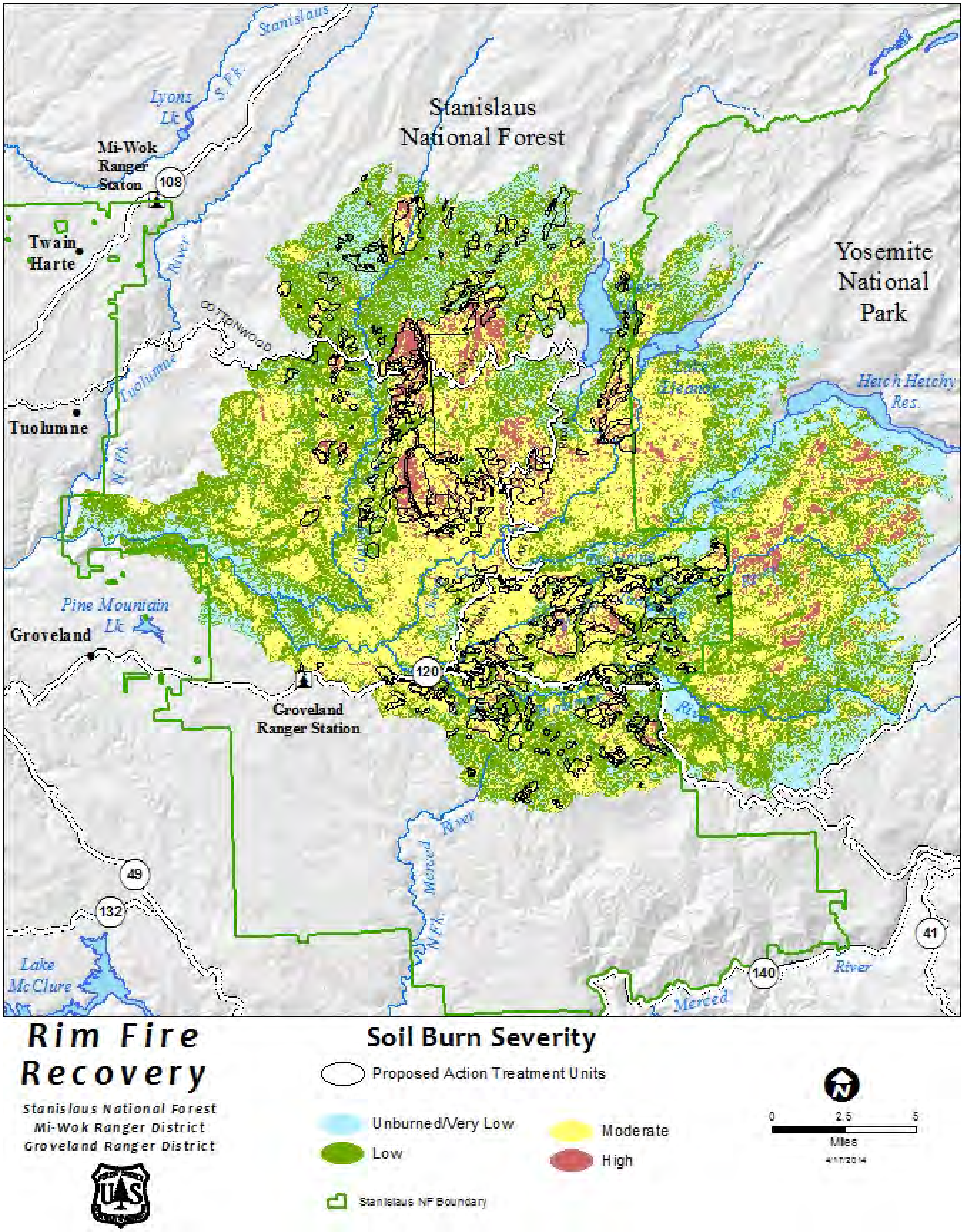

Figure 1.04-3 Soil Burn Severity Map

Updates to the Proposed Action

The Forest updated the proposed action based on subsequent field information and a unit-by-unit ID Team review. The updated proposed action differs from the original scoping package (Scoping) with over half the changes in relation to the remapping of the severely burned California spotted owl, great grey owl, and goshawk PACs as called for in the scoping package. Additional roads analysis led to additional categories of road actions. Temporary roads occur in two sub-categories (new and existing) to better capture impacts. In addition, the category "temporary use – revert" tracks non-system roads needed for project access and also anticipated as needed for future use separate from the Forest Transportation System (FTS).

Table 1.04-1 displays and compares the Proposed Action from Scoping with the updates identified for Alternative 1 (Proposed Action) in this draft EIS.

Table 1.04-1 Updates to the Proposed Action

Proposed Treatments[1]	Proposed Action (Scoping)	Alternative 1 (Proposed Action)
Salvage (ground based)	25,174 acres	24,127 acres
Salvage (ground based/skyline swing)	0 acres	16 acres
Salvage (aerial based helicopter)	3,147 acres	2,930 acres
Salvage (skyline system)	1,327 acres	1,253 acres
Subtotal Salvage	**29,648 acres**	**28,326 acres**
Hazard Tree Removal	369 miles	341 miles
Subtotal Hazard Tree Removal	**17,890 acres**	**16,315 acres**
Total Hazard Tree and Salvage	**47,538 acres**	**44,641 acres**
New Construction	6 miles	5.4 miles
Reconstruction	327 miles	319.9 miles
Maintenance	164 miles	216.1 miles
Subtotal Construction and Maintenance	**497 miles**	**540.6 miles**
Temporary Road Construction	14 miles	
Temporary Road Construction (new)		3.9 miles
Temporary Road Construction (existing)		9.3 miles
Subtotal Temporary Road Construction	**14 miles**	**13.2 miles**
Temporary Use - Revert	8 miles	8.4 miles
Total Road	**519 miles**	**562.2 miles**
Rock Quarry Sites	75	7
Potential Water Sources	95	81

[1] Salvage Treatments include removal of dead trees and fuel reduction; Hazard Tree Treatments include hazard tree removal and fuel reduction.

1.05 Principal Laws and Regulations

The National Environmental Policy Act of 1969 (NEPA) requires that all major federal actions significantly affecting the human environment be analyzed to determine the magnitude and intensity of those impacts and that the results be shared with the public and the public given opportunity to comment. The regulations implementing NEPA further require that to the fullest extent possible, agencies shall prepare EISs concurrently with and integrated with environmental analyses and related surveys and studies required by the Endangered Species Act of 1973, the National Historic Preservation Act of 1966, and other environmental review laws and executive orders. Other laws that apply to this project include: the Multiple Use and Sustained Yield Act of 1960; the National Forest

Management Act of 1976; the Clean Air Act of 1990; the Clean Water Act of 1972; and, the Forest and Rangeland Renewable Resources Planning Act of 1974.

1.06 DECISION FRAMEWORK

As the Responsible Official, the Forest Supervisor may decide to: (1) select the proposed action; (2) select one of the alternatives; (3) select one of the alternatives after modifying the alternative with additional mitigating measures or combination of activities from other alternatives; or, (4) select the no action alternative, choosing not to authorize the Rim Recovery project. In making this decision, the Forest Supervisor will consider such questions as:

- How well does the selected alternative meet the purpose and need described in this EIS?
- How well does the selected alternative move the project area toward the desired conditions established in the Forest Plan?
- Does the selected alternative mitigate potential adverse effects?

Project-Level Pre-decisional Administrative Review (Objection) Process

This project is subject to comment pursuant to 36 CFR 218, Subparts A and B. Only those who submit timely project specific written comments[2] during a public comment period are eligible to file an objection. Individuals or representatives of an entity submitting comments must sign the comments or verify identity upon request. Comments received, including the names and addresses of those who comment, will be considered part of the public record on this proposal and will be available for public inspection.

Emergency Situation Determination

In order to facilitate implementation of this project, the Forest Service Chief granted an Emergency Situation Determination (ESD) pursuant to 36 CFR 218.21 (78 Federal Register 59, March 27, 2013; p. 18481-18504) on April 23, 2014. An emergency situation is a situation on NFS lands for which immediate implementation of a decision is necessary to achieve one or more of the following: relief from hazards threatening human health and safety; mitigation of threats to natural resources on NFS or adjacent lands; avoiding a loss of commodity value sufficient to jeopardize the agency's ability to accomplish project objectives directly related to resource protection or restoration (36 CFR 218.21(b)). The determination that an emergency situation exists is not subject to administrative review (36 CFR 218.21(c)). With an ESD granted, the project is not subject to the pre-decisional objection process (36 CFR 218.21(d)).

Alternative Arrangements

In order to facilitate implementation of this project, the President’s Council on Environmental Quality (CEQ) granted alternative arrangements in accordance with 40 CFR 1506.11 on December 9, 2013. With these alternative arrangements for the Rim Recovery project, CEQ specifically approved the following:

- Shortened the public comment period for the draft EIS from 45 to 30 days.
- Eliminated the minimum 90-day requirement between the Notice of Availability of the draft EIS and the publication of the Record of Decision (ROD).
- Eliminated the 30-day waiting period between the publication of the final EIS and the ROD.

[2] **Specific written comments**. Written comments are those submitted to the responsible official or designee during a designated opportunity for public participation (§ 218.5(a)) provided for a proposed project. Written comments can include submission of transcriptions or other notes from oral statements or presentation. For the purposes of this rule, specific written comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the responsible official to consider.

CEQ also included the following requirements for the Forest:

- Continue to enhance public and stakeholder engagement during the scoping initiated by the December 6, 2013 Notice of Intent to prepare the EIS.
- Continue active engagement of interested parties throughout the preparation of the EIS.
- Continue communication with the Yosemite Stanislaus Solutions collaborative group.
- Attend and continue communication with the Sierra Nevada Conservancy and parties participating in the Rim Fire Landscape Restoration Technical Workshop on December 18, 2013.
- Post the Final EIS and proposed ROD on the Forest Service website for public review 5 to 10 business days prior to publishing the official Notice of Availability in the Federal Register.

1.07 Public Involvement

Public participation is important at numerous points during the analysis. The Forest Service seeks information, comments and assistance from federal, state and local agencies and individuals or organizations that may be interested in or affected by the proposed action.

Because of the critical need to begin implementation as soon as possible, this project focused on unprecedented up front public involvement. The Forest engaged two large collaborative groups. One local group, Yosemite Stanislaus Solutions (YSS) includes a wide variety of local county stakeholders including the timber industry, environmental organizations and business leaders. YSS fosters partnerships among private, nonprofit, state and federal entities with a common interest in the health and well-being of the landscape and communities in the Tuolumne River Watershed. The group fosters an all-lands strategy to create a heightened degree of environmental stewardship, local jobs, greater local economic stability, and healthy forests and communities. The other group, known as the Rim Fire Technical Team consists of representatives from state and national environmental organizations, the timber industry and other government entities with a more national or statewide interest base. The Forest Service met with both of these groups on several occasions including field trips into the burn area and all day workshops identifying the long-term goals of this landscape and future desired conditions.

The Forest held its first field trip into the Rim Fire on October 16, 2013 with individuals from the Tuolumne Band of Me-Wuk Indians, Central Sierra Environmental Resource Center (CSERC), Sierra Club, Tuolumne County Alliance for Resources and Environment (TuCARE), California Fish and Wildlife Service, Audubon Society, Tuolumne County Supervisors, logging companies, sawmills, Sierra Nevada Conservancy and the local collaborative group YSS. On November 14, 2013 the Rim Fire Technical Team toured the burn area with several stops and discussions with Forest Service managers and researchers.

Public Scoping Period (30-days) for the Notice of Intent

The Forest Service conducts scoping according to the Council on Environmental Quality (CEQ) regulations (40 CFR 1501.7). In addition to other public involvement, scoping initiates an early and open process for determining the scope of issues to be addressed in the EIS and for identifying the significant issues related to a proposed action. This scoping process allows the Forest Service not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues, narrowing the scope of the EIS process accordingly (40 CFR 1500.4(g)).

The Forest Service first listed the Rim Recovery project online in the Stanislaus National Forest Schedule of Proposed Actions (SOPA) on December 5, 2013. The project first appeared in the published quarterly SOPA in January 2014. The Forest distributes the SOPA to about 160 parties and it is available on the internet [http://www.fs.fed.us/sopa/forest-level.php?110516].

The Forest Supervisor sent a scoping letter and package to 131 individuals, permittees, organizations, agencies, and Tribes interested in this project on December 5, 2013. The letter requested specific written comments on the Proposed Action during the initial 30-day designated opportunity for public participation. The Forest Service published a Notice of Intent (NOI) that asked for public comment on the proposal between December 6, 2013 and January 6, 2013 (78 Federal Register 235, December 6, 2013; p. 73498-73499). Interested parties submitted 4,200 total letters during the comment period including 174 unique individual letters and 4,026 form letters. Other interested parties submitted 3,627 form letters (late) after the comment period closed. The Scoping Summary (project record) identifies specific comments and shows how the ID Team used them to identify issues (Chapter 1.08).

The Forest Service held public open houses at the Supervisor's Office on December 13 and 14, 2013. They were advertised on local radio stations, in the local newspaper, on the Stanislaus National Forest website, through a "tweet" to more than 68,000 followers, through direct mailings to those on the SOPA mailing list, and to those who showed interest in the project. Over 25 people attended the open houses where the Forest described the preliminary purpose and need for the project as well as proposed recovery treatments. ID Team members participated and answered questions regarding the project and proposed action.

Ongoing Public Involvement

The Forest held a follow up public open house at the Supervisor's Office on February 13, 2014. It was advertised on local radio stations, in the local newspaper, on the Stanislaus National Forest website, and through a "tweet" to more than 68,000 followers. Over 50 people attended the open house where the Forest described the alternatives developed since the original scoping package described the proposed action.

In addition to the ongoing discussions with YSS, over the past few months the Forest organized several tours into the Rim Fire area for congressional aides, local government, and other interested parties. The Forest provides a monthly update to the Tuolumne Board of Supervisor's Natural Resources Committee. Forest Service representatives have also spoken with many local and statewide businesses, interest groups and service clubs including Hetch Hetchy, TuCARE, Blue Ribbon Coalition, American Forest Resource Council, Range Permittees, Rotary Clubs, Stanislaus Wilderness Volunteers, Sierra Forest Legacy, timber operators and the Lions Club.

1.08 ISSUES

The Forest reviewed the purpose and need, proposed action and scoping comments in order to identify issues (Scoping Summary, project record). An issue is a point of discussion, dispute, or debate with the Proposed Action; an issue is an effect on a physical, biological, social, or economic resource; an issue is not an activity; instead, the predicted effects of the activity create the issue. The Forest Service separated the issues into two groups: significant and non-significant. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)..."

Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Significant Issues are used to formulate alternatives, prescribe mitigation measures, or analyze environmental effects. Issues are significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflicts.

Non-Significant Issues are those: 1) outside of the scope of the proposed action; 2) already determined through law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; 4) conjectural and not supported by scientific fact; 5) a comment, opinion, or statement of position; or, 6) a question for clarification or information. Although non-significant issues are not used to formulate alternatives or prescribe mitigation measures, the EIS will disclose all significant environmental effects including any related to non-significant issues. The Scoping Summary (project record) identifies non-significant issues and reasons why they were found non-significant.

As described above, issues are significant because of the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflicts. Based on public comments, the Forest developed significant issues to formulate and compare alternatives, prescribe mitigation measures, or analyze and compare the environmental effects of each alternative. Significant issues are listed below with issue statements based on public comments submitted during scoping.

Significant Issues

1. Health and Safety

a. Existing conditions do not provide a safe environment for administration and public use of roads because hazard trees pose a threat to health and safety.
b. Public conflicts with logging operations along roads and worker conflicts along power lines and Highway 120 pose threats to worker and public safety.

2. Snag Forest Habitat

a. Proposed activities may affect Black-backed Woodpecker (BBWO) populations because the woodpeckers may occur at higher densities in areas treated and the project does not include avoidance measures or limited operating periods for nesting BBWO.
b. Proposed activities may affect Spotted Owls because re-mapping of existing PACs and Home Range Core Areas (HRCAs) burned in the fire would damage this still viable and important owl habitat.

3. New Road Construction

a. Proposed new road construction may affect roadless areas and destroy habitat because these areas are currently undisturbed and inaccessible to motor vehicles.

4. Wildlife Habitat

a. Proposed activities may affect critical deer winter range as well as oak and green island habitat because the project does not include specific protection or enhancement measures.
b. Proposed management requirements seem excessive (i.e., a one mile buffer for suitable frog habitat and 20 down logs within streams every mile) because these measures are not necessary and the cost of implementation is high.

5. Salvage Logging

a. Proposed activities may reduce biodiversity, threaten rare plants, and impact the outstanding remarkable values and integrity of the Clavey River due to impacts from salvage logging.
b. Application of sporax may affect implementation of the logging because it is not necessary and adds costs.

6. Soil and Watershed Impacts

a. Proposed activities may affect streams with significant sedimentation and soil loss because of the already compromised condition of these areas and insufficient buffers.

1.09 GIS DATA

The Forest Service uses the most current and complete data available. Geographic Information System (GIS) data and product accuracy may vary. They may be developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation and/or, incomplete while being created or revised. Using GIS products for purposes other than those intended may yield inaccurate or misleading results.

The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification. The information contained within Chapter 2 (The Alternatives) of this EIS takes precedence in case of disagreement with the GIS data (including maps created using that data).

2. The Alternatives

This Chapter describes and compares the alternatives considered for the Rim Fire Recovery project. It presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among the options for the Responsible Official and the public. It includes the action alternative or the Proposed Action (Alternative 1), the no action alternative (Alternative 2), and two additional action alternatives (3 and 4) that provide a comprehensive range for the decision maker. The no action alternative serves as a baseline for comparison purposes (73 Federal Register 143, July 24, 2008; p. 43084-43099). Based on the issues identified through public comment on the proposed action as well as the unique opportunities created by the Rim Fire, the Forest Service developed the other action alternatives that achieve the purpose and need through different combinations and types of activities than the proposed action. Some of the information used to compare the alternatives is based on the design of the alternative, and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

This chapter is divided into five sections:

- Chapter 2.01 describes how the alternatives were developed.
- Chapter 2.02 presents the alternatives considered in detail.
- Chapter 2.03 describes the management requirements common to all action alternatives.
- Chapter 2.04 presents the alternatives considered, but eliminated from detailed study, including the rationale for eliminating them.
- Chapter 2.05 compares the alternatives based on their environmental, social and economic consequences including a comparative display of the projected effects of the alternatives.

2.01 How the Alternatives Were Developed

The planning area includes NFS lands, on the Stanislaus National Forest, outside of Wilderness. It does not include any private, state or other federal lands. Each alternative assumes that other adjacent federal lands, such as those administered by Yosemite National Park will be managed according to existing management plans and applicable federal laws. Each alternative also assumes that private lands will meet applicable state and federal land use regulations.

Chapter 2.02 displays the alternatives fully considered in detail including three action alternatives and the no action alternative, while Chapter 2.04 describes other alternatives considered, but eliminated from detailed study. Appendix D (Research) and Appendix E (Treatments) provide detailed information related to the alternatives. The separate map package includes large scale maps showing treatment units and other information included in each alternative.

Primary Objectives

The action alternatives represent a wide range of perspectives designed to address the purpose and need (Chapter 1.03) and the issues identified through scoping (Chapter 1.08). The purpose and need includes five primary objectives identified for the proposed action (Chapter 1.03). In addition to those five objectives, the ID Team identified research as a sixth primary objective for developing Alternatives 3 and 4.

Table 2.01.1 displays the six primary objectives used to identify treatments and develop the action alternatives while Table 2.05-2 shows acres by primary objective and Appendix E (Treatments) shows primary objectives for each specific treatment unit.

Table 2.01-1 Primary Objectives

Primary Objective	Purpose
1. Economic Value	Capture the economic value of hazard trees and dead trees which pays for their removal from the forest and potentially for other future restoration treatments.
2. Public and Worker Safety	Remove dead and dying hazard trees adjacent to Forest Roads and project access areas. This primary objective also includes the health and safety of workers and permittees during range fence installation and maintenance.
3. Fuel Reduction	Reduce fuels to provide for future forest resiliency and firefighting safety and success. Additional treatments in SPLATS and Defense Zones.
4. Enhance Hydrologic Function	Improve road infrastructure to enhance hydrologic function of roads. This only applies to roads so it will not be displayed in table 2.05-2 which displays unit acres.
5. Enhance Wildlife Habitat	Retain specific old forest components (large snags and down logs) and/or remove material to improve wildlife habitat. a. Deer Habitat Improvement – Removal of dead trees (commercial and non-commercial) for movement and access, and to achieve desired forage/cover ratios b. Snag Retention
6. Research	Utilize the unique scale and intensity of the Rim Fire to answer questions and provide more information on a wide range of research topics.

The action alternatives were developed and described according to the following activity groups where applicable.

Salvage and Fuel Reduction

The action alternatives vary in the number of acres proposed for salvage harvest, the type of harvest, associated fuel reduction treatments (e.g. biomass or tractor piling).

Merchantable trees [likely those dead trees greater than 16 inches diameter at breast height (dbh) by the time of harvest] would be removed as sawlogs and non-merchantable trees of smaller diameters may be masticated (shredded), felled and lopped, machine piled and burned, or removed as biomass. Harvest would occur in a timely manner to minimize loss of value; dead trees lose their value within 2 years or even less for smaller diameter material. Salvage and hazard tree removal are expected to take place first in order to capture the highest economic value of the standing timber and to remove hazard trees for safety of operations. Biomass removal may be completed simultaneously with the salvage operation or occur as a second entry into the area. Post-harvest evaluation would determine the extent of treatments necessary to meet fuels, watershed, and wildlife objectives for ground cover and fuel loading. It is anticipated salvage harvest operations would begin as early as August 2014 and continue for up to 5 years. Actual timing may vary based on deterioration of material, weather and resource availability (personnel and budget). The action alternative maps in the map package show the unit locations.

Salvage

Dead conifer trees greater than 16 inches dbh (this diameter will vary based on tree merchantability at the time of harvest) would be removed utilizing ground based mechanized equipment where practical. Ground based equipment would include harvesters and rubber tired skidders. Helicopter logging or skyline systems would be utilized on steeper slopes and where necessary to meet resource objectives. Feller-bunchers may be utilized on skyline and helicopter units where slopes are less than 45 percent. Only trees with no green needles (as seen from the ground) would be removed. Residual live trees within salvage units would be protected during harvest operations and retained. Management Requirements identify the snag and down log retention guidelines. All activity generated fuels would be treated to meet the fuels desired conditions.

Biomass Removal

Biomass treatments would entail the mechanical removal of un-merchantable trees between 4 inches and 16 inches dbh (this varies depending on log merchantability and the desire for retaining material onsite for various resource needs). These trees would be removed as firewood, shavings logs, pulpwood, removed for biomass fuel for electric cogeneration plants, or decked and left on site for public firewood cutting. The biomass treatments would likely be conducted at the same time as the thinning treatments, but depending on availability of equipment and operators, this activity may occur as a second entry after the timber is removed.

Machine Piling and Burning

Machine piling and burning is the use of mechanical equipment to push brush skeletons, small dead trees and excess downed fuels into piles for burning. This method would be used in areas where high fuel loads remain post-harvest. In order to meet wildlife and soils objectives, piling would be conducted in a manner that would leave the down logs, greater than 20 inches diameter (large end) and 10 feet in length, out of the piles.

Jackpot Burning

Jackpot burning is the prescribed burning of heavy concentrations of down woody fuels. This type of burning would allow for the majority of the area to retain ground cover while reducing the heavy concentrations of fuels post-harvest. This treatment is proposed within the helicopter and skyline units where machine piling is not feasible.

Mastication

Alternatives 3 and 4 would include mastication treatments consisting of the shredding of brush skeletons and small dead trees (generally under 10 inches dbh). The shredded material generated would be left on site. This treatment would be conducted in areas that do not meet the minimum requirements for soil cover and/or are in watershed sensitive areas (WSAs). Criteria for evaluating the need for this action included: proposed recovery activities, burn severity, percent slope, slope shape, slope length, existing and potential soil cover, proximity to intermittent and perennial drainages, and proximity to high runoff response soils. This treatment would not be used where post treatment fuel levels exceed objectives. This treatment would also be used in predominantly brushy areas for deer habitat enhancement.

Drop and Lop

Alternatives 3 and 4 would include drop and lop proposed in portions of units identified as WSAs to increase ground cover. Criteria for evaluating the need for this action are the same as described above for mastication. This treatment would involve felling non-merchantable trees less than 10 inches dbh and lopping them into pieces small enough to ensure the material is not stacked and has as much ground contact as practical. A minimum 50 percent effective ground cover is desired but may be limited by fuel objectives.

Hazard Tree Removal and Fuel Reduction

Due to hazardous conditions created by the Rim Fire, all of the action alternatives propose hazard tree removal along low standard roads and trails used in the project as well as routes accessing salvage and fuels reduction units including those within all Wild and Scenic River segment classifications. Routes used in the project would be assessed for hazard trees and abated where they exist; however, it should be noted that many areas would receive no treatments because there is no hazard or threat to health and safety (i.e. low severity burn resulted in no tree mortality, forest structure is composed of small trees or shrub layer). Hazard trees would be designated for removal using the Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region, April 2012

(USDA 2012c). Only those green trees deemed to be imminent hazards (high certainty of mortality or failure within the next two years) would be removed and all green trees would be marked (not designated by description in the timber sale contract). These areas would also receive fuels reduction treatments.

Biomass Removal

Biomass treatments would entail the mechanical removal of un-merchantable trees between 4 inches and 16 inches dbh (this varies depending on log merchantability and the desire for retaining material onsite for various resource needs). These trees would be removed as firewood, shavings logs, pulpwood, removed for biomass fuel for electric cogeneration plants, or decked and left on site for public firewood cutting. The biomass treatments would likely be conducted at the same time as the thinning treatments, but depending on availability of equipment and operators, this activity may occur as a second entry after the timber is removed.

Machine Piling and Burning

Machine piling and burning is the use of mechanical equipment to push brush skeletons, small dead trees and excess downed fuels into piles for burning. This method would be used in areas where high fuel loads remain post-harvest. In order to meet wildlife and soils objectives, piling would be conducted in a manner that would leave the down logs, greater than 20 inches diameter (large end) and 10 feet in length, out of the piles.

Roads

All of the action alternatives propose either maintenance or road reconstruction to support the removal of logs and biomass from treatment units as well as hazard trees adjacent to lower standard forest roads. In addition, Alternatives 1 and 3 propose new construction to access some salvage units and reduce log yarding distances. Each action alternative includes several miles of temporary roads to minimize skidding distances. Several areas identified as “skid zones” would be used to move dead trees from the unit to the designated landing outside the unit boundary. No changes in allowed public uses would occur on any existing National Forest System Road (NFSR) or National Forest System Trail (NFST) used for the project.

New Construction

Alternatives 1 and 3 would include new roads that designed to engineering standards according to assigned road management objectives. Expected actions include vegetation clearing, excavation and embankment, blading and shaping, installation of drainage structures, and importing of armoring and surfacing rock material as needed. All new roads would be added to the FTS, gated and closed to public vehicular traffic, and would remain available for long-term administrative use for future access and management of NFS lands.

Reconstruction

Reconstruction generally includes work to improve and restore roads. This work would improve the road conditions as needed for safe and efficient haul of forest products as well as for proper hydrologic function and stream protection in accordance with applicable BMPs. Actions may include surface improvement; construction of drainage dips, culverts, riprap fills or other drainage or stabilization features with potential disturbance outside the established roadway (toe of fill to top of cut); realignment; and widening of curves as needed for log trucks and chip van passage. Reconstruction also includes the actions identified in the Maintenance category, such as removal of roadside hazard trees.

Maintenance

Roads used for the project that are in functioning condition would be maintained. Maintenance preserves the function of the road but generally does not include improvements. Maintenance activities generally include: blading; brushing; removal of roadside hazard trees; repair and/or replacement of road surfaces; cleaning, repair, or installation of drainage structures such as culverts, ditches, and dips; dust abatement; removal and installation of closure barriers; and installation or repair of signs. Maintenance activities generally do not disturb ground outside the existing road prism (toe of fill to top of cut) other than removal of material around culvert inlets.

Stored Roads

Some Maintenance Level 1 roads (currently closed and stored) would be opened and receive the appropriate maintenance or reconstruction treatments as described above. By definition, these roads are expected to be used intermittently when needed for project access, but kept closed for periods of years between uses. Following the project, these roads would be physically closed to all motor vehicle travel by using native material barriers such as boulders, berms, cull logs and stumps. Beyond the closure, the integrity of Maintenance Level 1 roads would be preserved to the extent practicable, implementing measures as necessary to reduce sediment delivery from the road surface and fills and reduce the risk of crossing failure and stream diversion, making it hydrologically neutral.

Temporary Roads

Temporary roads are not intended to be a permanent part of the road system and would be decommissioned after use. Temporary roads may overlay existing corridors or be newly constructed features. Some NFSTs currently managed for either motorized or non-motorized use, are proposed as temporary roads. These would be put back to their previous use after project completion.

Construction of temporary roads may include vegetation clearing, excavation, blading and shaping to provide for safe project access and removal of forest products. New and existing temporary roads would have improvements necessary to attain stabilization of the roadbed and fill slopes, including employing measures such as out-sloping, drainage dips, and water-spreading ditches. Unlike permanent roads, temporary roads would only have the minimal investment and drainage required to minimize resource impacts while providing for safe use and passage of haul vehicles during the short life of the route.

After a temporary road has served the project purpose, the Forest Service would coordinate decommissioning. This involves: removing bridges and culverts, eliminating ditches, subsoiling and out-sloping the roadbed, removing ruts and berms, effectively blocking the road to vehicular traffic, and building cross ditches and water bars. When bridges and culverts are removed, associated fills shall also be removed to the extent necessary to permit normal maximum flow of water.

Temporary Use - Revert

Some segments identified for temporary project use would revert to their existing use post-project. These routes are associated with authorized or other needed uses (for example, access to a water tank under special use permit), and are expected to still be utilized into the future. Temporary use routes would be improved to a minimal standard for haul, while also improved to minimize adverse environmental impacts, maintain stabilization, and ensure proper drainage. These routes would continue to exist after the project is completed.

Skid Zones

The term skid zone is being used to identify areas where landings for units harvested using ground based equipment are not located either within or adjacent to the units. The skid zones encompass an area that skidding equipment may traverse to take logs from the unit to the landing, using a specified skid trail pattern that would be determined during harvest operations by a FS timber sale administrator. The intent is to identify areas outside units that need to be surveyed and assessed for potential impacts due to treatment activities.

Right-of-Way Acquisition

Some roads under private jurisdiction would provide more efficient access to the project. These roads would require a Forest Service right-of-way or access agreement to allow for access and haul of forest products. Where appropriate, public easements would be pursued; at a minimum administrative access would be needed for project use.

Other Infrastructure

Available water and rock material sources within and adjacent to the project area would be utilized to support project road work. Roads providing access to and from these sites would also be maintained.

Wildlife Habitat Enhancement

The action alternatives vary by type and amount of wildlife habitat enhancement treatments for critical deer range and increased snag retention.

Research

Alternatives 3 and 4 include research proposals to evaluate impacts of proposed activities. Research opportunities are abundant within the Rim Fire perimeter and scientists from PSW and managers from the Stanislaus National Forest are working together and collaborating with universities and others to take advantage of this unique opportunity (a fire of this scale and intensity). The primary study design at this time is to allocate 44 California Spotted Owl (CSO) sites affected by the Rim Fire into treatment groups. Some treatment units were dropped from the project and some unit boundaries were modified based on the needs of the research proposals. Sample units consist of 200 hectare (494 acres) circular core areas around the centroid (nest/main roost) for each of the 44 CSO sites. Sample units were arrayed across gradients by amount of post-fire suitable habitat and proposed salvage/road hazard tree treatment acres and then allocated to one of three treatment groups: (1) Controls; (2) Light Salvage prescription (retain approximately 100 square feet of Basal Area); and (3) High Salvage prescription (retain approximately 30 square feet of Basal Area). These 38 locations would serve as the sample units for the research to address “site occupancy” (i.e. the proportion of sites occupied by a species of interest through time) to assess response of CSO post fire. Occupancy surveys would be conducted annually for 5 years beginning in 2014. Assuming a best case treatment schedule, salvage treatments would be initiated in late Fall 2014 and continue through at least 2016. Two years of post-treatment surveys are needed to assess the effects of both wildfire and salvage-logging. Occupancy surveys would assess reproduction. Researchers may also conduct radio-telemetry work to document habitat use and foraging behavior of CSOs during the five year period post-fire. The study would be adapted to utilize the specific timing and spatial implementation of treatments.

These large 200 hectare sample units (13 units as controls, 12 units as light salvage, and 13 units as normal salvage) would also serve as footprints for a number of other research projects. The 200 hectare units can provide a canvas for strip transects to conduct small mammal trapping grids and avian monitoring using point count surveys. They would also be used for monitoring cavity use and foraging behavior of black-backed woodpeckers using standard nest searching protocols. These units would serve as sites to quantify effects of salvage and several mitigation treatments on hillslope soil erosion. Silt fences would be installed to measure erosion rates in small (less than 0.5 acre) treated and untreated swales within areas of high soil burn severity. Also, water quality research would evaluate the effects of salvage logging and erosion mitigation treatments on sediment yield and peak discharge at the small watershed scale. This study would use paired small catchment (10 to 20 acres) to measure total sediment yields, runoff and peak flow as well as small hillslope sediment fences to quantify hillslope contributions. Additional research is likely to occur within the Rim Fire, but would utilize the proposals and activities in this EIS as the basis for treatment and non-treatment pairings.

Forest Plan Amendments

Alternatives 3 and 4 include a Forest Plan Amendment designating a Forest Carnivore Connectivity Corridor (FCCC).

Management Requirements

The action alternatives include management requirements designed to implement the Forest Plan and to minimize or avoid potential adverse impacts. Each action alternative lists the management requirements specific to it and Chapter 2.03 identifies those common to all action alternatives. Management requirements are mandatory components of each alternative and will be implemented as part of the proposed activities.

2.02 Alternatives Considered In Detail

The action alternatives (Alternatives 1, 3 and 4) and the no action alternative (Alternative 2) are considered in detail. The no action alternative, as required by the implementing regulations of NEPA, serves as a baseline for comparison among the alternatives (73 Federal Register 143, July 24, 2008; p. 43084-43099). The following sections describe each of the alternatives considered in detail (see Map Package and project record for detailed maps of each alternative).

Alternative 1 (Proposed Action)

This is the Proposed Action, as described in the Notice of Intent (78 Federal Register 235, December 6, 2013; p. 73498-73499), with corrections based on updated data and map information and completion of PAC re-maps as stated in the scoping package (Chapter 1.04). These corrections and refinements provide additional resource protection and a more accurate and informed proposed action. Alternative 1 (Proposed Action) includes the treatments and actions described below. Table 2.05-1 provides a summary of the proposed activities and Appendix E (Treatments) provides detailed information for each specific treatment unit.

Salvage and Fuel Reduction

Alternative 1 includes salvage logging on up to 28,326 acres including 24,127 acres of ground based, 16 acres of ground based/skyline swing, 2,930 acres of helicopter, and 1,253 acres of skyline treatments. Proposed fuel treatments include: 7,626 acres of biomass removal, 24,143 acres of machine piling and burning and 4,199 acres of jackpot burning.

Hazard Tree Removal and Fuel Reduction

Fell and remove hazard trees (green and dead) adjacent to 341 miles of forest roads outside of proposed salvage units, amounting to 16,315 acres. Some non-merchantable trees may be felled and left in place.

Roads

Alternative 1 includes 5.4 miles of new construction, 319.9 miles of reconstruction and 216.1 miles of maintenance. About 3.9 miles of temporary road construction (new), 9.3 miles of temporary road construction (existing), and 8.4 miles of existing temporary use routes tied to current and future uses would be used for the project and then reverted afterwards to their original use.

Wildlife Habitat Enhancement

Within Critical Winter Deer Range and adjacent to Yosemite National Park units were identified for salvage and/or biomass removal to achieve desired forage/cover ratios and to provide for deer passage and access. These units encompass 1,351 acres and include: L03, L06, L07, L202, L203A, L203B, L204A, L204B, L205, L206, M201, O201, and P201.

Management Requirements

Alternative 1 includes the following management requirements in addition to the Management Requirements Common to All Action Alternatives (Chapter 2.03).

1. Whole tree yard merchantable trees within ground based salvage units where fuel levels exceed desired amounts. If breakage from trees occurs during logging operations and debris amount exceeds 10 tons/acre, piling and burning and/or jackpot burning may be utilized.
2. Where existing fuel loads are less than or equal to 5 tons/acre, some trees may be felled and left in place or masticated into pieces less than 2 feet in length to reduce potential soil erosion and maintain soil productivity. Total fuel loading for these units should not exceed 10 tons/acre with a fuel bed depth of less than or equal to 12 inches. Woody debris less than or equal to 8 inches in diameter will not exceed 3 tons/acre.
3. Piling and burning, and/or jackpot burning may be used to reduce fuel loading when dead and down woody fuels (3 inches and above) within salvage units exceed 10 tons/acre.
4. Meet habitat needs for Threatened, Endangered and Sensitive (TES) aquatic species:
    a. Maintain a 30 foot no cut and no equipment buffer around areas identified as suitable California red-legged frog aquatic habitat (breeding and non-breeding) including: 1) 0.16 miles of Middle Fork Tuolumne River located in unit V10; 2) 2.7 miles of unnamed stream (flowing out of Birch Lake) and tributary in unit U01; and, 3) Homestead pond located in unit Y02. This requirement does not apply to operations for hazard tree removal.
    b. In suitable Sierra Nevada yellow-legged frog (SNYLF) habitat within 75 feet of proposed activities where no surveys have been completed (Looney Creek) a qualified biologist will perform a visual encounter survey before project implementation. If SNYLF are detected, establish a 75 foot no equipment buffer from the high water mark.
    c. To provide key pieces of wood to the channel, retain a minimum of 20 pieces of large woody debris (LWD, trees of the largest diameters) per mile of perennial and intermittent channels in salvage units. These snags should be felled into the stream in an upstream direction (greater than 45 degrees from perpendicular) to the maximum extent possible in order to actively recruit large wood to the channel. If these trees pose an unacceptable fuels risk, retain the largest portion of the bole equivalent to three times the bankfull width of the stream.
    d. Adjacent to Abernathy Meadow (Unit U01), retain 12 down logs per acre around the perimeter of the meadow, extending 300 feet from the edge of the meadow to replace important elements for western pond turtle habitat. These trees shall be felled and left on the ground and be representative of the largest 50 percent of the trees in the retention zone.
    e. Do not allow new construction, including temporary roads, within 0.25 miles of Abernathy Meadow in Unit U01 or within 0.25 miles of “Big Kibbie Pond” in unit O02.
    f. To minimize direct impact to foothill yellow-legged frogs, do not allow skidding directly across the main stream channel in units H11, H13, K01, K02 and L03.
5. Forest Service Manual 2550-Soil Management-R5 Supplement (USDA 2012) and Forest Plan Direction (USDA 2010) provide standards and guidelines for soil management and are the basis for soil requirements to minimize potential impacts:
    a. Spread existing windrows within units following treatments. A soil scientist will evaluate spreading operations on slopes greater than 25 percent to ensure standards are met.

6. Provide for a forest carnivore connectivity corridor for fisher and marten, linking Yosemite National Park, the North Mountain inventoried roadless area west to the Clavey River, including the following proposed salvage units: L02, L05, M1 through M10, M12, M13, M15, M16, M18, M19, and N1.
7. Consider additional snags and downed logs to meet habitat needs in Old Forest Emphasis Areas (OFEA), Spotted Owl Home Range Core Areas (HRCA), and forest carnivore connectivity corridor (FCCC).
8. Consider avoiding construction of new landings and skid trails within PACs.
9. Consider avoiding road construction within 0.25 miles of nest roost sites.
10. Within critical winter deer range and migration corridors, remove or pile and burn non-merchantable material to protect remnant oaks and achieve desired forage/cover ratios identified in consultation with the California Department of Fish and Wildlife. This includes proposed units L03, L06, L07, L202 through L206, M201, O201 and P201.
11. Consider mitigating areas where roadside hazard treatments are within PACs and HRCAs by adding acreage to the PAC and/or HRCA equivalent to the treated acres of the most suitable habitat available.
12. Prevent introduction and spread of noxious weeds:
    a. Where possible above 4,000 feet elevation, prior to use, manually treat dense infestations of weeds in areas utilized by project equipment/vehicles to prevent spread, if flowers or seeds are present on the plants.
    b. Flag and avoid infestations of high priority noxious weeds during project activities. Manual methods such as hand thinning may take place within noxious weed sites if timed for before seed set.

Alternative 2 (No Action)

Alternative 2 (No Action) provides a baseline for comparison with the other alternatives (Table 2.05-1). Under Alternative 2 (No Action), general salvage and hazard tree abatement and removal adjacent to lower standard roads would not occur. Current management plans would continue to guide management of the project area. None of the viable timber would be removed from this area leaving tens to hundreds of tons of fuel per acre once these trees fall down and rendering access for firefighting virtually impossible. No hazard tree removal would occur adjacent to lower standard roads, leaving thousands of existing hazard trees to fall on their own as a result of natural forces. These roads would likely remain closed to public access. The cost of future activities where removal of this material is essential to implementation would be far more expensive and perhaps become cost prohibitive. The maintenance and reconstruction would not be implemented to accomplish the project goal of a properly functioning road infrastructure.

Alternative 3

Alternative 3 responds to issues and concerns related to: Snag Forest Habitat; New Road Construction, Wildlife Habitat; and, Soil and Watershed Impacts (Chapter 1.08). Compared to Alternative 1, it addresses those issues by proposing: additional wildlife habitat enhancement (including biomass removal in Critical Deer Winter Range and the FCCC Forest Plan Amendment); additional soil and watershed protection (mastication and drop and lop); and, less new construction. It also includes research to help answer wildlife, fuels, watershed, and soils questions. Alternative 3 includes the treatments and actions described below. Table 2.05-1 provides a summary of the proposed activities and Appendix E (Treatments) provides detailed information for each specific treatment unit.

Salvage and Fuel Reduction

Alternative 3 salvage and fuels treatments are similar to Alternative 1; however, it includes two additional fuel treatments (mastication and drop and lop) to mitigate impacts of the fire and logging on soil and water resources.

Alternative 3 includes salvage logging on up to 30,399 acres including 26,252 acres of ground based, 16 acres of ground based/skyline swing, 3,035 acres of helicopter, and 1,096 acres of skyline treatments. Proposed fuels treatments include: 8,379 acres of biomass removal, 22,036 acres of machine piling and burning and 4,147 acres of jackpot burning, 1,309 acres of mastication, and 2,228 acres of drop and lop.

Hazard Tree Removal and Fuel Reduction

Alternative 3 involves felling and removing of hazard trees (green and dead) adjacent to 314.8 miles of forest roads, amounting to 15,253 acres, outside of proposed salvage units. Some non-merchantable trees may be felled and left in place.

Roads

Alternative 3 includes 1.0 mile of new construction, 323.6 miles of reconstruction and 200.6 miles of maintenance. It also includes 9.5 miles of temporary road construction (new), 22.7 miles of temporary road construction (existing), and 3.3 miles of existing temporary roads tied to current and future uses would be used for the project and then reverted afterwards to their original use.

Wildlife Habitat Enhancement

Alternative 3 includes several additional treatment units to enhance the Critical Deer Winter Range (Appendix E). In addition, the FCCC Forest Plan Amendment provides for long-term movement of wildlife from Yosemite National Park through the Stanislaus National Forest.

Research

Alternative 3 includes the Research projects described in Chapter 2.01. Appendix D (Research) provides additional details for the individual research proposals.

Forest Plan Amendment

Alternative 3 includes a Forest Plan Amendment designating a 4 mile wide Forest Carnivore Connectivity Corridor (FCCC), as habitat for old-forest habitat associated species, particularly forest carnivores (portions of this corridor also overlap critical deer range). Figure 2.02-1 shows the corridor would lead from Yosemite National Park and North Mountain Inventoried Roadless Area (IRA) west to the Clavey River. The corridor includes the following proposed units that would be managed for Old Forest Emphasis: L02, L05, M1 through M10, M12, M13, M15, M16, M18, M19, and N1.

This Forest Plan Amendment changes the land allocation on 9,923 acres from General Forest to Old Forest Emphasis Area (OFEA) and includes the following desired condition. Other existing land allocations (Wild and Scenic River, PAC, HRCA, and OFEA) allocations would remain unchanged (Table 3.01-1).

Desired Condition: the Forest Carnivore Connectivity Corridor (FCCC) provides habitat connectivity for forest carnivores, linking Yosemite National Park and the North Mountain Inventoried Roadless Area west to the Clavey River. For habitat connectivity, a future forested area is desired with a minimum of 50 percent of the forested area having at least 60 percent canopy cover; more than 10 tons per acre of coarse woody debris in decay classes 1 and 2; and, an average of 6 snags per acre. Habitat structures are important to retain that may constitute rest sites as described in Freel 1991 and Lofroth et al. 2010 (e.g. plate 7.7 and 7.8).

Management Requirements

Alternative 3 includes the following management requirements in addition to the Management Requirements Common to All Action Alternatives (Chapter 2.03).

1. Complete all burning under approved burn and smoke management plans. Acquire burn permits from the appropriate county Air Pollution Control District(s) which will determine when burning is allowed. The California Air Resources Board provides daily information on "burn" or "no burn" conditions. Design and implement burn plans to minimize particulate emissions.
2. Retain 10 to 20 tons per acre coarse woody debris greater than 3 inches. The goal is to maintain a total fuel load of 10 tons per acre, and not to exceed 20 tons per acre when it is needed to meet other resource requirements. Do not exceed 5 tons per acre woody debris less than 3 inches in diameter.
3. Do not exceed 12 inch fuel depth within SPLATS and 18 inch fuel depth outside SPLATS.
4. Meet habitat needs for Threatened, Endangered and Sensitive (TES) aquatic species:
    a. To avoid California red-legged frog take, fell trees away from 1) 0.16 miles of Middle Fork Tuolumne River located in unit V10; 2) 2.7 miles of unnamed stream (flowing out of Birch Lake) and tributary in unit U01D; and 3) Homestead pond located in unit Y02.
    b. Ensure California red-legged frog cover is provided in the upland habitat located within unit U01D. Consultation between the Sale Administrator and an aquatic biologist will occur during harvest. If the area is found to be deficient in downed material, drop and lop dead trees 8 to 16 inches dbh uniformly across the landscape at a rate of 3 to 5 tons/acre. Provide a minimum of 5 standing dead trees per acre within RCAs adjacent to all perennial channels that are within or bordering salvage units. These snags should have the largest diameters possible and be located within 100 feet of the edge of the active channel. To minimize direct impact to western pond turtle, limit the ground based equipment to the maximum extent possible in units S01, S04 (within ¼ mile of the South Fork Tuolumne River), V10 and V14B between June 1 and July 15.
5. Forest Service Manual 2550-Soil Management-R5 Supplement (USDA 2012) and Forest Plan Direction (USDA 2010) provide standards and guidelines for soil management and are the basis for soil requirements to minimize potential impacts:
    a. In high burn severity areas, leave a 20 foot buffer of small trees (non-merchantable) adjacent to motorized trail segments, and 10 to 20 tons of surface material.
    b. Ground-based operations will occur when soil moisture is relatively dry in the 4 to 8 inch depth range. Consultation with a Soil Scientist will occur prior to start-up of operations. Suspend operations whenever soil moisture conditions are such that excessive damage would occur. In high burn severity areas, use the Very High Erosion Hazard Rating when considering application of erosion control measures.
6. Ensure consistency with Forest Plan and Regional Conservation strategies for terrestrial wildlife:
    a. Snag retention in OFEA, HRCA and FCCC units: the intent is to retain legacy structure where it exists for long-term resource recovery needs (i.e., the development of future old forest habitat with higher than average levels of large conifer snags and down woody material). Retain all hardwood snags greater than or equal to 12 inches diameter at breast height (dbh). Retain an average of 30 square feet of basal area of conifer snags across each unit by starting at the largest snag and working down, with a minimum of four and a maximum of 6 per acre.
    b. In OFEA, HRCA, FCCC, and in roadside hazard units within Protected Activity Centers (PACs), retain the largest size classes of down woody material at a rate of 15 to 20 tons per

acre on a unit basis. In all units, emphasize down woody material retention greater than 100 feet from roadsides.

c. Where roadside hazard treatments are within PACs and HRCAs, add acreage to the PAC and/or HRCA equivalent to the treated acres of the most suitable habitat available.
d. Within viable post-fire PACs, flag and avoid current and historic nest trees and avoid altering screening vegetation within 500 feet; if hazard abatement is deemed immediately necessary, coordinate with a wildlife biologist and with other disciplines (e.g. recreation) as needed to identify options for the deciding official.
e. Reduce LOPs in PACs to 0.25 mile area around a nest site if surveys are conducted.
f. Within critical winter deer range and migration corridors, remove or pile and burn non-merchantable material to protect remnant oaks and achieve desired cover/forage ratios identified in collaboration with the California Department of Fish and Wildlife and partners. This includes proposed units L03, L04, L07, L201 through L206, M201 through M204, O201 and P201.
g. Flag and avoid hardwood aggregations and meadows and seeps within units. Aggregations are 1/10 to 1/2 acre groups of sprouting hardwood or of meadow/seep vegetation. Groups or meadows/seeps may be linear along drainages. Reaching in and end lining allowed. Ground-based equipment prohibited. Exceptions should be limited but may be made for operability in consultation with the sale administrator and project biologist.

7. Ensure consistency with Forest Plan and other direction for sensitive and watch list plants.
   a. For roadside hazard tree abatement, where it is not possible to fully avoid a Sensitive Plant occurrence, a botanist will review the site with the Sale Administrator and advise on the least impactive method to use for the site, such as timing of impacts, directionally fall trees away from dense concentrations, full suspension removal of the log, partial suspension, or buck and leave the log.
   b. Hide, obscure or block appearance of motorized access created by the project to “lava cap” habitats. Existing patches of live or dead brush or other vegetation on the edges of the “lava caps” can be utilized for this purpose.
   c. In Unit A01B avoid mastication slash on “lava cap” soils.
   d. In order to protect occurrences of *Peltigera gowardii*, conduct project activities in such a way that sediment is not added to or accumulates within occurrences, especially in Corral Creek at Sections 17 and 20, T1N, R18E, the unnamed tributary to Clavey River in Section 18, T1N, R18E; the unnamed tributary to Skunk Creek in Section 21, T1N, R18E; and, Twomile Creek in Section 36, T3N, 17E; and Section 1, T2N, R17E.
   e. During helicopter salvage operations, avoid flying logs over cliff habitats in and adjacent to unit X23. Off-road equipment will not track within 25 feet of the bases or tops of cliffs and large rock outcrops, or through gravelly openings with shallow soils in units X18, X19 and X23 nor in the roadside hazard tree removal of Forest Roads 1S60Y, 1S79, 1S80, 2S65D, 2S66Y, and 2S66YA. Manual removal of fuels, directional felling and tree removal using an articulating arm or equipment which allows for full suspension may occur in these equipment exclusion areas during the dry, non-growing period for the rare plant species, approximately July 1 through November 30
   f. Avoid adverse effects to Pacific Madrone (*Arbutus menziesi*i), Tanoak (*Notholithocarpus densiflorus*), California nutmeg (*Torreya californica*) and Sierra sweet bay (*Myrica hartwegii*) trees and saplings during all project activities. During reconstruction activities, avoid these species unless the trees or saplings create a safety hazard or interfere with the integrity of the road surface. Prune limbs to obtain sight distance rather than masticate the trees or saplings.

8. Conduct a pre-project implementation invasive plant inventory of all project areas subject to project associated ground disturbance. This inventory, along with previous survey information, will be utilized to implement the requirements below.
   a. Flag and avoid infestations of high and moderate priority weeds in all project locations subject to ground disturbance from either mechanical or foot traffic (e.g. project units, staging/landing areas, turnouts, roads). Units currently included are: B32, D04B, E01B, F11, F16, F23A, H11, H12X, K02, L04, L202, L202B, L203, L204, L205, L206, M202A, M203, N01, Q14A, R01A, R04A, R04B, R12X, R17X, R19A, R19B, R19D, S02, S03, V10, V13, V14B, V14C, X04, X06, X116, X118X and X119X (70 acres).
   b. In areas needed for implementation of the proposed activities, manually treat new or expanding portions of post-Rim Fire infestations before seed dispersal. Manual treatment will entail the cutting, digging, or pulling of all flower heads and/or vegetative reproductive parts (i.e. rhizomatous root parts). The Weed Risk Assessment (project record) describes species specific treatments.
   c. Where re-using landing and/or staging areas is necessary, the topsoil (top 6-8 inches) may be pushed into a wind-row and covered to prevent seed dispersal. Topsoil will be pushed back into place following project completion.
   d. Conduct maintenance activities in a manner which reduces the risk of weed spread, such as: avoiding soil movement out of weed sites; grading toward weed infestations, not away; or utilizing manual methods.
   e. Obtain construction materials, including crushed rock, drain rock, riprap and soil, from sources free of high and moderate priority weeds. If sources do contain these priority weeds, either flag and avoid or move topsoil to a nearby location that will not be disturbed and cover.
9. Protect and avoid all surviving proven and candidate rust resistant sugar pine trees during operations.
10. Place all fuel piles as far from wilderness and National Park boundaries as possible. Place piles behind remaining vegetation/topography and out of view.
11. No harvest operations on weekends from Memorial Day through Labor Day within units where log haul requires the use of Evergreen Road.
12. No operations on weekends beginning Memorial Day through Labor Day in areas adjacent to Lost Claim and Sweetwater Campgrounds (units Y01B, Y01D, V12A and V12B).
13. Identify and protect NFSTs during operations. Trails, if damaged, will be restored in kind according to Forest Service standards including the placement of rolling dips.
14. Close skid trails to motorized travel with earth berms, logs and/or rocks after operations are complete. Do not use stumps or root wads to close skid trails.
15. Avoid using water sources in developed recreation sites while facilities are open to public use.
16. Maintain existing cattleguards to Forest Service standards during post-harvest maintenance.

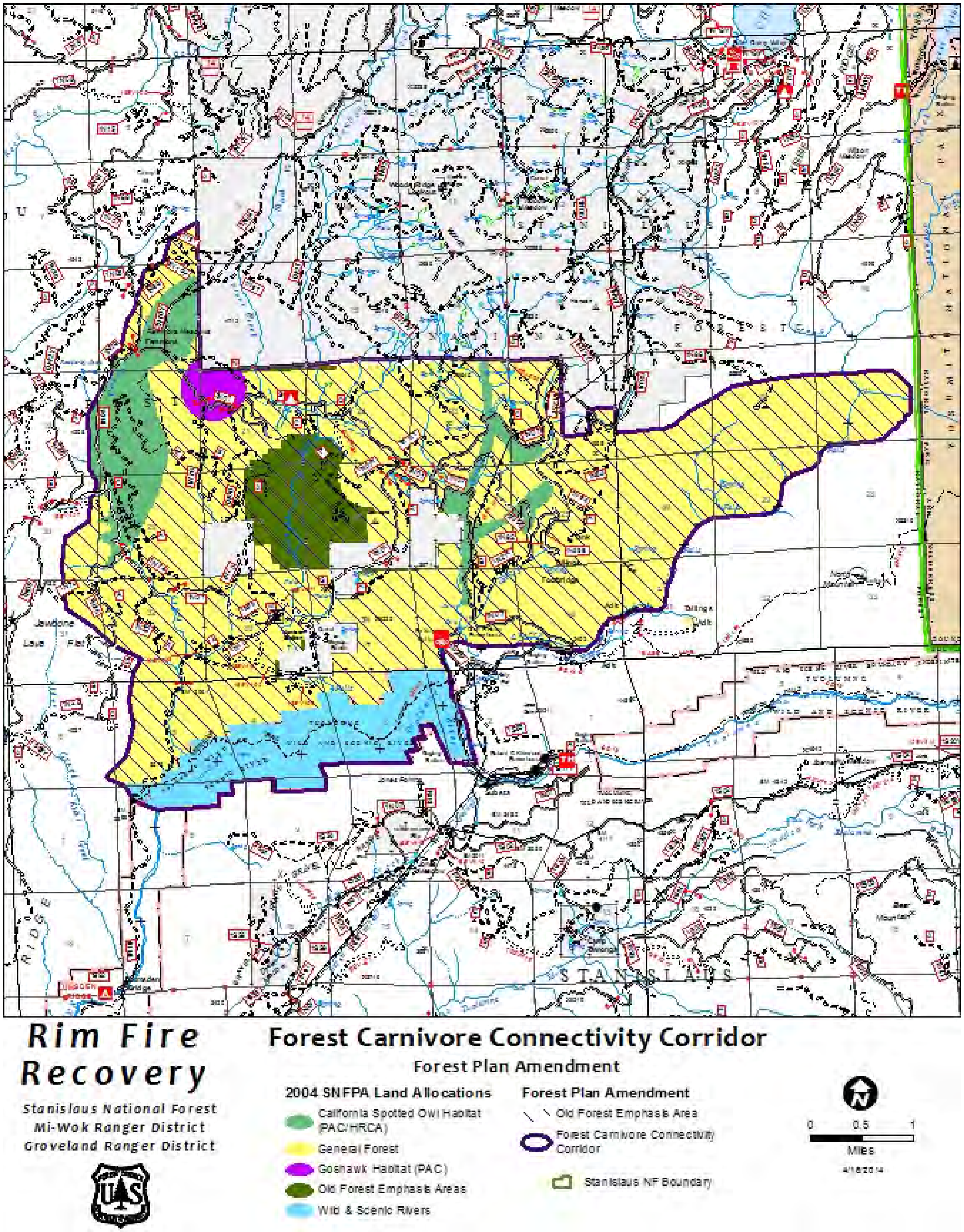

Figure 2.02-1 Forest Carnivore Connectivity Corridor Forest Plan Amendment

Alternative 4

Alternative 4 is similar to Alternative 3 except that it replaces new construction with temporary roads and drops 2,500 acres of salvage logging in highly suitable black-backed woodpecker habitat.

Alternative 4 responds to issues and concerns related to: Snag Forest Habitat; New Road Construction, Wildlife Habitat; and, Soil and Watershed Impacts (Chapter 1.08) by proposing the same action items as Alternative 3 for wildlife habitat enhancement (including biomass removal in Critical Deer Winter Range and the FCCC Forest Plan Amendment) and, soil and watershed protection (mastication and drop and lop). It also includes research to help answer wildlife, fuels, watershed, and soils questions. Compared to Alternative 3, Alternative 4 further addresses the Snag Forest Habitat issue with additional black-backed woodpecker habitat retention and, the New Road Construction issue with no new construction. Alternative 4 includes the treatments and actions described below. Table 2.05-1 provides a summary of the proposed activities and Appendix E (Treatments) provides detailed information for each specific treatment unit.

Salvage and Fuel Reduction

Alternative 4 includes salvage logging on up to 27,826 acres including 24,176 acres of ground based, 16 acres of ground based/skyline swing, 2,568 acres of helicopter, and 1,066 acres of skyline treatments. Proposed fuels treatments include: 7,975 acres of biomass removal, 20,320 acres of machine piling and burning and 3,650 acres of jackpot burning, 1,309 acres of mastication, and 1,798 acres of drop and lop.

Hazard Tree Removal and Fuel Reduction

Alternative 4 involves felling and removing of hazard trees (green and dead) adjacent to 324.6 miles of forest roads, amounting to 15,692 acres, outside of proposed salvage units. Some non-merchantable trees may be felled and left in place.

Roads

Alternative 4 includes 315.0 miles of reconstruction and 209.3 miles of maintenance. Alternative 4 does not include new construction. It includes 8.4 miles of temporary road construction (new), 22.1 miles of temporary road construction (existing) and 3.3 miles of existing temporary use routes tied to current and future uses would be used for the project and then reverted afterwards to their original use.

Wildlife Habitat Enhancement

Alternative 4 includes the same wildlife enhancement treatments as Alternative 3.

Research

Alternative 4 includes the same research treatments as Alternative 3.

Forest Plan Amendment

Alternative 4 includes the same FCCC Forest Plan Amendment as Alternative 3.

Management Requirements

Alternative 4 includes the same management requirements as Alternative 3.

2.03 MANAGEMENT REQUIREMENTS COMMON TO ALL ACTION ALTERNATIVES

Based on a site specific review of each alternative, resource specialists identified the following management requirements that would be implemented under the action alternatives (1, 3 and 4).

1. Whole tree yard merchantable trees within ground based salvage units where fuel levels exceed desired amounts.
2. Meet habitat needs for Threatened, Endangered and Sensitive (TES) aquatic species:
    a. Prohibit mechanical operations within 1 mile of areas identified as suitable California red-legged frog breeding habitat during the wet season (the first rainfall event depositing more than 0.25 inches of rain on or after October 15 until April 15).
    b. To minimize direct impacts to California red-legged frogs, do not locate burn piles within 100 feet of Homestead pond located in unit Y02 (suitable California red-legged frog breeding habitat), within 50 feet of the 0.16 miles of Middle Fork Tuolumne River located in harvest unit V10, or within 50 feet of the 2.7 miles of unnamed stream (flowing out of Birch Lake) and tributary in harvest unit U01 (suitable California red-legged frog aquatic non-breeding habitat).
    c. When igniting hand piles within 1 mile of suitable California red legged frog breeding habitat, ignite only on one side, not to exceed half the circumference of the pile, on the side furthest from the nearest aquatic feature.
    d. Locate roads and landings at least 300 feet away from suitable California red legged frog breeding and non-breeding aquatic habitat. Construction within 1 mile of suitable habitat must occur during the dry season (typically April 15 through October 15). Table 2.03-1 shows road treatments for the breeding habitat areas.
    e. Retain existing downed large woody debris 24 inches and greater in diameter at the small end that is either crossing a perennial channel or within 30 feet of the stream edge. Tops may be removed if fuel issues are a concern; however, 50 percent of the tree bole should remain in the RCA.
    f. To minimize direct impacts to foothill yellow-legged frogs, do not fall timber directly across the stream in units F11, F15, F17, F18, H13A, K01, K02, L01, L02B, L203 and L205. This requirement also applies to hazard tree removal along roads: 1N36, 1N41, 1N50, 1N50A, 1N50C and 1N79B.
    g. Prohibit equipment operations in units U01B and O02A, within 300 feet of Abernathy Meadow and Little Kibbie Pond from June 1 through July 15 and during periods when these features have no standing water.
    h. Use screening devices on water drafting pumps and use pumps with low entry velocity to minimize impacts to aquatic species. A drafting box measuring 2 feet on all sides covered in a maximum of 0.25 inch screening is required.
    i. USFWS Consultation: Continue further consultation with the USFWS to comply with Section 7 of the Endangered Species Act (must be completed prior to a decision).

Table 2.03-1 Units and roads associated with California red-legged frog breeding habitat

Breeding Habitat	Treatment Units	Hazard Tree Removal	Road Treatments
Drew Creek	W03, V06, V10	01N10, 01N10C, 01S30, 01S30B, 01S52, 01S58, 01S58A, 01S58B, 01S58E, 01S58F, 01S61, 01S99Y, 18E217, 18E219, 18EV420, 18EV421, 18EV422, 18EV424, FR14720, FR14722, FR1981, FR36710, FR4100, FR4875, FR7858, FR9139	Temporary Road: FR4100, 18EV420, 18EV422
Birch Lake and Mudd Lake	U01, Q14A, Q14B, Q15, Q16	01S19, 01S19A, 01S20Y, 01S32, 01S68Y, 01S96, 19EV211, 19EV214, FR8799	Reconstruct: 01S18Y, 01S19, 01S19A, 01S20Y, 01S32, 01S68Y, 01S96, 19EV214
Homestead Pond	Y02, Y03	01N10, 01S08YA, 01S21Y, 01S23E, 01S48Y, FR9772, TR9835	Reconstruct: 01S08Y, 01S08YA, FR98671
Hunter Creek and ponds	NONE	01N01H, 01N01K, 01N02, 01N02B, 01N13, 01N13A, 01N13B, 01N17, 01N17A, 01N18, 01N18A, 01N19, 01N25, 01N25A, 01N25B, 01N27, 01N27A, 01N27B, 01N34Y, 01N35, 01N38, 01N38A, 01N39, 01N40, 01N43, 01N43B, 01N43C, 01N43D, 01N48, 01N48A, 01N48B, 01N54, 01N67, 01N78, 02N11D, 02N11F, 11624B, 11624C, 11708A, 11708B, 11717B, 11719C, 11721E, 11728B, 11728C, 11729A, 11730C, 11731A, 16E179, 18E317, FR7965	NONE
Harden Flat Ponds	R15, S11, V14B, X104, X109, X115, X116, X120, X25	01S03B, 01S62, 01S75, 01S75Y	01S03B, 01S09, 01S62, 01S64, 01S75Y, FR5310

3. Management requirements designed to protect water quality and watershed conditions are derived from Regional and National BMPs (USDA 2011a, USDA 2012) and Riparian Conservation Objectives (RCOs) (USDA 2004). Riparian resources within Riparian Conservation Areas (RCAs) and the Critical Aquatic Refuge (CAR) will be protected through compliance with the RCOs outlined in the Forest Plan (USDA 2010). BMPs protect beneficial uses of water by preventing or minimizing the threat of discharge of pollutants of concern. BMPs applicable to this project are listed below with site-specific requirements and comments. Project planners and administrators (e.g., layout, Sale Administrator, Contracting Officer Representative) are responsible for consulting with a hydrologist and/or soil scientist prior to or during project implementation for interpretation, clarification, or adjustment of watershed management requirements.
   a. **Mechanized Equipment Operations within RCAs/CAR**. On the Stanislaus National Forest, ground-based mechanized equipment operations in RCAs are divided into three zones. The exclusion zone, at the edge of streams or wetlands, prohibits mechanized equipment use. Next, the transition zone allows light mechanized activity. Last, the outer zone allows activity to increase to standard operations beyond the RCA. Together, these zones comprise a wide, graduated RCA buffer zone intended to achieve RCOs as well as vegetation management objectives. The purpose of mechanized RCA operations is to reduce fuel loading and improve riparian vegetation community condition close to streams and wetlands. These operations are carefully conducted to prevent detrimental soil impacts and retain a high percentage of ground cover in the RCA. Where ground cover is minimal in an RCA, such as following wildfire, specialized low ground pressure vehicles become the primary type of equipment used. They minimize disturbance during timber removal operations and can be used to increase ground cover by chipping and distributing woody debris. Forest guidance for Mechanized Equipment Operations in RCAs (Frazier 2006) as summarized above was

developed for RCA vegetation management operations in unburned areas. It has since been revised to include post-wildfire operations. Table 2.03-2 provides a summary of the operating requirements for mechanical operations in RCAs.

Table 2.03-2 Operating requirements for mechanized equipment operations in RCAs

Stream Type[1]	Zone	Width (feet)	Equipment Requirements	Element	Operating Requirements
Perennial/ Intermittent and Special Aquatic Features (SAFs)	Exclusion	0 - 15	Mechanical Harvesting/ Shredding[2]: Prohibited		
		0 - 50	Skidding[3]: Prohibited		
	Transition	15 - 100	Mechanical Harvesting/ Shredding: Allowed	Streamcourse Debris	Remove activity-created woody debris to above the high water line of stream channels
				Vegetation	Retain remaining post-fire obligate riparian shrubs and trees that have live crown foliage or are resprouting (e.g., willows, alder, dogwoods and big leaf maples)
				Streambanks	Do not damage streambanks with equipment.
		50 - 100	Skidding: Allowed	Skid Trails	Use existing skid trails except where unacceptable impact would result. Do not construct new primary skid trails within 100 feet of the stream
				Stream Crossings	The number of crossings should not exceed an average of 2 per mile
	Outer (Perennial/SAFs)	100 - 300	Mechanical Harvesting/ Shredding/ Skidding: Allowed	Skid Trails	Allow skid trail density and intensity to gradually increase with distance from the Transition Zone
	Outer (Intermittent)	100 - 150	Mechanical Harvesting/ Shredding/ Skidding: Allowed	Skid Trails	Allow skid trail density and intensity to gradually increase with distance from the Transition Zone
Ephemeral	Exclusion	0 - 15	Mechanical Harvesting/ Shredding: Prohibited		
		0 - 25	Skidding: Prohibited		
	Transition	15 - 50	Mechanical Harvesting/ Shredding: Allowed		
		25 - 50	Skidding: Allowed	Stream Crossings	The number of crossings should not exceed an average of 3 per mile

1 Perennial streams flow year long. Intermittent streams flow during the wet season but dry by summer or fall. Ephemeral streams flow only during or shortly after rainfall or snowmelt. Special aquatic features (SAFs) include lakes, meadows, bogs, fens, wetlands, vernal pools and springs.
2 Low ground pressure track-laying machines such as feller bunchers and masticators.
3 Rubber-tired skidders and track-laying tractors.

b. **Management Requirements Incorporating BMPs and Forest Plan S&Gs**. Table 2.03-3 presents management requirements pertaining to: erosion control plans; operations in RCAs; road activities; stream crossings; log landings; skid trails; suspended log yarding; water sources, rock borrow pits/quarries, slope and soil moisture limitations, servicing and refueling of equipment; burn piles; application of registered borate compound; water quality monitoring; and, cumulative watershed effects

Table 2.03-3 Management requirements incorporating BMPs and Forest Plan S&Gs

Management Requirements	BMPs/Forest Plan[1]/Locations
Erosion Control Plan - Prepare a project area Erosion Control Plan (USDA 2011a) approved by the Forest Supervisor prior to the commencement of any ground-disturbing project activities. Prepare a BMP checklist before implementation.	**Regional BMPs** 2-13 Erosion Control Plans (roads and other activities) 1-13 Erosion Prevention and Control Measures During Operations 1-21 Acceptance of Timber Sale Erosion Control Measures before Sale Closure **National Core BMPs** Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all areas where ground-disturbing activities occur.

Operations in Riparian Conservation Areas
- Delineate riparian buffers along streams and around special aquatic features within project treatment units as described above in Table 2.03-2.
- Fell trees harvested within RCAs directionally away from stream channels and SAFs unless otherwise recommended by a hydrologist or biologist. Fall hazards trees that cannot be removed either parallel to the contour of the slope or into the channel, as recommended by a hydrologist or biologist.
- Maintain or provide ground cover (e.g., maintain post-fire conifer needle cast; provide logging slash, straw, wood chips, felled or masticated small burned trees) within 100 feet of perennial and intermittent streams and SAFs to the maximum extent practicable to minimize erosion and sedimentation. A minimum of 50% well distributed ground cover is desired.
- Minimize turning mechanical harvesters/shredders in the RCA Transition Zone to limit disturbance.
- Exclude mechanized equipment between the near-stream roads that closely parallel both sides of Corral Creek [1N01, 1N08 on the west and 1N74 (south of junction with 1N74C) and 1N74C on the east] unless otherwise recommended by a hydrologist or soil scientist. Smooth out all end lining ruts within this area. The maximum mechanized equipment exclusion width is the RCA width (300 feet).
- The Sale Administrator shall coordinate with a hydrologist prior to operating around Scout Spring Gully (Unit T22).
- The Sale Administrator shall coordinate with a hydrologist prior to operating in unit T27B to protect the Bear Gully restoration site, the stream channel downstream of the site, and the alluvial flat.
- In areas with less than 50% soil cover and slopes greater than 15%, the following requirements apply:
  - From 0-50 feet from perennial and intermittent stream banks, smooth out feller buncher or end lining ruts greater than 4 inches in depth.
  - From 50-100 feet from perennial and intermittent stream banks, smooth out feller buncher or end lining ruts greater than 4 inches in depth or waterbar these ruts following the waterbar spacing guidelines for a very high erosion hazard rating.
- Increase the ground-based equipment exclusion zone in RCAs to 100 feet on slopes between 25 and 35% with slope lengths greater than 100 feet, high burn severity, and immediately adjacent to perennial and intermittent channels within the following units: D04B, D12, E01B, E02, E03B, F11, G01, G03B, L02D, M01, M05A, M15, N01I, R16, S02, S04, T04B, T04C, T27B, U03, V13, V14B, V14C. Prior to implementation, these sites will be evaluated in the field by a hydrologist or soil scientist to identify on the ground areas where exclusion is required.
	Regional BMPs
	1-4 Using Sale Area Maps and/or Project Maps for Designating Water Quality Protection Needs
	1-8 Streamside Zone Designation
	1-10 Tractor Skidding Design
	1-18 Meadow Protection During Timber Harvesting
	1-19 Streamcourse and Aquatic Protection
	5-3 Tractor Operation Limitations in Wetlands and Meadows
	5-5 Disposal of Organic Debris
	7-3 Protection of Wetlands
	National Core BMPs
	Aq Eco-2 Operations in Aquatic Ecosystems
	Plan-3 Aquatic Management Zone Planning
	Veg-1 Vegetation Management Planning
	Veg-2 Erosion Prevention and Control
	Veg-3 Aquatic Management Zones
	Veg-4 Ground-Based Skidding and Yarding Operations
	Forest Plan S&Gs
	193 (RCO 2)
	194 (RCO 3)
	194 (RCO 4)
	195 (RCO 5)
	Locations: All units containing RCAs and SAFs, and specifically the portions of units mentioned in this section of Table 2.03-3.

Road Construction and Reconstruction - Maintain erosion-control measures to function effectively throughout the project area during road construction and reconstruction, and in accordance with the approved erosion control plan. - Stabilize disturbed areas with certified weed free mulch, erosion fabric, vegetation, rock, large organic materials, engineered structures, or other measures according to specification and the erosion control plan. - Set the minimum construction limits needed for the project and confine disturbance to that area. - Adjust surface drainage structures to minimize hydrologic connectivity by: discharging road runoff to areas of high infiltration and high surface roughness;	**Regional BMPs** 2-2 General Guidelines for the Location and Design of Roads 2-3 Road Construction and Reconstruction 2-8 Stream Crossings 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Road-3 Road Construction and Reconstruction **Forest Plan S&Gs**

Management Requirements	BMPs/Forest Plan[1]/Locations
armoring drainage outlets to prevent gully initiation; and, increasing the number drainage facilities within RCAs. - Minimize diversion potential by installing diversion prevention dips that can accommodate overtopping runoff. Place diversion prevention dips downslope of crossing, rather than directly over the crossing fill, and in a location that minimizes fill loss in the event of overtopping. Armor diversion prevention dips when the expected volume of fill loss is significant. - Locate and designate waste areas before operations begin. Deposit and stabilize excess and unsuitable materials only in designated sites. Do not place such materials on slopes with a high risk of mass failure, in areas subject to overland flow (e.g., convergent areas subject to saturation overland flow), or within the RCA. Provide adequate surface drainage and erosion protection at disposal sites. - Do not permit side casting in RCAs. Prevent excavated materials from entering water or RCAs. - Schedule operations during dry periods when rain, runoff, wet soils, snowmelt or frost melt are less likely. Limit operation of equipment when ground conditions could result in excessive rutting, soil compaction (except on the road prism or other surface to be compacted), or runoff of sediments directly to streams. - Stabilize project area during normal operating season when the National Weather Service predicts a 50% or greater chance of precipitation. - Keep erosion-control measures sufficiently effective during ground disturbance to allow rapid closure when weather conditions deteriorate. - Complete all necessary stabilization prior to precipitation that could result in surface runoff. - Scatter construction-generated slash on disturbed areas. Ensure ground contact between slash and disturbed slopes. Windrow slash at the base of fills to reduce sedimentation. Ensure windrows are placed along contours with ground contact between slash and disturbed slope. - Monitor contractor's plans and operations to assure contractor does not open up more ground than can be substantially completed before expected winter shutdowns, unless erosion-control measures are implemented. - Install erosion-control measures on incomplete roads prior to precipitation or the start of winter (November 16 through March 31) and in accordance with the Erosion Control Plan. Remove ineffective temporary culverts, culvert plugs, diversion dams, or elevated stream crossings; leaving a channel at least as wide as before construction and as close to the original grade as possible. Install temporary culverts, side drains, cross drains, diversion ditches, energy dissipaters, dips, sediment basins, berms, dikes, debris racks, pipe risers, or other facilities needed to control erosion. Remove debris, obstructions, and spoil material from channels, floodplains, and riparian areas. Do not leave project areas for the winter with remedial measures incomplete. Provide protective cover for exposed soil surfaces.	62 193 (RCO 2) 194 (RCO 4) **Locations**: all new construction and reconstruction.
Road Maintenance and Operations - Clean ditches and drainage structure inlets only as often as needed to keep them functioning. Prevent unnecessary or excessive vegetation disturbance and removal on features such as swales, ditches, shoulders, and cut and fill slopes. - Maintain road surface drainage by removing berms, unless specifically designated otherwise. - Accompany grading of hydrologically connected road surfaces and inside ditches with erosion and sediment control installation. - Divert springs across roads to prevent them from pooling and diverting on or along the road. A layer of coarse rock with geotextile fabric or other treatments may be necessary. - Ensure that after maintenance activities (i.e., grading/earthwork activities) the final road surface drainage system will remove water from the road surface with the purpose to minimize concentrated runoff to an area. Ensure that existing metal/drain gutters are in working condition and /or install them as needed. - Conduct road watering for maintenance, dust abatement, and road surface protection using approved existing water sources locations. (See Water Sources Development and Use below)	**Regional BMPs** 2-4 Road Maintenance and Operations 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Road-4 Road Operations and Maintenance Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 193 (RCO 2) 194 (RCO 4) **Locations**: all roads with maintenance or project use.

Management Requirements	BMPs/Forest Plan[1]/Locations
Stream Crossings **Design of New or Reconstructed Crossings** - Design permanent stream crossings (new construction and replacement culverts) to pass the 100-year flood flow plus associated sediment and debris; armor to withstand design flows and provide desired passage of fish and other aquatic organisms. - Locate and design crossings to minimize disturbance to the water body. Use structures appropriate to the site conditions and traffic. Favor armored fords for streams where vehicle traffic is seasonal or temporary, and where the ford design maintains the channel pattern, profile and dimension. - Install stream crossings according to project specifications and drawings. Design should sustain bankfull dimensions of width, depth and slope, and maintain streambed and bank resiliency. - Construct diversion prevention dips to accommodate overtopping of runoff if diversion potential exists. Locate diversion prevention dips downslope of the crossing rather than directly over crossing fill; armor diversion prevention dips based on soil characteristics and risk. Install cross drains (e.g., rolling dips; waterbars) to hydrologically disconnect the road above the crossing and to dissipate concentrated flows. **Construction, Reconstruction and Maintenance Operations** - Keep excavated materials out of channels, floodplains, wetlands and lakes. Install silt fences or other sediment- and debris-retention barriers between the water body and construction material stockpiles and wastes. Dispose unsuitable material in approved waste areas outside of the RCA. - Inspect and clean equipment; remove external oil, grease, dirt and mud and repair leaks prior to unloading at site. Inspect equipment daily and correct identified problems before entering streams or areas that drain directly to water bodies. Remove all dirt and plant parts to ensure that noxious weeds and aquatic invasive species are not brought to the site. - Remove all project debris from the stream in a manner that will cause the least disturbance. - Minimize streambank and riparian area excavation during construction. Stabilize adjacent disturbed areas using mulch, retaining structures, and or mechanical stabilization materials. - Ensure imported fill materials meet specifications, and are free of toxins and invasive species. - Divert or dewater stream flow for all live streams or standing water bodies during crossing installation and invasive maintenance.	**Regional BMPs** 2-8 Stream Crossings 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** AqEco-2 Operations in Aquatic Ecosystems Road-7 Stream Crossings Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 62 193 (RCO 2) 194 (RCO 4) **Locations**: all stream crossings on constructed, reconstructed and maintained roads.
Closure of Temporary and ML 1 Roads - Remove road stream crossings and other culverts identified at high risk of failure and posing a threat to water quality before a road is closed. - Block closed roads to prevent vehicle access. - Road-stream crossings deemed safe to leave in place will be treated to remove the potential for streamflow diversions in the event of a crossing failure or blockage, and, where needed, will have rock armor added to downstream crossing fill to prevent erosion. - Ensure that the road, culvert, and all hydrologically connected drainage structures are cleaned, and sediment and erosion controls are intact and functioning prior to closure. - Ensure road is effectively drained (e.g. waterbars, dips, outsloping) and treated to return the road prism to near natural hydrologic function. - Treat and stabilize road surfaces through subsoiling, scattering slash, and/or revegetation. Reshape and stabilize side slopes as needed.	**Regional BMPs** 2-6 Road Storage 2-7 Road Decommissioning 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Road-6 Road Storage and Decommissioning Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 57 193 (RCO 2) **Locations**: all roads post-project closed or ML1 status.
Log Landings - Re-use log landings to the extent feasible. Existing landings within RCAs may be used when sedimentation effects can be mitigated by erosion prevention measures. - Do not construct new landings within 100 feet of perennial or intermittent streams and SAFs and 50 feet of ephemeral streams. - See the Soils Management Requirements for subsoiling requirements.	**Regional BMPs** 1-12 Log Landing Location 1-16 Log Landing Erosion **National Core BMPs** Veg-6 Landings Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all landings.

Management Requirements	BMPs/Forest Plan[1]/Locations
Skid Trails - Design and locate skid trails to best fit the terrain, volume, velocity, concentrations and direction of runoff water in a manner that would minimize erosion and sedimentation. - Locate new primary skid trails at least 100 feet from perennial and intermittent streams and SAFs and new secondary skid trails at least 50 feet from perennial and intermittent streams and SAFs. Locate all skid trails at least 25 feet from ephemeral streams. Primary skid trails typically have 20 or more passes and result in detrimental compaction or displacement of soils. Secondary skid trails have fewer passes and result in minor compaction or displacement. - Use existing skid trails wherever possible except where unacceptable resource damage may result. Existing skid trails <100 feet from streams may be used if they are rehabilitated following use to improve infiltration from their current state. - Skid trails within 100 feet of steams will be given priority for subsoiling. - See Soils Management Requirements for additional requirements on rehabilitating skid trails.	**Regional BMPs** 1-10 Tractor Skidding Design 1-17 Erosion Control on Skid Trails **National Core BMPs** Veg-2 Erosion Prevention and Control Veg-4 Ground-Based Skidding and Yarding Operations **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all ground-based yarding system units.
Suspended Log Yarding - Fully suspend logs to the extent practicable when yarding over RCAs and streams. - Locate skyline corridors to minimize damage to live streamside trees or resprouting streamside burned trees and shrubs. - Install skyline corridor erosion control measures prior to each winter season to ensure runoff will be well dispersed and not concentrated down corridors. Measures may include water bars constructed in alternating directions, smoothing of ruts, and/or logging slash lopped to contract specifications.	**Regional BMPs** 1-11 Suspended Log Yarding in Timber Harvesting 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Veg-2 Erosion Prevention and Control Veg-5 Skyline and Aerial Yarding Operations **Locations**: all units using skyline yarding systems.
Water Sources - For water drafting on fish-bearing streams: do not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs); do not exceed 20% of surface flows below 4.0 cfs; and, cease drafting when bypass surface flow drops below 1.5 cfs. - For water drafting on non-fish-bearing streams: do not exceed 350 gallons per minute for streamflow greater than or equal to 2.0 cfs; do not exceed 50% of surface flow; and, cease drafting when bypass surface flow drops below 10 gallons per minute. Water sources designed for permanent installation, such as piped diversions to off-site storage, are preferred over temporary, short-term-use developments. Locate water drafting sites to avoid adverse effects to in-stream flows and depletion of pool habitat. - Do not allow water drafting from streams by more than one truck at a time. - Do not construct basins at culvert inlets for the purpose of developing a waterhole, as these can exacerbate plugging of the culvert. - Gradually remove temporary dams when operations are complete so that released impoundments do not discharge sediment into the streamflow - When diverting water from streams, maintain bypass flows that ensure continuous surface flow in downstream reaches, and keep habitat in downstream reaches in good condition. - Locate approaches as close to perpendicular as possible to prevent stream bank excavation. - Treat road approaches and drafting pads to prevent sediment production and delivery to a watercourse or waterhole. Armor road approaches as necessary from the end of the approach nearest a stream for a minimum of 50 feet, or to the nearest drainage structure (e.g., waterbar or rolling dip) or point where road drainage does not drain toward the stream. - Armor areas subject to high floods to prevent erosion and sediment delivery to water courses. - Install effective erosion control devices (e.g., gravel berms or waterbars) where overflow runoff from water trucks or storage tanks may enter the stream, - Check all water-drafting vehicles daily and repair as necessary to prevent leaks of petroleum products from entering RCAs. Water-drafting vehicles shall contain petroleum-absorbent pads, which are placed under vehicles before drafting. Water-drafting vehicles shall contain petroleum spill kits. Dispose of absorbent pads according to the Hazardous Response Plan.	**Regional BMPs** 2-5 Water Source Development and Utilization 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** WatUses-3 Administrative Water Developments AqEco-2 Operations in Aquatic Ecosystems **Forest Plan S&Gs** 193 (RCO 2) 194 (RCO 4) **Locations**: all water drafting sites.

Management Requirements	BMPs/Forest Plan[1]/Locations
Rock Borrow Pits/Quarries - Limit the area of disturbance to the minimum necessary for efficient operations. - Rehabilitate and stabilize sites after operations are complete to minimize risk of off-site movement. - Where appropriate, install temporary barriers between the extraction area and surface waters to prevent sedimentation. - Obliterate or decommission temporary access roads unless other treatment is required. - Maintain system roads to quarries or borrow pits.	**Regional BMPs** 2-12 Aggregate Borrow Areas 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Min-5 Mineral Materials Resource Sites **Locations**: all borrow pits.
Slope and Soil Moisture Limitations - See Soils report for specific slope limitations for operation of ground-based equipment. - See Soils report for wet weather operating restrictions.	**Regional BMPs** 5-2 Slope Limitations for Mechanical Equipment Operation 5-6 Soil Moisture Limitations for Mechanical Equipment Operations **National Core BMPs** Veg-2 Erosion Prevention and Control Veg-4 Ground-Based Skidding and Yarding Operations **Locations**: all ground-based equipment units.
Servicing, Refueling, and Cleaning Equipment and Parking/Staging Areas - Allow temporary refueling and servicing only at approved sites located outside of RCAs. - Rehabilitate temporary staging, parking, and refueling/servicing areas immediately following use. - A Spill Prevention and Containment and Counter Measures (SPCC) plan is required where total oil products on site in above-ground storage tanks exceed 1320 gallons or where a single container exceeds 660 gallons. Review and ensure spill plans are up-to-date. - Report spills and initiate appropriate clean-up action in accordance with applicable State and Federal laws, rules and regulations. The Forest hazardous materials coordinator's name and phone number shall be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment. - Remove contaminated soil and other material from NFS lands and dispose of this material in a manner according to controlling regulations. - Install temporary wash sites only in areas where the water and residue can be adequately collected and either filtered on site or conveyed to an appropriate wastewater treatment facility.	**Regional BMPs** 2-10 Parking and Staging Areas 2-11 Equipment Refueling and Servicing **National Core BMPs** Road-9 Parking and Staging Areas Road-10 Equipment Refueling and Servicing Fac-7 Vehicle and Equipment Wash Water **Forest Plan S&Gs** 193 (RCO 1) **Locations**: designated temporary refueling, servicing and cleaning sites and parking/staging areas.
Application of Registered Borate Compound - Do not apply fungicide within 10 feet of surface water, when rain is falling, or when rain is likely that day (i.e., National Weather Service forecasts 50% or greater chance). - Follow all State and Federal rules and regulations as they apply to pesticides.	**Regional BMPs** 5-7 Pesticide Use Planning Process 5-8 Pesticide Application According to Label Directions and Applicable Legal Requirements 5-11 Cleaning and Disposal of Pesticide Containers and Equipment 5-12 Streamside Wet Area Protection During Pesticide Spraying **National Core BMPs** Chem-1 Chemical Use Planning Chem-2 Follow Label Directions Chem-3 Chemical Use Near Waterbodies Chem-5 Chemical Handling and Disposal **Forest Plan S&Gs** 193 (RCO 1) **Locations**: portions of units with applications in RCAs.

Management Requirements	BMPs/Forest Plan[1]/Locations
Burn Piles - Place burn piles a minimum of 50 feet away from perennial and intermittent streams and SAFs and 25 feet from ephemeral streams. Locate piles outside areas that may receive runoff from roads. Avoid disturbance to obligate riparian vegetation. - Do not dozer pile in sensitive watershed areas (areas where mastication or drop and lop have been prescribed). Grapple piling is allowed in these areas, but is subject to the mechanized equipment restrictions for RCAs. When grapple piling in sensitive watershed areas, consult a hydrologist or soil scientist if less than 70% ground cover would be retained. - Minimize effects on soil, water quality, and riparian resources by appropriately planning pile size, fuel piece size limits, spacing, and burn prescriptions in compliance with state or local laws and regulations if no practical alternatives for slash disposal in the RCA are available.	**Regional BMPs** 6-2 Consideration of Water Quality in Formulating Fire Prescriptions 6-3 Protection of Water Quality from Prescribed Burning Effects **National Core BMPs** Fire-1 Wildland Fire Management Planning Fire-2 Use of Prescribed Fire **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all pile burning areas, sensitive watershed areas.
Cumulative Watershed Effects (CWE) Analysis - CWE analysis will be conducted for the project.	**Regional BMPs** 7-8 Cumulative Off-Site Watershed Effects **Locations**: All activities within the project watersheds will be analyzed
Water Quality Monitoring - Conduct implementation and effectiveness monitoring using the Best Management Practices Evaluation Program (BMPEP) (USDA 2002) and the National Core Monitoring Protocols (FS-990b) (USDA 2012). - Conduct project-level in-channel monitoring as required in the Water Quality Management Handbook (USDA 2011).	**Regional BMPs** 7-6 Water Quality Monitoring **Locations**: Monitoring locations will be detailed in a project monitoring plan.

[1] Forest Plan S&Gs indicate page number from Forest Plan Direction (USDA 2010).

4. Forest Service Manual 2550-Soil Management-R5 Supplement (USDA 2012) and Forest Plan Direction (USDA 2010) provide S&Gs for soil management and are the basis for soil requirements to minimize potential impacts.
    a. Where present, maintain soil cover, surface organic matter and soil organic matter consistent with the Forest Plan. If the existing condition is deficient, watershed specialists may prescribe activities to increase soil cover on sensitive soils or where accelerated runoff and erosion could pose unacceptable risk to resources as a result of the proposed action. These activities could include mastication or lop and scatter of trees less than 10 inches for mastication and up to 16 inches for drop and lop, a cut-to-length logging system, drop and leave, certified weed-free straw mulch applications or seeding with approved native seed. Generally, these treatments would only be considered in units with greater than 15 percent slopes, high Erosion Hazard Ratings and an existing or predicted deficiency in ground cover that would persist longer than one season.
    b. Use existing skid trails and landings except where unacceptable resource damage may result (i.e. skid trails running on 40 percent slope). Limit disturbed skid trail footprint (main and branching secondary trails) to less than 15 percent of the unit area or to the existing disturbed area.
    c. Subsoil main skid trails and waterbar remaining skid trails prior to each winter season and unit close out. Subsoiling will occur on all primary skid trails and on secondary skid trails found to be creating an unacceptable risk to soil or water resources. In addition, landings and temporary roads will be subsoiled and all erosion control measures applied after use is completed. Subsoiling may be excluded from areas of high soil sensitivity, such as shallow or rocky soils, when recommended by a soil scientist. Obliterate out-sloped berms. Outslope re-used skid trails where gullies formed from water concentration along insloped segments.
    d. Segments of pre-existing skid trails and landings causing watershed issues (i.e. concentrating water, gullying) will be subsoiled and waterbarred for resource protection, including those not used during implementation.
    e. Limit ground based equipment to less than 35 percent slopes unless a soil scientist evaluates operations on the steeper slopes. Feller bunchers may do short pitches up to 45 percent slope.

5. Ensure consistency with Forest Plan and Regional Conservation strategies for terrestrial wildlife. Protected Activity Centers (PACs) apply to spotted owls, goshawks, and great gray owls.
   a. In all units retain:
      1. All large hardwood snags greater than or equal to 12 inches dbh.
      2. A minimum of 4 snags (in the largest size class available) per acre averaged across ten acres in mixed conifer forest type.
      3. A minimum of six snags per acre in red fir forest type.
      4. The largest size classes of dead and downed logs greater than or equal to 12 inches in diameter at the midpoint at a rate of 10 to 20 tons/acre.
   b. Maintain a LOP prohibiting vegetation treatments, new construction, blasting, landing construction, and helicopter flight paths within ¼ mile of a protected activity center during the breeding season for California spotted owls (March 1 through August 15), northern goshawks (February 15 through September 15), great gray owls (March 1 through August 15) and within 0.5 miles of the known bald eagle nest (January 1 through August 31) unless surveys conducted by a Forest Service biologist confirm non-nesting status.
   c. Conduct surveys in compliance with the Pacific Southwest Region's survey protocols to establish or confirm the location of the nest activity center for spotted owl, great gray owl and goshawk.
   d. For any new permanent road construction within PACs, HRCAs, forest carnivore connectivity corridors or winter deer range, designate the route as blocked Level 1 or Level 2 gated year round. This management requirement does not apply to Alternative 4.
   e. Flag and avoid elderberry plants greater than one inch stem diameter that occur below 3,000 feet elevation and within 100 feet of planned activities (units V10, V12A, V12B, V13, V14B, X15, X16, X25, Y01A, Y01C, and Y01D).
      1. Prohibit ground based mechanical operations and burning within 50 feet of elderberry plants.
      2. Pile burning and mechanical activities within 100 feet of flagged shrubs will be subject to an LOP from April 1 through June 30 of any given year to avoid fire and dust impacts to beetles.
      3. If additional elderberry shrubs with stems over 1 inch diameter are found prior to or during project implementation, they will be similarly avoided and the District wildlife biologist will be notified immediately and adequate mitigation measures will be taken.
   f. Notify the District Wildlife Biologist if any Federally Threatened, Endangered, Candidate species or any Region 5 Forest Service Sensitive species are discovered during project implementation so that LOPs or other protective measures can be applied, if needed.

6. Apply a registered borate compound to all freshly cut fir stumps 14 inches and greater in diameter (green trees only) to limit the spread and establishment of new centers of annosum root disease within harvest areas where live trees still exist. Do not apply fungicide within 10 feet of surface water, when rain is falling or when rain is likely that day (i.e. National Weather Service forecasts 50 percent or greater chance); follow all State and Federal rules and regulations as they apply to pesticides.

7. Ensure consistency with Forest Plan and other direction for sensitive plants.
   a. Flag and avoid known and new occurrences of Sensitive Plants except as allowed below:
      1. Manual fuel reduction may take place within *Clarkia australis*, *Clarkia biloba* ssp. *australis*, *Mimulus filicaulis* or *Mimulus pulchellus* occurrences only during the dry non-growing period (Table 2.03-4). Pile or scatter all material outside Sensitive Plant occurrences.
      2. Mastication and skid trail legacy compaction subsoiling may be conducted within *Clarkia australis* occurrences only during the dry non-growing period (Table 2.05-4). Do not track masticator through occurrences smaller than 0.25 acre. Minimize tracking in

occurrences larger than 0.25 acres. Wherever possible, reach into occurrences with masticator head to conduct the work instead of tracking through.

b. In order to protect the habitat for the Sensitive Plants which occupy “lava cap” soils all equipment and vehicles will remain on roads through this habitat type (i.e. no parking off road, landing construction or staging areas).

Table 2.03-4 Growing seasons and appropriate identification periods for select Sensitive Plants

Species	Growing Season	Identification Period	Dry, Non-growing Period[1]
Clarkia australis	December 1 - August 15	June 15 - August 15	August 15 - November 30
Clarkia biloba ssp. australis	December 1 - July 31	May 15 - July 15	August 1 - November 30
Mimulus filicaulis	March 15 - July 15	April 15 - June 30	July 15 - November 30
Mimulus pulchellus	March 1 - June 15	April1 - June 1	June 15 - November 30

[1] The actual dry, non-growing period will be determined by field observations year to year by a Botanist. The dry, non-growing period is the time when these species are most resistant to disturbance activities. All dates are approximate, varying with elevation, weather and site conditions.

8. Prevent introduction and spread of noxious weeds:
   a. Implement the equipment cleaning requirements in the standard contract provisions for all contract operations and activities.
   b. The Forest Service will designate the order, or progression, of unit completion to emphasize treating uninfested units before treating infested units to reduce the risk of weed spread from infested units into uninfested units. Clean equipment before moving from infested sites and prior to being transported from the project area.
   c. Use certified weed-free mulches (woodstraw and rice straw are preferred) where available. Stage these materials in weed-free sites only.
   d. Obtain construction materials, including crushed rock, drain rock, riprap and soil, from sources free of high and moderate priority weeds. If sources do contain these priority weeds either flag and avoid or move topsoil to a nearby location that will not be disturbed and cover.

9. Protect range resources:
   a. Avoid damage to rangeland infrastructure (fences, water developments, cattleguards) during project implementation.
   b. Any serviceable/intact infrastructure that is damaged during implementation must be repaired to Forest Service standards.
   c. Consider seeding to provide for site stabilization in areas adjacent to meadows where salvage occurs. Use only native, sterile or non-persistent weed-free seed.
   d. Avoid snag retention adjacent to critical range infrastructure.

10. Project implementation shall also comply with Programmatic Agreement Among the United States Forest Service, Stanislaus National Forest, The California State Historic Preservation Officer, and The Advisory Council on Historic Preservation, Regarding the Compliance with the National Historic Preservation Act for Proposed Actions Pertaining to the RIM Fire Restoration and Salvage and the Adverse Effects to Historic Properties caused by the RIM Fire Emergency, Tuolumne County, California (RIM PA).
    a. All sites will be delineated on the ground prior to implementation to prevent impacts during proposed treatment activities.
    b. Any tree inadvertently felled into a cultural site boundary is to be left in place until the incident is evaluated by the Heritage Resource specialist and recommendations made to the deciding official.
    c. If a transportation corridor is found to contain an archaeological deposit, all efforts shall be made to avoid using that portion of the travel-way. Alternatively, two foot padding may be placed on the travel-way to protect the resource if the placement of the padding is determined

sufficient for resource protection by the Forest Engineer. In addition, the pads should be easily distinguished from the underlying deposit.

d. In the event that new cultural resources are discovered during project implementation, the district archaeologist must be notified and all activities in the vicinity (150 feet) of the resource shall cease until consultations are completed; in accordance with the PA.
e. Heritage Resource Surveys: conduct surveys to determine presence of resources following Regional and Rim PA standards.
f. SHPO Consultation: Forest Service consultation with the State Historic Preservation Officer (SHPO) to comply with Section 106 of the National Historic Preservation Act (must be completed prior to implementation).

2.04 Alternatives Considered but Eliminated from Detailed Study

NEPA requires that federal agencies rigorously explore and objectively evaluate all reasonable alternatives and briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments and internal scoping suggested the alternatives briefly described below along with a brief response discussing the reasons for eliminating them from detailed study.

a. Remove the Maximum Amount of Timber Value

This alternative, based on scoping comments would salvage every acre within the NFS lands and produce 5,000 BF or more per acre and eliminate more expensive logging systems like helicopter and skyline to maximize returns. It would minimize the number of snags retained within treatment units and across the landscape, and limit the costs associated with biomass removal within each sale. Although it meets portions of the purpose and needs to capture economic value, promote public and worker safety, and improve the hydrologic function of roads, it was considered but eliminated from detailed study for the following reasons:

- Although most of the large trees would be removed, only minimal fuel treatments would be accomplished and no biomass removed (due to the high cost of removal) so it does not meet the purpose and need of fuels reduction for forest resiliency.
- It does not meet the purpose and need of wildlife habitat enhancement because it would not remove logs and smaller material within Critical Deer Winter Range or leave additional snags for various wildlife species.
- The Forest made the decision to not harvest within Roadless Areas such as North Mountain to ensure those scenic and less accessible locations were not impacted by project implementation.

b. Hazard Tree Removal Only

This alternative, based on scoping comments, would only cut and remove dead trees adjacent to low standard NFSRs; all other dead trees would remain. It was considered but eliminated from detailed study for the following reasons:

- It does not meet the purpose and need to capture the economic value since most of this habitat includes the largest and most dense stands of dead trees within the burn.
- If only roadside hazard trees are removed, only minimal fuels reduction would occur across this large landscape, making future fires difficult to manage and contain, jeopardizing future forest resiliency.
- At a minimal level, it meets the purpose and need of improving the hydrologic function of the road system where timber is removed.

c. Retain 100 Percent Black-Backed Woodpecker Modeled Pairs

This alternative, based on scoping comments raised during collaborative meetings, would retain 100 percent of black-backed woodpecker pairs on the Stanislaus National Forest as modeled by Tingley et al. 2014. This alternative would need to retain about 21,000 more acres than Alternative 4. Compared to Alternative 4, this alternative would reduce salvage treatments to 7,500 acres and hazard tree removal to 14,500 acres. It was considered but eliminated from detailed study for the following reasons:

- It does not meet the purpose and need to capture the economic value since most of this habitat includes the largest and most dense stands of dead trees within the burn.
- Roadside hazard trees would be left standing making roads unsafe for the public and field workers.
- It does not meet the purpose and need to reduce fuels for forest resiliency in those areas left unlogged. In 10 to 15 years when most of those trees fall to the ground, the large amount of fuel in these areas would make future fires difficult to manage and contain, jeopardizing future fire resiliency.
- It would not meet the purpose and need of improving the hydrologic function of the road system where logs are not removed and roads not improved.

d. Retain 75 Percent of the Black-Backed Woodpecker Modeled Pairs

This alternative, based on scoping comments raised during collaborative meetings, would retain 75 percent of black-backed woodpecker pairs on the Stanislaus National Forest as modeled by Tingley et al. 2014. This alternative would need to retain about 14,000 acres more than Alternative 4. Compared to Alternative 4, this alternative would reduce salvage treatments by half. It was considered but eliminated from detailed study for the following reasons:

- It does not meet the purpose and need to capture the economic value since most of this habitat includes the largest and most dense stands of dead trees within the burn.
- Roadside Hazard trees could be removed to protect public and worker health and safety.
- It does not meet the purpose and need to reduce fuels for forest resiliency in those areas left unlogged. In 10 to 15 years when most of those trees fall to the ground, the large amount of fuel in these areas would make future fires difficult to manage and contain, jeopardizing future fire resiliency.
- It would not meet the purpose and need of improving the hydrologic function of the road system where logs are not removed and roads not improved.

e. Retain Pre-Fire Spotted Owl PAC Boundaries, No PAC Remapping or Retiring

This alternative, based on scoping comments, would retain the 46 spotted owl PACs burned within the Rim Fire in their original location. No remapping of boundaries into adjacent green habitat would occur and none that were completely consumed by the fire would be retired. These would be kept as suitable habitat for the owls. It was considered but eliminated from detailed study for the following reasons:

- It does not meet the purpose and need to capture the economic value since most of this habitat includes the largest and most dense stands of dead trees within the burn.
- It does not meet the purpose and need to provide worker and public safety since hazard trees would not be removed where roads run through PACs.
- It does not meet the purpose and need to reduce fuels for forest resiliency in those areas left unlogged. In 10 to 15 years when most of those trees fall to the ground, the large amount of fuel in these areas would make future fires difficult to manage and contain, jeopardizing future fire resiliency.

- It would not meet the purpose and need of improving the hydrologic function of the road system where logs are not removed and roads not improved.
- It would eliminate the proposed spotted owl research project.

f. Natural Succession

This alternative, based on scoping comments, would allow the forest to recover naturally. This differs from "No Action" by including measures to reduce erosion and sedimentation, decommissioning roads, and curtailing cattle grazing in recovering areas. Salvage logging would be reduced or eliminated in sensitive areas. Impacted fisheries would recruit new populations from endemic stock migration rather than hatchery augmentation. It was considered but eliminated from detailed study for the following reasons:

- Road decommissioning, cattle grazing, and fisheries recruitment are outside the scope of this project.
- It does not meet the purpose and need to capture the economic value since most of this habitat includes the largest and most dense stands of dead trees within the burn.
- It does not meet the purpose and need to reduce fuels for forest resiliency in those areas left unlogged. In 10 to 15 years when most of those trees fall to the ground, the large amount of fuel in these areas would make future fires difficult to manage and contain, jeopardizing future fire resiliency.
- It does not meet the purpose and need of improving the hydrologic function of the road system where logs are not removed and roads not improved.

2.05 COMPARISON OF THE ALTERNATIVES

Chapter 3 describes the environmental consequences of the alternatives. This section compares the alternatives by providing summary tables showing the key differences between alternatives. The Alternative Comparison Map (project record) displays the locations of treatments considered in all action alternatives.

Table 2.05-1 compares the alternatives with a summary of proposed activities.

Table 2.05-1 Comparison of Alternatives: Proposed Activities

Proposed Treatments[1]	**Alternative 1** (Proposed Action)	**Alternative 2** (No Action)	**Alternative 3**	**Alternative 4**
Salvage ground based (acres)	24,127	0	26,252	24,176
Salvage ground based/skyline swing (acres)	16	0	16	16
Salvage aerial based helicopter (acres)	2,930	0	3,035	2,568
Salvage skyline system (acres)	1,253	0	1,096	1,066
Subtotal Salvage (acres)	**28,326**	**0**	**30,399**	**27,826**
Hazard Tree Removal (miles)	341	0	314.8	324.6
Subtotal Hazard Tree Removal (acres)	**16,315**	**0**	**15,253**	**15,692**
Total Hazard Tree and Salvage (acres)	**44,641**[2]	**0**	**45,652**[2]	**43,518**[2]
Biomass Removal	7,626	0	8,379	7,975
Mastication	0	0	1,309	1,309
Drop and Lop	0	0	2,228	1,798
Machine Piling and Burning	24,143	0	22,036	20,320
Jackpot Burning	4,199	0	4,147	3,650
Total Fuels (acres)	**35,968**[2]	**0**	**38,099**[2]	**35,052**[2]
New Construction (miles)	5.4	0	1.0	0
Reconstruction (miles)	319.9	0	323.6	315.0
Maintenance (miles)	216.1	0	200.6	209.3
Subtotal Construction and Maintenance (miles)	**541.4**	**0**	**525.2**	**524.3**
Temporary Road (new miles)	3.9	0	9.5	8.4
Temporary Road (existing miles)	9.3	0	22.7	22.1
Temporary Use – Revert (miles)	8.4	0	3.3	3.3
Subtotal Temporary Roads (miles)	**21.6**	**0**	**35.5**	**33.8**
Total Roads (miles)	**563.0**	**0**	**560.7**	**558.1**
Private Roads Needing Right-of-Way (miles)	11.2	0	11.2	11.2
Rock Quarry Sites	7	0	7	7
Potential Water Sources	81	0	81	81

[1] Salvage Treatments include removal of dead trees and fuel reduction; Hazard Tree Treatments include hazard tree removal and fuel reduction.

[2] Salvage and Hazard Tree treatment acres overlap and are do not total with Fuel Reduction treatments.

Table 2.05-2 compares the alternatives with a summary of salvage and fuel reduction treatment acres by primary objective(s). Table 2.01.1 displays the six primary objectives used to identify treatments and develop the action alternatives and Appendix E (Treatments) shows primary objectives for each specific treatment unit.

Table 2.05-2 Comparison of Alternatives: Treatment Acres by Primary Objective(s)

Primary Objectives	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
1. Economic Value	2,564	0	406	331
1. Economic Value 2. Public and Worker Safety	24,410	0	1,886	1,774
1. Economic Value 2. Public and Worker Safety 3. Fuel Reduction	0	0	4,499	3,750
1. Economic Value 2. Public and Worker Safety 3. Fuel Reduction 5. Enhance Wildlife Habitat b. Snag Retention	0	0	4,304	3,928
1. Economic Value 2. Public and Worker Safety 3. Fuel Reduction 6. Research	0	0	360	360
1. Economic Value 2. Public and Worker Safety 3. Fuel Reduction 5. Enhance Wildlife Habitat b. Snag Retention 6. Research	0	0	1,519	1,519
1. Economic Value 2. Public and Worker Safety 5. Enhance Wildlife Habitat a. Deer Habitat Improvement	36	0	0	0
1. Economic Value 2. Public and Worker Safety 5. Enhance Wildlife Habitat a. Deer Habitat Improvement b. Snag Retention	0	0	519	519
1. Economic Value 2. Public and Worker Safety 5. Enhance Wildlife Habitat b. Snag Retention	0	0	6,342	5,255
1. Economic Value 2. Public and Worker Safety 5. Enhance Wildlife Habitat b. Snag Retention 6. Research	0	0	3,369	3,369
1. Economic Value 2. Public and Worker Safety 6. Research	0	0	31	31
1. Economic Value 3. Fuel Reduction	0	0	269	269
1. Economic Value 3. Fuel Reduction 5. Enhance Wildlife Habitat b. Snag Retention	0	0	446	350

Primary Objectives	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
1. Economic Value 3. Fuel Reduction 5. Enhance Wildlife Habitat b. Snag Retention 6. Research	0	0	76	76
1. Economic Value 5. Enhance Wildlife Habitat a. Deer Habitat Improvement	195	0	0	0
1. Economic Value 5. Enhance Wildlife Habitat a. Deer Habitat Improvement b. Snag Retention	0	0	185	185
1. Economic Value 5. Enhance Wildlife Habitat b. Snag Retention	0	0	1,043	965
1. Economic Value 5. Enhance Wildlife Habitat b. Snag Retention 6. Research	0	0	685	685
2. Public and Worker Safety 3. Fuel Reduction	0	0	150	150
2. Public and Worker Safety 3. Fuel Reduction 5. Enhance Wildlife Habitat a. Deer Habitat Improvement b. Snag Retention	0	0	756	756
2. Public and Worker Safety 3. Fuel Reduction 5. Enhance Wildlife Habitat b. Snag Retention	0	0	659	659
2. Public and Worker Safety 5. Enhance Wildlife Habitat a. Deer Habitat Improvement	1,121	0	0	0
2. Public and Worker Safety 5. Enhance Wildlife Habitat a. Deer Habitat Improvement b. Snag Retention	0	0	2,788	2,788
2. Public and Worker Safety 5. Enhance Wildlife Habitat b. Snag Retention	0	0	15	15
5. Enhance Wildlife Habitat a. Deer Habitat Improvement b. Snag Retention	0	0	92	92
totals	**28,326**	**0**	**30,399**	**27,826**

Table 2.05-3 compares the alternatives with a summary of effects.

Table 2.05-3 Comparison of Alternatives: Summary of Effects

	Resource and Indicator	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Air Quality	Smoke Emissions from Machine Pile Burning	effects to local communities and Yosemite would be minimal due to controlled emissions	none from pile burning, but under uncontrolled circumstances this amount of material would cause issues for sensitive groups	same as alternative 1	same as alternative 1
Aquatics	Foothill yellow-legged frog	may affect individuals but not likely to lead to a trend toward federal listing or loss of viability	none	similar to alternative 1	similar to alternative 1
	Western pond turtle	may affect individuals but not likely to lead to a trend toward federal listing or loss of viability	none	similar to alternative 1	similar to alternative 1
	Hardhead	may affect individuals but not likely to lead to a trend toward federal listing or loss of viability	none	similar to alternative 1	similar to alternative 1
	California red-legged frog	may affect, but not likely to adversely affect	none	similar to alternative 1	similar to alternative 1
	Sierra Nevada yellow-legged frog	may affect, but not likely to adversely affect	none	similar to alternative 1	similar to alternative 1
Cultural Resources	Cultural Resources	none	no direct effects, moderate indirect and cumulative effects; may affect fragile resources	same as alternative 1; however, watershed treatments will benefit cultural sites	same as alternative 3
	Cultural Resource Special Interest Area (SIA)	salvage removal will enhance or protect the cultural values of the SIA	none	same as alternative 1	same as alternative 1
Fire and Fuels	Fire Behavior	fire effects in treated units would be significantly reduced	future fires would burn with increasingly higher intensities	similar to alternative 1; treatments provide break in fuel profiles across the project area	same as alternative 3
	Fire Suppression Capability	high capability; reduced fuel continuities; increased safety; reduced potential for resource damage; potential for reduced suppression costs	capability dramatically declines over time; fire effects exceed firefighter capabilities; fireline production rates decline over time	same as alternative 1	same as alternative 3
	Fuel Loading	surface fuel loading reduced to 10 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	Increased surface fuel loading over time, to an estimated 98 tons/acre in 30 years; future reburn likely to lead to substantial erosion and sedimentation	surface fuel loading reduced to 10-20 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	same as alternative 3

	Resource and Indicator	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Invasive Species	Habitat Alteration and Vectors	high risk for habitat alteration; high risk of increased vectors	none	moderate risk for habitat alteration and moderate to high risk of increased vectors because of additional management requirements	same as alternative 3
Range	Grazing Management	beneficial effects	none	same as alternative 1	same as alternative 1
	Rangeland Vegetation	no long term changes to vegetation types; beneficial effect on rangeland vegetation condition	no direct effects; potential for negative indirect effects from falling dead trees	same as alternative 1	same as alternative 1
Recreation	Recreation Access and Opportunity	negative effects on some developed recreation sites; short term negative impacts to dispersed recreation; positive effects to public safety and recreation access	negative long-term effects to recreation access and public safety; closure of some developed recreation sites is likely to result in over-use of open developed sites	same as alternative 1	same as alternative 1
Sensitive Plants	Sensitive Plants	management requirements would protect sensitive plants	no direct effects; negative indirect effects might occur from falling dead trees	similar to alternative 1	same as alternative 1
Society	Social and Cultural Impacts	administrative access enhanced, dispersed recreation open, and public firewood gathering allowed	administrative access constrained, dispersed recreation closed, and public firewood gathering not allowed	same as alternative 1	same as alternative 1
	Temporary Employment Generation	6,659 jobs supported	none	6,318 jobs supported	5,511 jobs supported
Soils	Soil Stability and Effective Soil Cover	slight improvements to erosion	erosion rates remain high, slightly higher than alternative 1	improves cover, erosion hazard ratings, and erosion rates in WSAs	similar to alternative 3
	Porosity	improves porosity; limited porosity decreases in areas off skid trails; decreases effects of soil sealing	none	similar to alternative 1	similar to alternative 1
Transportation	Forest Transportation System Conditions	beneficial direct, indirect and cumulative effects	adverse indirect and cumulative effects	same as alternative 1	same as alternative 1

	Resource and Indicator	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Watershed	Erosion and Sedimentation (Timber and Fuel Reduction Activities)	negligible change in erosion rates in most watersheds; one watershed with slightly elevated erosion and two watersheds with decreased erosion; highest potential for erosion and sedimentation related to fuel reduction	erosion rates similar to alternative 1 and higher than alternatives 3 and 4; sedimentation would not increase; existing skid trail sediment transport networks remain;	negligible change or decrease in erosion rates in most watersheds; watershed treatments increase ground cover and reduce erosion in WSAs; less potential for erosion and sedimentation in WSAs than alternative 1	same as alternative 3
	Erosion and Sedimentation (Road Related Activities)	road treatments reduce erosion potential; reduced erosion potential on existing temporary roads; some erosion and sedimentation potential for new temporary roads, water sources and material sources	hydrologic connectivity of roads and streams would remain; existing temporary roads not decommissioned; increased risk of stream crossing failures and reduced accessibility of sites	similar to alternative 1	similar to alternative 1
	Fuel Loading	surface fuel loading reduced to 10 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	Increased surface fuel loading over time, to an estimated 98 tons/acre in 30 years; future reburn likely to lead to substantial erosion and sedimentation	surface fuel loading reduced to 10-20 tons/acre; reduced risk of substantial erosion and sedimentation caused by future stand-replacing fire	same as alternative 3
	Riparian Vegetation	beneficial effects to riparian obligate trees and shrubs; management requirements protect fens and meadows	none	same as alternative 1	same as alternative 1
	Stream Condition	no measurable changes in stream flow or channel incision; stream banks not degraded; increases LWD and sediment storage	no measurable changes in stream flow or channel incision; initially less ground cover along stream banks; large levels of LWD and sediment storage over time	no measurable changes in stream flow or channel incision; stream banks not degraded; increases LWD and sediment storage, but less alternative 2	same as alternative 3
	Water Quality (Beneficial Uses of Water)	water temperature not affected; some sedimentation; limited potential for registered borate compound to contaminate surface waters; no effects to beneficial uses	none	same as alternative 1	same as alternative 1
Wildlife	Valley elderberry longhorn beetle	may affect but not likely to adversely affect	no effect	same as alternative 1	same as alternative 1
	Bald eagle	may affect individuals but is not likely to result in a trend toward federal listing or loss of viability	no effect	same as alternative 1	same as alternative 1
	California spotted owl	may affect individuals and is likely to result in a trend toward federal listing or loss of viability	no effect	may affect individuals but is not likely to result in a trend toward federal listing or loss of viability	same as alternative 3

	Resource and Indicator	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Wildlife	Great gray owl	may affect individuals and is likely to result in a trend toward federal listing or loss of viability	no effect	may affect individuals but is not likely to result in a trend toward federal listing or loss of viability	same as alternative 3
	Northern goshawk	may affect individuals and is likely to result in a trend toward federal listing or loss of viability	no effect	may affect individuals but is not likely to result in a trend toward federal listing or loss of viability	same as alternative 3
	American marten	may affect individuals but is not likely to result in a trend toward federal listing or loss of viability	no effect	same as alternative 1	same as alternative 1
	Pacific fisher	may affect individuals, but is not likely to contribute to the need for federal listing or result in loss of viability	no effect	same as alternative 1	same as alternative 1
	Pallid bat and fringed myotis	may affect individuals, but is not likely to contribute to the need for federal listing or result in loss of viability	no effect	same as alternative 1	same as alternative 1
	Black-Backed woodpecker	lowest predicted pair density; retains 41 percent of modeled pairs	none; retains 100 percent of modeled pairs	second lowest predicted pair density; retains 46 percent of modeled pairs	highest predicted pair density of the action alternatives; retains 54 percent of modeled pairs
	Mule deer	improves 1,352 acres of critical deer winter range	none	improves 4,416 acres of critical deer winter range	same as alternative 3

3. Affected Environment and Environmental Consequences

3.01 Introduction

This Chapter summarizes the physical, biological, social, and economic environments that are affected by the proposed action and alternatives and the effects on that environment that would result from implementation of any of the alternatives. This Chapter also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

The "Affected Environment" section under each resource topic describes the existing condition against which environmental effects were evaluated and from which progress toward the desired condition can be measured. Environmental consequences form the scientific and analytical basis for comparison of alternatives, including the proposed action, through compliance with standards set forth in the Stanislaus National Forest Land and Resource Management Plan, as amended (Forest Plan). The environmental consequences discussion centers on direct, indirect and cumulative effects, along with applicable mitigation measures. Effects can be neutral, beneficial or adverse. The "Irreversible and Irretrievable Commitments of Resources" section is located at the end of this chapter. These terms are defined as follows:

- Direct effects 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.

Analysis Process

The environmental consequences presented in Chapter 3 address the impacts of the actions proposed under each alternative. This effects analysis was done at the project scale (the scale of the proposed action as discussed in Chapter 1). However, the effects findings in this chapter are based on site-specific analyses. Each resource specialist assessed every alternative at a level sufficient to support their effects analysis and identify any necessary site-specific mitigation. The resource reports (project record) contain additional details about the analysis process.

Cumulative Effects

According to the 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 all NFS, private and other public lands that lie within the Rim Fire perimeter. Past activities are considered part of the existing condition and are discussed in the "Affected Environment (Existing Conditions)" and "Environmental Consequences" sections under each resource.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. Existing conditions reflect the aggregate impact of all prior human actions and natural events that affected the environment and might contribute to cumulative effects. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis for three reasons.

First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Innumerable actions over the last century (and beyond) impacted current conditions and trying to isolate the individual actions with residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because information on the environmental impacts of individual past actions is limited, and one cannot reasonably identify each and every action over the last century that contributed to current conditions. Focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Finally, the Council on Environmental Quality (CEQ) issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions” (CEQ 2005).

The cumulative effects analysis is consistent with Forest Service NEPA regulations (73 Federal Register 143, July 24, 2008; p. 43084-43099), which state, in part:

> “CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)”

For these reasons, the analysis of past actions in Chapter 3 is based on current environmental conditions. Appendix B (Cumulative Effects Analysis) lists present and reasonably foreseeable future actions potentially contributing to cumulative effects.

Forest Plan Amendments

Alternative 3 and Alternative 4 include a Forest Plan Amendment designating a 4 mile wide FCCC, as habitat for old-forest habitat associated species, particularly forest carnivores (portions of this corridor also overlap critical deer range). Figure 2.02-1 shows the corridor would lead from Yosemite National Park and North Mountain IRA west to the Clavey River. The corridor includes the following proposed units that would be managed for Old Forest Emphasis: L02, L05, M1 through M10, M12, M13, M15, M16, M18, M19, and N1. This Forest Plan Amendment changes the land allocation on 9,923 acres from General Forest to OFEA and includes the desired condition described in Chapter 2. Other existing land allocations (Wild and Scenic River, PAC, HRCA, and OFEA) allocations would remain unchanged (Table 3.01-1).

The effects analysis in Chapter 3 does not specifically identify effects directly related to the FCCC Forest Plan Amendment; however, the analysis discloses effects for Alternative 3 and Alternative 4 assuming implementation of this Forest Plan Amendment. Since the Forest Plan S&Gs for General

Forest and OFEA are the same (USDA 2010a, p. 190-191), this Forest Plan Amendment is not expected to cause any direct, indirect or cumulative effects.

Table 3.01-1 Forest Carnivore Connectivity Corridor Forest Plan Amendment Land Allocations

Land Allocation	Existing	Proposed
California Spotted Owl Habitat (PACs and HRCAs)	1,197	1,197
General Forest	9,923	0
Goshawk Habitat (PACs)	176	176
Old Forest Emphasis Areas	794	10,717
Wild and Scenic Rivers	1,213	1,213
Total	**13,303**	**13,303**

HRCA=Home Range Core Area; PAC=Protected Activity Center

Forest Plan Direction

The Forest Service completed the Stanislaus National Forest Land and Resource Management Plan (Forest Plan) on October 28, 1991. The "Forest Plan Direction" (USDA 2010a) presents the current Forest Plan management direction, based on the original Forest Plan, as amended. The Forest Plan identifies land allocations and management areas within the project area including: Wild and Scenic Rivers, Proposed Wild and Scenic Rivers, Critical Aquatic Refuge (CAR), Riparian Conservation Areas (RCAs), Near Natural, Scenic Corridor, Special Interest Areas, Wildland Urban Intermix, Protected Activity Centers (PACs), Old Forest Emphasis Areas, and Developed Recreation Sites. The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Incomplete or Unavailable Information

CEQ regulations for implementing NEPA describe how Federal agencies must handle instances where information relevant to evaluating "reasonably foreseeable" [3] adverse impacts of the alternatives is incomplete or unavailable. According to 40 CFR 1502.22:

> When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.
>
> a. If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the EIS.
>
> b. If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the EIS:
>   1. A statement that such information is incomplete or unavailable;
>   2. A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
>   3. A summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and,
>   4. The agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

Chapter 3 identifies incomplete or unavailable information so the reader understands how they are addressed. The EIS summarizes existing credible scientific evidence relative to environmental effects

[3] For the purposes of this rule, CEQ states: "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason (40 CFR 1502.22).

and makes estimates of effects on theoretical approaches or research methods generally accepted in the scientific community.

Resource Reports

The resource sections in this chapter provide a summary of these project-specific reports and other documents (project record); they are available by request and are incorporated by reference.

Air Quality: Air Quality Report

Aquatic Species: Aquatic Species – Sensitive Species Report (Aquatic Sensitive Species Report); Aquatic Species – Threatened and Endangered Species Report (Aquatic T&E Report); Aquatic Management Indicator Species Report (Aquatic MIS Report); Biological Assessment for Rim Fire Recovery Project (Aquatic BA)

Cultural Resources: Cultural Resources Report

Fire and Fuels: Fire and Fuels Report (Fuels Report)

Invasive Species: Noxious Weed Risk Assessment (NRWA)

Range: Rangeland Specialist Report (Range Report)

Recreation: Recreation Report

Sensitive Plants: Botanical Resources Report (Botany Report); Biological Evaluation for Sensitive Plants (Sensitive Plants BE)

Society, Culture and Economy: Social and Economic Report

Soils: Soils Report

Special Areas: Special Areas Report

Transportation: Transportation Report

Watershed: Watershed Management Report (Watershed Report)

Wildlife: Terrestrial Biological Assessment, Evaluation, and Wildlife Report Rim Fire Recovery (Wildlife BE); Terrestrial Management Indicator Species Report (Wildlife MIS Report)

Affected Environment Overview

All resources share many aspects of the affected environment. In order to avoid repeating these shared elements of the affected environment in each resource section, the following general elements of the affected environment are provided.

The 400 square mile Rim Fire encompasses a diverse and complex landscape. Landforms within the Rim Fire are dramatic, punctuated by river canyons, glaciation, a lava cap, and large expanses of gentle to moderately steep slopes spread across much of the fire area. Geology is varied and includes all three of the principal geologic types in the Sierra Nevada mountain range. Metamorphic rock occupies much of the lower elevations and the Sierra granitic batholith and relic volcanic flows generally occur at higher elevations. As its watersheds rise in elevation from about 2,000 to 7,000 feet they include rock-rimmed river canyons and mountain meadows, major rivers and small secluded streams. They have oak grasslands at the lowest elevations, large expanses of mixed conifer forests at mid-elevation and even some red fir-lodgepole pine stands at the highest elevations. Cottonwoods and quaking aspens occupy occasional streamside and meadow sites at mid to high elevations.

The Rim Fire area lies within a Mediterranean climate zone consisting of warm, mostly dry summers and cool, wet winters. Average summer high temperatures are about 95°F at the lowest elevations and 75°F at the higher elevations. Average low winter temperatures are about 30°F at the lowest elevations and 20°F at the highest. Extreme high and low temperatures vary about 10 to 15 degrees from average. Precipitation increases in elevation, with a range of about 30 to 50 inches per year across the fire area.

Information on Other Resource Issues

The alternatives considered in detail do not affect the following resources or localized effects are disclosed under other resources; they are not further discussed in Chapter 3.

Climate Change

The Environmental Protection Agency (EPA) developed a "State of Knowledge" paper that outlines what is known and what is uncertain about global climate change (EPA 2007). The following elements of climate change are known with near certainty:

1. Human activities are changing the composition of Earth's atmosphere. Increasing levels of greenhouse gases, like carbon dioxide (CO2) in the atmosphere since pre-industrial times, are well-documented and understood.
2. The atmospheric buildup of CO2 and other greenhouse gases is largely the result of human activities such as the burning of fossil fuels.
3. An "unequivocal" warming trend of about 1.0° to 1.7° F occurred from 1906-2005. Warming occurred in both the Northern and Southern Hemispheres and over the oceans (IPCC 2007).
4. The major greenhouse gases emitted by human activities remain in the atmosphere for periods ranging from decades to centuries. It is virtually certain that atmospheric concentrations of greenhouse gases will continue to rise over the next few decades.
5. Increasing greenhouse gas concentrations tend to warm the planet.

According to EPA (2007), however, it is uncertain how much warming will occur, how fast that warming will occur, and how the warming will affect the rest of the climate system including precipitation patterns. Given what is known and what is not known about global climate change, the following discussion outlines the cumulative effects of this project on greenhouse gas emissions and the effects of climate change on forest resources.

Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_20) emissions generated by project activities are expected to contribute to the global concentration of greenhouse gases that affect climate change. Projected climate change impacts include air temperature increases, sea level rise, changes in the timing, location, and quantity of precipitation, and increased frequency of extreme weather events such as heat waves, droughts, and floods. The intensity and severity of these effects are expected to vary regionally and even locally, making any discussion of potential site-specific effects of global climate change on forest resources speculative.

Because greenhouse gases from project activities mix readily into the global pool of greenhouse gases, it is not currently possible to discern the effects of this project from the effects of all other greenhouse gas sources worldwide, nor is it expected that attempting to do so would provide a practical or meaningful analysis of project effects. Potential regional and local variability in climate change effects add to the uncertainty regarding the actual intensity of this project's effects on global climate change. Further, emissions associated with this project are extremely small in the global atmospheric CO_2 context, making it impossible to measure the incremental cumulative impact on global climate from emissions associated with this project.

In summary, the potential for cumulative effects is considered negligible for all alternatives because none of the alternatives would result in measurable direct and indirect effects on air quality or global climatic patterns.

Inventoried Roadless Areas

All or portions of 3 Inventoried Roadless Areas (IRAs) are located on NFS lands within the Rim Fire perimeter: 1) the Cherry Lake IRA (1,000 acres) is located in the east-central portion of the Forest adjacent to the Emigrant Wilderness and Yosemite National Park; 2) the North Mountain IRA (8,100 acres) is located in the southeast part of the Forest adjacent to Yosemite National Park; and, 3) the

Tuolumne River IRA (17,300 acres) is located in the southwest part of the Forest. It contains the lower Clavey River and about 18 miles of the Tuolumne Wild and Scenic River.

The alternatives do not include any activities within or adjacent to these IRAs. Nearby short-term road maintenance and other project induced noise is consistent with the Roadless Area Characteristics[4] identified in the 2001 Roadless Rule. Therefore, the alternatives are not likely to result in direct, indirect or cumulative effects on those characteristics.

Vegetation

The Stanislaus National Forest contains a mosaic of vegetation distributed and controlled primarily by climate and soils. The dominant vegetation types occur as broad bands oriented northwest-southeast across the Forest occupying general elevation zones. Conifer forests are the predominant vegetation type where proposed activities would occur. Action alternatives would remove primarily dead vegetation and may damage live trees or plants during harvest operations, but the extent of damage would be localized and long term effects to vegetation would be negligible. The range, sensitive plants, soils, watershed and wildlife sections disclose any localized effects on specific vegetation.

Visual Resources

In moderate and high severity burn areas, the dramatically altered landscape does not meet Forest Plan S&Gs for Visual Quality Objectives (USDA 2010a, p. 63). Most perceived as negative effects to the visual resource (flush cut stumps, hand/machine piles, treatment edges, ground disturbance, and untreated slash) occurs during implementation. This initial phase is short term and does not represent the completed treatment. At the conclusion of treatment, visual signs of activity (i.e., cut stumps or track and tire marks) may still be evident but would dissipate over time. Evidence of burning on trees and ground features naturally occur in forests with wildfire regimes.

Overall the proposed treatments would improve visual quality. By treating slash and activity fuels through piling and burning, vegetation would regrow providing visually pleasing contrast to surrounding features and landforms. With growth of shrubs, grasses, and forbs, the majority of evidence of management activities would not be evident to the casual forest visitor. Where project activities are proposed within sight distance of Wild and Scenic Rivers, Wilderness or Yosemite National Park, distance and geographic features would obscure most treatments from the casual observer or users of those areas. As such, the alternatives are not likely to result in direct, indirect or cumulative effects on visual resources.

Yosemite National Park

The Stanislaus National Forest shares a common boundary, much of which is Wilderness, with Yosemite National Park to the east. The National Park Service manages park resources and values to leave them unimpaired for the enjoyment of future generations.

The alternatives considered in detail will not directly affect park resources. Action alternatives will increase worker and public safety and improve Forest Service ability to manage future fires, which may indirectly benefit park resources and values. Wildlife habitat improvement activities may benefit Yosemite National Park wildlife populations by providing corridors for wildlife movement on the Stanislaus National Forest.

[4] Roadless Area Characteristics are: high quality or undisturbed soil, water, and air; sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non- motorized, and semi-primitive motorized recreation opportunities; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; and, other locally identified unique characteristics. (66 Federal Register 9, January 12, 2001; p. 3245)

Analysis Framework

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." The following resource sections list the applicable laws, regulations, policies and Executive Orders relevant to that resource. The resource reports (project record) include the surveys, analyses and findings required by those laws.

CEQA and NEPA Compliance

NEPA requires agencies to assess the environmental effects of a proposed agency action and any reasonable alternatives before making a decision on whether, and if so, how to proceed. The California Environmental Quality Act (CEQA) applies to projects of all California state, regional or local agencies, but not to Federal agencies. Its purposes are similar to NEPA. They include ensuring informed governmental decisions, identifying ways to avoid or reduce environmental damage through feasible mitigation or project alternatives, and providing for public disclosure (CEQA Guidelines, 15002, subd. (a)(1)-(4)).

The CEQ regulations for implementing NEPA encourage cooperation with state and local agencies in an effort to reduce duplication in the NEPA process (40 CFR 1506.2). The CEQ regulations further provide agencies with the ability to combine documents, by stating that "any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork" (40 CFR 1506.4). Furthermore, if an existing document cannot be utilized, portions may be incorporated by reference. Like NEPA, CEQA encourages cooperation with Federal agencies to reduce duplication in the CEQA process. In fact, CEQA recommends that lead agencies rely on a Federal EIS "whenever possible," so long as the EIS satisfies the requirements of CEQA (Cal. Pub. Resources Code, 21083.7).

Overall, the resource analysis contained in this EIS should meet CEQA requirements; however, the following information is provided since this document uses terminology not commonly used in CEQA:

- **Management Requirements**: Chapter 2 lists management requirements. The action alternatives include management requirements designed to implement the Forest Plan and to minimize or avoid potential adverse impacts. Each action alternative lists the management requirements specific to it and Chapter 2.03 identifies those common to all action alternatives. Management requirements are mandatory components of each alternative and will be implemented as part of the proposed activities.
- **Green House Gas Emissions**: Chapter 3.01 (Climate Change) and Chapter 3.02 (Air Quality) describe and evaluate greenhouse gas emissions.
- **Growth Inducing Impacts and Energy Impacts**: Chapter 3.10 (Society, Culture and Economy) describes population growth and evaluates economic growth inducing impacts. No population growth inducing impacts are expected since NFS lands are not available for urbanization. Chapter 3.10 also describes energy impacts related to haul distance and biomass use for electrical power.

3.02 AIR QUALITY

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The Stanislaus National Forest "Forest Plan Direction" presents the current Forest Plan management direction, based on the original Stanislaus National Forest Land and Resource Management Plan, as amended (USDA 2010). The Forest Plan Direction includes Management Practices (p. 17) and Forestwide Standards and Guidelines (p. 33) that apply to Air Quality.

Air Quality Management Practices

Smoke from prescribed fire is managed so that emissions meet applicable state and federal standards. Prescribed fire includes but is not limited to burning of timber residue, which improves wildlife habitat and range type conversion. Prescribed fires are managed by the local Air Pollution Control District (APCD) and the 1990 Clean Air Act (CAA) amendments, which require the application of Best Available Control Measures (BACMs) to reduce particulate emissions. BACMs are a combination of practices intended to reduce emissions to the lowest practicable amount. BACMs are accomplished by diluting or dispersing emissions, or by preventing potential emission sources whenever possible. Examples of BACMs include:

- Reducing pollutants by limiting the mass of material burned, burning under moist fuel conditions when broadcast burning, shortening the smoldering combustion period, and increasing combustion efficiency by encouraging the flaming stage of fire when burning piles.
- Diluting pollutant concentrations over time by reducing the rate of release of emissions per unit area, burning during optimum conditions, and coordinating daily and seasonally with other burning permittees in the area to prevent standard exceedences.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Air Quality

- Emissions were based on a wildfire burning under 90th percentile weather conditions at year 20 for all scenarios.
- Emissions were only calculated for treatment unit acres as outside treatment units would all have the same emission outputs.
- Alternative 2 does not have treatment units so Alternative 3 treatment acres were used since this alternative treated the most acres.
- Emissions calculations were based on pile burning on every treated acre (excluding those treated by biomass removal or mastication). This is the worst case scenario and will not actually be implemented on the ground because of the desire to leave some down woody material for soil protection.

Data Sources

- First Order Fire Effects Monitoring Program
- Fire Family Plus Program
- Piled Fuels Biomass and Emissions Calculator

Air Quality Indicators

The Clean Air Act lists 189 hazardous air pollutants to be regulated. Some components of smoke, such as polycyclic aromic hydrocarbines (PAH) are known to be carcinogenic. Probably the most carcinogenic component is benzo-a-pyrene (BaP). Other components, such as aldehydes, are acute irritants. In 1994 and 1997, 18 air toxins were assessed relative to the exposure of humans to smoke from prescribed and wildfires. The following six toxins were most commonly found in prescribed fire smoke:

- **Particulate Matter** (PM2.5 and PM10): Particulates are the most prevalent air pollutant from fires, and are of the most concern to regulators. Research indicates a correlation between hospitalizations for respiratory problems and high concentrations of fine particulates. PM2.5 are fine particles that are 2.5 microns in diameter or less in size. PM10 are fine particles that are between 10 and 2.5 microns in diameter or less in size. Particulates can carry carcinogens and other toxic compounds. Overexposure to particulates can cause irritation of mucous membranes, decreased lung capacity, and impaired lung function.
- **Methane** (CH_4): Methane is an odorless, colorless flammable gas. Short term exposure to methane may result in feeling tired, dizzy, and headache. There is no long term health effects currently associated with exposure to methane.
- **Carbon Monoxide** (CO): Carbon Monoxide reduces the oxygen carrying capacity of the blood, a reversible effect. Low exposures can cause loss of time, awareness, motor skills, and mental acuity. Also, exposure can lead to heart attack, especially for persons with heart disease. High exposures can lead to death due to lack of oxygen.
- **Carbon Dioxide** (CO_2): Carbon dioxide is a colorless, odorless and non-poisonous gas formed by combustion of carbon and in the respiration of living organisms. Carbon dioxide is the primary greenhouse gas emitted through human activities. Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. The buildup of greenhouse gases can change Earth's climate and result in dangerous effects to human health and welfare and to ecosystems.
- **Nitrogen Oxide** (NO_x): Nitrogen Oxide is a group of different gases made up of different levels of oxygen and nitrogen. Nitrogen Dioxide (NO_2) contributes to global warming, hampers the growth of plants, and can form with other pollutants to form toxic chemicals. Small levels can cause nausea, irritated eyes and/or nose, fluid forming in lungs and shortness of breath. Breathing in high levels can lead to rapid, burning spasms, swelling of throat, reduced oxygen intake, a larger buildup of fluids in lungs, and/or death.
- **Sulphur Oxide** (SO_x): Short-term exposure to high enough levels of Sulphur Dioxide (SO_2) can be life threatening. Generally, exposures to SO_2 cause a burning sensation in the nose and throat. SO_2 exposure can cause difficulty breathing, including changes in the body's ability to take a breath or breathe deeply, or take in as much air per breath. Long term exposure to sulfur dioxide can cause changes in lung function and aggravate existing heart disease. Asthmatics may be sensitive to changes in respiratory effects due to SO_2 exposure at low concentrations. Sulfur Dioxide is not classified as a human carcinogen (it has not been shown to cause cancer in humans).
- **Non-Methane Hydrocarbons** (NMHC): The sum of all hydrocarbon air pollutants except methane; significant precursors to ozone formation.

Affected Environment

Existing Conditions

The Rim Recovery project area is located in Tuolumne County and Mariposa County, California. The direct, indirect and cumulative effects analysis area for the air quality section of this report is the Tuolumne and Mariposa Air Pollution Control Districts, Mountain Counties Air Basin.

According to the Environmental Protection Agency (EPA) Green Book, updated December 05, 2013, Tuolumne and Mariposa counties are Designated Non-Attainment Areas for ozone; the project area falls within these two counties. The Emigrant Wilderness is a class 1 Federal area within the project area. Yosemite National Park is a class 1 Federal area adjacent to the project area. The San Joaquin

Valley, a non-attainment area, runs along the western boundary of the project area. The Forest Service will follow the guidelines assigned by the California Air Resource Board [ozone State Implementation Plan (SIP), visibility SIPs, and Title 17] to limit state-wide exposure on a cumulative basis, in compliance with the Clean Air Act.

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Table 3.01-1 displays total emissions for Alternative 1 machine pile burning. Due to the dispersed nature of the burn piles, the near complete combustion of piled material, and the control over ignition times to favor good smoke dispersion, it is not anticipated that pile burning would substantially impact the local communities. Smoke would be transported to the northeast by typically southwest winds during the day. At night, smoke from burn piles in the project area would move down drainages. All burning would be completed under approved burn and smoke management plans. Piles would be constructed and burned under weather conditions that would allow efficient combustion. Emissions for machine pile burning were modeled using the Piled Fuels Biomass and Emissions Calculator (http://depts.washington.edu/nwfire/piles/).

Table 3.02-1 Alternative 1: Emissions for Machine Pile Burning (tons/acre)

PM10	PM2.5	CH_4	CO	CO_2	NMHC[1]
0.8556	0.7272	0.2398	3.2502	142.3482	0.1936

[1] NMHC = Non-methane Hydrocarbonsns per pile

Emissions from wildfires within the project area for Alternative 1 were also modeled. Table 3.02-2 is based on the First Order Fire Effects Model (FOFEM 6.0), the 90th percentile weather for the project area, and the estimated fuel loading under Alternative 1 out to year 20.

Table 3.02-2 Alternative 1: Emissions during wildfire conditions out 20 years (tons/acre)

Out Year	PM10	PM2.5	CH_4	CO	CO_2	NO_x	SO_x
1 year	0.1	0.1	0.0	0.9	15.6	0.0	0.0
5 years	0.1	0.1	0.1	1.2	11.7	0.0	0.0
10 years	0.1	0.1	0.1	1.2	11.7	0.0	0.0
20 years	0.1	0.1	0.1	1.2	11.7	0.0	0.0

Road construction, reconstruction, logging and haul, and rock quarry blasting would have a minor effect on air quality due to the project's management requirements and implementation of standard dust abatement requirements within all Forest Service Timber Sale contracts.

CUMULATIVE EFFECTS

Additional projects within and adjacent to the project area will utilize prescribed burning: Twomile Ecological Restoration: Vegetation Management, Soldier Creek Timber Sale, Reynolds Creek Ecological Restoration, and several thousand acres of pile burning on private land. California's Smoke Management Program (Title 17) is designed to prevent cumulative effects from prescribed fire operations. The program provides allocations of emissions based on the airshed's capacity and forecasted dispersal characteristics. The allocation process considers all burn requests, meteorological conditions, forecasted air pollution levels, and uncontrollable events like wildfire. Wildfire emissions can overwhelm air basins and most often all prescribed burn requests are denied during wildfire events. As a result of the California Smoke Management Program and agency oversight, Alternative 1 is not expected to contribute toward air quality cumulative effects.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, no pile burning and no jackpot burning occur; therefore, there would be no smoke directly generated from management activities. It is expected that there will continue to be lightning and human caused ignitions within the perimeter of the Rim Fire. Where these wildfires cannot be contained and they burn into heavy fuels, it is expected that heavy smoke from fire burning or smoldering in downed logs would result. This smoke would be blown to the northeast towards Yosemite National Park, a federal class 1 area, by typically southwest winds during the day. At night, smoke from a fire in this area would move down the drainages and likely cause impacts to the San Joaquin Valley, a non-attainment area.

Table 3.02-3 is based on the First Order Fire Effects Model (FOFEM 6.0), the 90th percentile weather for the project area, and the estimated fuel loading under Alternative 2 out to year 20.

CUMULATIVE EFFECTS

Same as Alternative 1.

Table 3.02-3 Alternative 2: Emissions during wildfire conditions out 20 years (tons/acre)

Out Year	PM10	PM2.5	CH_4	CO	CO_2	NO_x	SO_x
1 year	0.01	0.01	0.01	0.90	4.60	0.01	0.00
5 years	0.20	0.20	0.10	2.20	16.5	0.01	0.01
10 years	0.40	0.30	0.20	4.02	27.11	0.02	0.02
20 years	0.61	0.52	0.31	6.70	39.39	0.02	0.03

Alternative 3

DIRECT AND INDIRECT EFFECTS

Machine pile burning would generate the same amount of emissions in tons per acre as Alternative 1 (Table 3.02-1). Under a wildfire scenario during the 90th percentile weather conditions emissions for Alternative 3 are 399,566 total tons (Table 3.02-5).

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Machine pile burning would generate the same amount of emissions in tons per acre as Alternative (Table 3.02-1). Under a wildfire scenario during the 90th percentile weather conditions emissions for Alternative 4 are 365,768 total tons (Table 3.02-5).

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

Smoke emissions were modeled for both machine pile burning and for wildfires. Initial pile emissions in tons per acre for a single machine pile were modeled using the Piled Fuels Biomass and Emissions Calculator. Tons per acre of nonmerchantable timber were calculated from post fire plot sampling. These data were then used, along with treatment acres, to derive the total emissions for each alternative.

Table 3.02-4 displays total emissions for machine pile burning for each alternative. Total emissions from wildfires were generated using the 90th percentile weather, fuel loading at year 20, and multiplied by the number of ground acres treatment for each alternative except Alternative 2. For Alternative 2, the 30,399 acres identified in Alternative 3 were used for the smoke emission analysis. Areas outside treatment units would experience similar fire behavior, which would result in similar emissions.

Table 3.02-4 Comparison of total emissions from Machine Pile Burning (tons)

Alternative	Acres	PM10	PM2.5	CH_4	CO	CO_2	NMHC	Total
Alternative 1	16,366	14,003	11,901	3,925	53,193	2,329,671	3,168	2,415,861
Alternative 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 3	16,564	14,172	12,045	3,972	53,836	2,357,856	3,206.7904	2,445,088
Alternative 4	14,892	12,742	10,829	3,571	48,402	2,119,849	2,883	2,198,277

Table 3.02-5 compares smoke emissions under wildfire conditions by alternative.

Table 3.02-5 Comparison of smoke emissions at year 20 under wildfire conditions (tons)

Alternative	Acres	PM10	PM2.5	CH_4	CO	CO_2	NO_x	SO_x	Total
Alternative 1	28,326	3,285	2,775	1,600	34,005	330,012	354	226	372,257
Alternative 2	30,399	20,476	17,360	10,352	224,632	1,319,961	744	972	1,594,497
Alternative 3	30,399	3,526	2,979	1,717	36,498	354,210	380	243	399,553
Alternative 4	27,826	3,228	2,727	1,572	33,412	324,256	347	222	365,764

Table 3.02-6 compares smoke emissions in tons per acre for each alternative under year 20 wildfire conditions. Because similar treatments for all action alternatives would result in a fuel loading of 10 to 20 tons per acre, estimated emission outputs would likewise be similar for those alternatives. Alternatives 1, 3 and 4 reduce emissions by 39.31 tons per acre as compared to Alternative 2.

Table 3.02-6 Comparison of smoke emissions at year 20 under wildfire conditions (tons/acre)

Alternative	Acres	PM10	PM2.5	CH_4	CO	CO_2	NO_x	SO_x	Total
Alternative 1	28,326	0.12	0.10	0.06	1.20	11.65	0.01	0.01	13.14
Alternative 2	30,399	0.67	0.57	0.34	7.39	43.42	0.02	0.03	52.45
Alternative 3	30,399	0.12	0.10	0.06	1.20	11.65	0.01	0.01	13.14
Alternative 4	27,826	0.12	0.10	0.06	1.20	11.65	0.01	0.01	13.14

Jackpot burning may be utilized within the helicopter and skyline units. The purpose of jackpot burning is to reduce heavy concentrations of down woody fuels where access is limited to ground based machinery. Emissions for jackpot burning were not modeled due to limitations within fire behavior modeling programs that may inaccurately predict the amount of emissions released. Since this type of burning would allow for the majority of the area to retain ground cover while reducing the heavy concentrations of fuels post-harvest, emissions in tons per acre for jackpot burning would most likely fall below emissions for machine pile burning.

Conformity Determination

The project is located in an area designated as non-attainment for Ozone. The burn treatments under Alternatives 1, 3 and 4 will be conducted under an EPA approved California Smoke Management Program (SMP). Under the revised Conformity Rules the EPA has included a Presumption of Conformity for prescribed fires that are conducted in compliance with a SMP; therefore, the federal actions will be presumed to conform and no separate conformity determination will be made.

3.03 Aquatic Species

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The Forest Plan includes goals and strategy applicable to aquatic species and the Rim Recovery project (USDA 2010a):

- **Fish and Wildlife Goal**: Provide habitat for viable populations of all native and desired non-native wildlife, fish and plants. Maintain and improve habitat for Threatened and Endangered species and give special attention to sensitive species to see that they do not become Federally listed as Threatened or Endangered (p. 5).
- **Aquatic Management Strategy**: Identifies endpoints (desired conditions) toward which management moves watershed processes and functions, habitats, attributes, and populations. Goals of the Aquatic Management Strategy (AMS) include direction to (1) maintain viable populations of native and desired non-native species, (2) maintain habitat connectivity for aquatic and riparian species, and (3) maintain streamflow patterns and sediment regimes in accordance with evolutionary processes. The AMS has six RCOs that include the following element: (RCO 3) Ensure a renewable supply of large down logs that can reach the stream channel and provide suitable habitat within and adjacent to the Riparian Conservation Area (p. 13).

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Project effects analyses covered threatened, endangered, and proposed species where their geographic and elevation range and suitable habitat occurred within the Rim Recovery project area. An official list of federal threatened, endangered, and proposed species covering the project area was obtained from the Sacramento U.S. Fish and Wildlife Office website on December 5, 2013, and updated on April 17, 2014 (Document 140417112513). The treatment in this analysis includes recent taxonomic changes and proposed listings for Sierra Nevada yellow-legged frog that were not reflected in the official list. Scientific literature, state and federal databases (CNDDB, Aquasurv) were also examined to determine if species may occur in the project area.

Assumptions Specific to Aquatic Species

- For the foothill yellow-legged frog (FYLF) and western pond turtle (WPT), all intermittent and perennial streams below 4,200 feet in elevation provided suitable habitat for the species. This is considered a conservative approach because some intermittent streams do not provide any perennial water, making occupancy by either species unlikely. If these small, intermittent tributaries have very steep pitches (e.g., 20 foot high waterfall), they are also unlikely to be used by the turtle (Holland 1994). Also, the WPT may also occupy streams above the 4,200 foot elevation because one known occupied site above this elevation, but almost all occupied sites are lower than 3,000 feet in elevation. Two occupied sites (ponds) are at 5,400 feet within this project area with no clear indication of how they became occupied by the species. It is possible that they occur at these sites naturally or are an artefact of introduction by humans.
- All suitable habitats are assumed to be occupied by the species because of the limitations inherent in visual encounter surveys. Since the FYLF can remain hidden in streamside vegetation, roots, or cracks in rocks and WPT detect and hide quickly from surveyors (at long distances), the lack of detection during a single survey does not indicate unoccupied habitat. Also, some surveys only cover portions of a stream which limits an assumption of occupancy for an entire stream.
- A 300-meter (984 feet) buffer was used for the WPT around suitable aquatic habitats to account for upland habitat use. This buffer is assumed to include a large majority of the upland habitat

use, but acknowledges that turtles sometimes move distances greater than 300 meters from the water.

- In the post-fire environment, most of the sediment from hillslope erosion is assumed to end up in a stream. This assumption is more valid for high soil burn severity areas on steep slopes that are close to streams. High-severity areas typically have no beneficial ground cover and have water-repellent layers that allow sediment to be eroded. Roughness in topography, downed wood, rocks, and stump holes all have the potential to trap sediment being transported downslope and the assumption of 100 percent sediment routing to stream channels is an overestimation. However, using this assumption allows for the comparison of erosion rates and sedimentation across all alternatives.
- Regardless of the level of project-related activity, changes in sediment from project-related activity at the 5th Level Hydrologic Unit Code (HUC) watershed scale are assumed to be relatively minor when compared to post-fire sedimentation. For example, the amount of post-fire sediment delivered to the Clavey River may have small, localized consequences, but at the point of confluence with the Tuolumne, there would be too little sediment to impair biological functions. Further, there would be very little detectable change in most aquatic habitats when the total amount of project-related sediment is added to the post-fire sediment. This is because large bedrock rivers are very effective at storing and transporting fine sediments.
- Species are not present where suitable habitat is not present.
- Proposed water quality BMPs and management requirements would function as designed and reduce the risk of both direct and indirect effects to aquatic species.

Data Sources

- Stanislaus National Forest basemap, watersheds delineated at multiple scales (Hydrologic Unit Codes 5-8), stream gradient layer.
- Stanislaus National Forest aquatic survey database (Aquasurv).
- Stanislaus Streamscape Survey Inventory (SSI) database.
- California Wildlife Habitat Relationships System (CWHR) and the California Natural Diversity Database.
- Erosion and sediment modeling (3.09 Soils and 3.14 Watershed.
- Hydrology, soils and geology BAER reports.

Aquatic Species Indicators

THREATENED AND ENDANGERED SPECIES

The Aquatic BA evaluated two threatened and endangered species: California red-legged frog (CRLF) and Sierra Nevada yellow-legged frog (SNYLF). The indicators used for the analysis of potential impacts to these aquatic species are related to habitat suitability, breeding habitat, and upland habitat.

Habitat Suitability

- Estimated post-fire and post-implementation sediment depths (inches) potentially added to suitable habitat based on Disturbed WEPP modeling.

Breeding or Non-breeding Habitat

- Miles of breeding and non-breeding streams or acres of pond with occupied habitat
- Miles of breeding and non-breeding streams or acres of pond with suitable habitat
- Miles of breeding and non-breeding streams or acres of pond within units and/or hazard tree treatments
- Number of road treatment intersections with breeding and non-breeding streams in analysis area

Upland Habitat

- Acres of available upland habitat
- Acres of occupied upland habitat
- Acres of upland habitat within units and/or hazard tree treatments
- Miles of road treatments within upland habitat

SENSITIVE SPECIES

The Aquatic BE evaluated 3 Forest Service sensitive species: foothill yellow-legged frog (FYLF), western pond turtle (WPT), and hardhead. The indicators used for the analysis of potential impacts to these aquatic species include indicators common to all three species and indicators specific to each species.

Common Indicators

- Amount of species-specific buffer affected by the activities in each alternative
- Proportion of watershed affected by project activities.

Species Specific Indicators

- Percentage of foothill yellow-legged frog buffer (in acres) affected by project activities
- Percentage of western pond turtle buffer (in acres) affected by project activities
- Percentage of watershed affected by project activities

Aquatic Species Methodology by Action

THREATENED AND ENDANGERED SPECIES

The methodology used in the analysis for the CLRF and the SNYLF were similar. Within the project area, occupancy and habitat suitability assessments identified localized analysis areas for each species. Discrete analysis areas were defined by suitable breeding habitats and the non-breeding, upland and dispersal habitats associated with them. Within each discrete analysis area, effects to individuals and effects to habitats were analyzed for each alternative.

California Red-legged Frog

Perennial and intermittent aquatic habitats at elevations of 4,000 feet or less (except at historic localities above this elevation) were assessed for CRLF breeding and non-breeding suitability based on the primary constituent elements (PCEs) as defined by the USFWS (Federal Register 2010). The direct, indirect and cumulative effects for CRLF were based on suitable breeding habitats within one mile of the project area boundaries. The remaining habitat components (non-breeding aquatic, upland and dispersal) were then identified within one mile of the breeding habitats.

Sierra Nevada Yellow-legged Frog

All fish-free, perennial aquatic habitats within proposed project activity boundaries at elevations greater than 5,000 feet were assessed for SNYLF breeding suitability based on the PCEs as defined by the USFWS (Federal Register 2013b). The direct, indirect, and cumulative effects were conducted for SNLYF suitable breeding, non-breeding and upland habitats where project activities were proposed within 984 feet of ponds and within 82 feet of any portion of a stream habitat as determined by the defined extent of the upland area for each of these habitats (Federal Register 2013b).

Existing Condition

Known pre-fire habitat characteristics were gathered and summarized to establish a baseline to compare how the estimated effects of the Rim Fire would affect each habitat. Most of the suitable breeding habitats included in this analysis had some level of pre-fire existing condition information. Breeding habitats with unknown pre-fire existing conditions were assessed based solely on the estimates of post-fire increases in sediment depth (see Sediment Analysis below) and any changes in habitat suitability are represented in terms of magnitude (Table 3.03-2). For example, a change in habitat suitability equaling -1 magnitude is equivalent to a full magnitude reduction in habitat suitability (e.g., from high to moderate) and a change equaling -0.5 magnitude would equate to a lesser reduction (e.g., from high to high-moderate).

Pre-fire existing condition assessments utilized a variety of factors. For the CRLF, the primary factors considered included, bullfrog presence, depth, and other human caused disturbances (recreation, roads, and urban areas). The primary factors contributing to SNYLF pre-fire existing condition assessments included depth, gradient and pool presence. These pre-fire existing condition factors were used in addition to the PCEs as defined by the USFWS (2010 and 2013b).

Using the pre-fire existing condition as a baseline, post-fire changes in habitat suitability were assessed based on sedimentation estimates (Table 3.03-3). The relative risk that the estimated changes in sediment depth may pose in each individual breeding and non-breeding aquatic habitat were considered.

Sediment Analysis

The estimated tons of soil that could be eroded within each breeding watershed post-fire and post-implementation were used for determining the existing condition of each breeding habitat and for assessing the effects of each alternative. These estimates are important because they provide an indicator for the level of sedimentation that could enter each breeding habitat.

The initial estimated sediment depths assume 100 percent of the eroded soils within the watershed would be transported to the breeding habitats and 100 percent stored within and uniformly distributed throughout each habitat, essentially equating to the worst-case scenario (100 percent transport and 100 percent storage). While this worst-case scenario is probable in certain instances, more often, both the transportation and storage of eroded soils will occur at reduced rate. The factors capable of reducing the transportation and storage of eroded soils considered in this analysis included vegetation burn severity, stream gradient, and hillside slope. All pond breeding habitats were analyzed under the assumption that any sediment transported to the habitat would be stored (100 percent storage).

Vegetation Burn Severity

Vegetation that burned at moderate to high severities will provide the least soil cover in the years following the fire. Since the ground cover was essentially eliminated where vegetation burned at moderate to high severity, there is a high risk that eroded soils will be transported to aquatic habitats in these areas. Therefore, this analysis used a 100 percent transport scenario to represent sediment transport within watersheds that had moderate to high vegetation burn severities (Table 3.03-1).

Low burned and unburned vegetation maintain soil cover similar to pre-fire conditions. Therefore, this analysis used the 25 percent transport scenario for breeding habitats located in watersheds where the majority of the vegetation remained unburned or burned at low severity (Table 3.03-1). Vegetation that primarily burned at moderate severities was subsequently assumed to allow 50 percent transportation of eroded soils to aquatic habitats (Table 3.03-1).

Table 3.03-1 Transport and storage scenarios

Vegetation Burn Severity	Percent Transport Scenario	Stream Gradient (percent)	Percent Storage Scenario
Moderate – High	100	0 – 2 (low)	100
Moderate	50	>2-4 (moderate)	50
Unburned – Low	25	>4 (high)	25

Sediment transport on moderately steep to very steep hillsides is greater than in areas with gently sloping terrain. Therefore, hillside slope was considered when assessing the most likely sediment transport scenario for each habitat. The existing condition and subsequent post-implementation qualities reflect this inclusion.

Stream Gradient

Streams with steeper gradients will typically store less sediment because flow velocity and the force of gravity are greater in stream systems with steeper gradients. Therefore, this analysis adjusted the sediment storage rate in streams in accordance with the associated average stream gradient. For example, this analysis used a 100 percent storage scenario for low gradient streams (0-2 percent), a 50 percent storage scenario for moderate gradient streams (greater than 2-4 percent), and a 25 percent storage scenario for high gradient streams (greater than 4 percent) (Table 3.03-1). In streams that have low flow most of the year or large portions that flow subsurface the storage scenario percentage was increased. The estimated outcome of different transport and storage scenarios are displayed in Table 3.03-3.

Cumulative Effects

The spatial boundary for analyzing cumulative effects occurred at two different scales: (1) direct overlap with suitable CRLF and SNYLF habitats, and (2) within the breeding watershed scale (Table 3.03-10 and Table 3.03-11). This was done to provide a detailed look at the activities that could affect each suitable habitat and subsequently any individual CRLF or SNYLF inhabiting them. Because each of the habitats are fairly isolated with little likelihood of dispersal between them (except SNYLF between Little Kibbie and Big Kibbie Ponds), populations or individuals inhabiting these habitats are expected to remain within the habitats associated with each identified suitable breeding habitat.

The temporal boundary established for cumulative effects analysis was ten years from present, a timeline commensurate with the Cumulative Watershed Effects (CWE) modeling and related to using a threshold of concern (TOC). When the TOC is exceeded there is the risk of increased sedimentation in the channel, reduction in deep water habitat volume, reduction in interstitial spaces in the streambed, higher turbidity during high stream flow, and reduced primary and secondary productivity. These changes in the aquatic system can affect reproduction, ability to avoid predation, and the availability of food resources. The CWE modeling indicated all streams would recover to near pre-fire levels within this time frame.

SENSITIVE SPECIES

For the FYLF and WPT, all streams below 4,200 feet were identified as suitable for the species. For the FYLF, all of these stream miles were buffered by 100 feet on both sides to provide an upland area for the frog. These two steps identified the number of stream miles to be calculated in the project area and amount of upland habitat associated with the streams. For the WPT, the same streams used for the FYLF analysis were buffered by a distance of 300 meters (984 feet) on each side of the stream to derive an upland habitat area. Both buffer areas (FYLF and WPT) are considered to contain the majority of upland habitat used by the species.

With these upland areas established, the activities proposed in each of the action alternatives were placed over the upland areas, or an intersection was created, to estimate the amount of area impacted by each activity for each species. Once this intersection of project activities and habitat buffer was established, the type of logging system used, volume estimates for “recovered” trees, road action types, and water use from designated sources were evaluated to conceptualize an intensity of activity occurring within each occupied or suitable watershed. This estimate was used to provide a point of reference for the amount of project-related activity occurring close to streams and provide a basis for assigning risk of direct and indirect effects to the species and their habitats. Since the types of actions in each action alternative were not different (only the amount of each activity differed), this approach was considered to be applicable to all of the alternatives.

For cumulative effects analysis, an internal planning effort identified all ongoing and planned activities on public and private lands (Appendix B). For public lands, ongoing actions (e.g., livestock grazing) and planned activities (e.g., Rim HT project) were identified on NFS and National Park Service (Yosemite NP) lands. For private lands, emergency timber plans were retrieved from CalFire to identify the areas where salvage logging occurred or is proposed to occur.

The spatial boundary for analyzing cumulative effects occurred at several different scales. For some small watersheds (7th and 8th level HUC and smaller) that are occupied or provide suitable habitat, cumulative effects were narrowed to the scale of the watershed. The reason this was done is to provide a detailed look at the activities that could affect small, isolated populations. Populations and individuals inhabiting these smaller streams are expected to remain within the watershed and complete all life stages in the watershed. Therefore, actions occurring outside of the small watershed, but within the larger 5th or 6th level HUC, may have no cumulative bearing on the isolated populations. Examples of smaller watersheds include Grapevine (7th level HUC) and Drew (8th level HUC) Creeks and the small, unnamed Clavey River tributaries (sub-8th level HUC). The spatial scale was also expanded out to larger watershed scales to address populations occurring in larger habitats, like the Clavey River. The downstream extent of the analysis area is Don Pedro Reservoir for the Tuolumne River watershed and the upper North Fork Merced River 5th level HUC.

The temporal boundary established for cumulative effects analysis was ten years from present, a date commensurate with the Cumulative Watershed Effects (CWE) modeling completed for the project (see Watershed Chapter). The reason this time frame was chosen is related to the modeling approach using a threshold of concern (TOC) for watersheds. When a watershed exceeds the TOC, there is an increased risk that a variety of watershed processes may not occur as they would when a watershed functions below the threshold. An example of a watershed process that may not function normally when the TOC is exceeded is the stability of the stream within its channel. When the TOC is exceeded there is the risk that the streambanks will become unstable and bank erosion can occur. This can lead to increased sedimentation in the channel, reduction in deep water habitat volume, reduction in interstitial spaces in the streambed, higher turbidity during high stream flow, and reduced primary and secondary productivity. These changes in the aquatic system can affect reproduction, ability to avoid predation, and the availability of food resources. The CWE model includes recovery times for certain actions, like logging, or events, like wildfire, whose effects diminish over time. When a watershed returns to below a TOC, natural processes in the stream system are expected to dominate and the stream should regain a high degree of stability over time. The CWE modeling indicated all streams (at 6th and 7th level HUC scale) would recover to near pre-fire levels within this time frame. It should be noted that some elements of the cumulative effects analysis, such as the long term recruitment of large woody debris (LWD), may extend 100 or more years into the future, but this timeframe could not be applied in the context of reasonably foreseeable future.

Affected Environment

The Rim Fire affected a variety of aquatic habitats including wetlands, ponds, natural and man-made lakes, streams, and rivers. The aquatic features at lower elevations, less than 2,500 feet, are primarily influenced by rainfall during the wet season (November through April), while aquatic features above this elevation are influenced by rainfall, snowpack, or a combination of both. Streams in the rainfall zone typically see peak flows following larger rain events and some intermittent streams may support surface water for several months. Streams in the rain/snow zones may see very high peak flows if rain falls on a snowpack, but streams typically show a period of peak flow as the snow melts in the late spring and early summer.

All of the larger stream systems affected by the Rim Fire are bedrock rivers (versus alluvial rivers) shaped by snowmelt runoff during the late spring (mid-May) to middle summer (mid-July). Geomorphic complexity in bedrock rivers in the Sierra Nevada requires variable annual flow (winter floods, snowmelt peak flows, winter and summer baseflow), periodic inputs of large volumes of sediments (landslides, hillslope mass wasting), and multiple flow thresholds (variable levels of flooding) (McBain and Trush 2004). Most of these rivers have steep canyons, and steep tributary streams, ascending to more gentle terrain above the canyon rim.

A very large proportion of the fire area occurred in the Tuolumne River watershed. The Tuolumne River originates in Yosemite National Park and has several large tributaries originating in the Park or on the Stanislaus National Forest. Five primary tributaries join the Tuolumne within the fire area: the Clavey and Middle, North, and South Fork Tuolumne Rivers, and Cherry Creek. The Middle and South Fork Tuolumne Rivers originate in Yosemite then flow in a westerly direction to join each other and then the main Tuolumne. Cherry Creek and the North Fork Tuolumne and Clavey Rivers originate from the Stanislaus and primarily flow in a southerly direction into the Tuolumne. There are many minor tributaries to the Tuolumne River and its principal tributaries including: Alder, Big, Corral, Drew, Grapevine, Indian, and Jawbone Creeks (Tuolumne River); Basin and Hunter Creeks (North Fork Tuolumne River); Big Creek (South Fork Tuolumne River); Eleanor Creek and Granite Creek (Cherry Creek); and Hull, Reed (including Bourland, Reynolds, and Little Reynolds Creeks), and Twomile Creeks (Clavey River). Additionally, there are numerous very small, typically unnamed tributaries to each of these listed streams and rivers.

Obligate riparian vegetation (e.g., willow and alder) along most streams in the affected area is typically restricted to a narrow (less than 50 feet) band adjacent to the edge of the water. There are some wetlands in fire perimeter that support obligate herbaceous riparian species as dominant plant community types.

The known distribution of all analyzed aquatic species follows and a description of suitable habitat for these species is also provided.

THREATENED AND ENDANGERED SPECIES

California Red-legged Frog

The CRLF is now likely extirpated from 70 percent of its former range (USFWS 2002). Rangewide, the CRLF occurred at elevations from sea level to 5,200 feet, although the highest known extant population occurs at 3,346 feet in Placer County (Barry and Fellers 2013). The historic localities in the Sierra Nevada over 3,600 feet were possibly introduced (USFWS 2002; Barry and Fellers 2013). The Fish and Wildlife Service has concurred that occurrences above 4,000 feet in the Sierra Nevada are atypical and has used this elevation as a threshold for critical habitat designation (Federal Register 2006).

California red-legged frogs inhabit various aquatic habitats including ponds, marshes, streams, and lagoons (Fellers 2005). The timing of breeding varies geographically, but typically occurs from November through April (USFWS 2002), which coincides with what will be referred to as the wet-season throughout this section. Females lay from 2,000-6,000 eggs (in masses) that are usually attached to vegetation near the water's surface. Eggs hatch in about 3 weeks. Tadpoles typically metamorphose within 11 to 20 weeks, from July to September, but overwinter aquatically at some sites (Fellers 2005; Bobzien and DiDonato 2007). Adult movements to terrestrial habitat or between aquatic habitats typically commence with the first fall rain (greater than 0.25 inches) and continue until April (Fellers and Kleeman 2007; Tatarian 2008). Adults may also disperse when aquatic habitats dry out (Fellers and Kleeman 2007). Individual movements of up to 2 miles have been reported (Fellers 2005), but 1 mile represents a more average dispersal distance (Federal Register 2010).

The CRLF recovery plan (USFWS 2002) identifies introduced species and habitat degradation and loss as primary drivers of CRLF population declines. Introduced bullfrogs, crayfish, fish, and plants which have become established throughout much of the historic CRLF range, detrimentally affect the

CRLF through predation, competition, and reduced habitat quality. Agricultural and urban development have destroyed and fragmented much of the historic CRLF habitat. Other factors that may have particularly impacted Sierra Nevada populations include dams and impoundments, mining, livestock overgrazing, recreation, and timber harvesting.

Timber operations and other related actions conducted within watersheds inhabited by, or containing suitable CRLF habitat, may contribute to the degradation of instream and riparian habitat. Possible effects of timber operations leading to degraded habitat include, increased sedimentation, removal of trees providing bank stability and structure, and altered runoff patterns (USFWS 2002).

Access roads, haul roads, skid trails, and ground-based tractor yarding systems have great impacts related to sedimentation and compaction. Wet weather operations also have more potential for impacts. Timber harvesting in upland habitat can also impact CRLFs by causing direct harm or injury to frogs that may be dispersing or sheltering. Indirectly, upland timber harvesting may impact CRLFs by making them more susceptible to predation by compacting or removing the CRLFs cover or refugia (USFWS 2002).

The CRLF has not been detected on the Stanislaus National Forest since 1967 and is considered extirpated from the Tuolumne River watershed (USFWS 2002) included in the project area.

Table 3.03-2 Existing condition habitat summary for CRLF and SNYLF breeding habitats

Habitat	Acres	Miles[3]	Avg. Depth[4] (feet)	Elevation (feet)	Vegetation Burn Severity (%)				Pre-fire Habitat Quality	Post-fire Habitat Quality
					H	M	L	UB		
California red-legged frog										
Birch Lake[1]	4.0	0.28	No data	4,500	31	14	18	37	Low	No Change
Mud Lake[1]	2.2	0.31	No data	4,500	0	55	22	23	Low	No Change
Drew Creek		1.3	1.75	2,960 to 3,300	50	23	21	5	Moderate-High	Low-Unsuitable
Harden Flat Pond 1	0.54	0.12	No data	3,500	11	40	34	16	Moderate	Moderate-Low
Harden Flat Pond 2	0.35	0.12	No data	3,500	0	11	3	86	Moderate	No Change
Homestead Pond[1]	0.17	0.06	> 6.5	3,100	86	14	0	0	Moderate	Moderate-Low
Hunter Creek[2]		7.5	1.6	1,600 to 4,000	13	18	18	51	Moderate	Moderate-Low
Hunter Creek Pond 1	0.39	0.10	No data	3,880	10	32	44	15	Unknown	-1 magnitude
Hunter Creek Pond 2	0.21	0.07	No data	3,760	9	32	46	13	Unknown	-1 magnitude
Hunter Creek Pond 3	0.23	0.08	No data	3,880	9	17	59	14	Unknown	No Change
Hunter Creek Pond 4	0.35	0.10	No data	3,760	14	41	39	6	Unknown	-1 magnitude
Hunter Creek Pond 5	0.37	0.10	No data	3,360	13	35	47	5	Unknown	-1 magnitude
Sierra Nevada yellow-legged frog										
Bear Creek		0.79	No data	5,000 to 5,200	83	16	1	0	Unknown	Unsuitable
Cherry Lake Tributary		1.40	No data	5,000 to 5,900	32	30	30	9	Low	Unsuitable
Jawbone Creek		4.62	"deep"	5,000 to 6,700	37	16	33	14	Low-Moderate	Low-Unsuitable
Little Reynolds Creek		3.60	< 1.0	5,600 to 6,800	1	11	40	48	Low	No Change
Looney Creek		5.00	No data	5,000 to 6,500	<1	6	21	72	Unknown	No Change
Lost Creek		1.86	1.00	5,400 to 6,500	5	16	39	41	Low	No Change
Niagara Creek		1.44	0.70	5,300 to 5,700	15	37	38	10	Low	Low-Unsuitable
Reynolds Creek Tributary		0.82	No data	5,000 to 5,600	8	21	43	28	Unknown	-0.5 magnitude
Richards Creek		0.82	< 0.32	5,000 to 6,000	41	37	20	2	Low-Unsuitable	Unsuitable
White Fir Creek		1.86	<1.10	5,000 to 5,900	21	22	28	28	Low-Unsuitable	Unsuitable
Little Kibbie Pond	0.57	0.12	1.60	5,400	73	27	0	0	Low-Moderate	No Change
Big Kibbie Pond	0.71	0.15	3.60	5,400	11	63	26	0	Moderate-High	No Change

H=High; M=Moderate; L=Low; UB=Unburned
[1] Bullfrogs present
[2] Trout present
[3] Miles of stream or shoreline of ponds
[4] Depths for creeks are average pool depths.

A total of 9.7 miles of potentially suitable breeding stream habitat, 8.9 acres of potentially suitable breeding pond habitat, 332.8 miles of non-breeding stream habitat, and 21,592 acres of upland habitat was identified within the project and analysis area. All other habitats were ruled out because they did not meet the suitability criterion. Within the Rim Recovery project area, five habitat units (Mather Vicinity, Drew Creek, Homestead Pond, Harden Flat, and Hunter Creek) were identified that have suitable breeding habitat in two streams (Drew Creek, Hunter Creek) and 10 ponds (Birch Lake, Mud Lake, Homestead Pond, and 7 unnamed ponds). Habitat characteristics including size (acres), length (miles), average depth (feet), and pre- and post-fire habitat quality determinations are summarized in Table 3.03-2. The percent of the landscape within each breeding habitat's watershed where vegetation remained unburned (UB) or burned at high (H), moderate (M), and low (L) severities is also displayed in Table 3.03-2. These values were used in determining the likely sediment transport scenario for the analysis.

Sierra Nevada Yellow-legged Frog

Prior to 2007, Rana muscosa and Rana sierrae were considered a single species referred to as mountain yellow-legged frogs (Vredenburg et al. 2007). Genetic work however, confirmed morphological and acoustic dissimilarities between the northern and southern populations of mountain yellow-legged frogs, and accordingly, the frogs were reclassified as two species. Mitochondrial DNA indicates that the contact zone between the two species is between the middle and south forks of the Kings River. Frogs north of this point are now classified as Sierra Nevada yellow-legged frogs (SNYLF, Rana sierrae), and those south, remain mountain yellow-legged frogs (MYLF, Rana muscosa). Consequently, the analysis summarized here will address the effects of project actions on the SNYLF. Where information applies to both species, the two species will be referred to collectively as the MYLF-complex.

Although frogs of the MYLF- complex were historically abundant throughout the Sierra Nevada, current research has reported declines over large expanses of their range and as much as 97 percent on Forest Service lands. Where frogs are present, their numbers are relatively low in comparison to historical estimates (Brown et al. 2014). The current remaining populations are restricted primarily to publicly managed lands within National Forests and National Parks at elevations ranging from 4,500 to 12,000 feet (CDFG 2011).

Frogs of the MYLF-complex inhabit high mountain lakes, ponds, marshes, meadows, tarns, and streams. They are highly aquatic at all life stages and extensively use deep water ponds deeper than 6.5 feet that lack introduced fish. Despite their positive correlation with deep water habitats (Knapp 2005), both tadpoles and adults are most commonly found along open gently sloping shorelines that provide shallow waters of only 2 to 3 inches in depth (Mullally and Cunningham 1956; Jennings and Hayes 1994; Federal Register 2013a).

At lower elevations, these species are known to be associated with rocky streambeds and wet meadows surrounded by coniferous forests (Zweifel 1955; Zeiner et al. 1988). Streams utilized by adults vary from high gradients and numerous pools, rapids, and small waterfalls to streams with low gradients and slow flows, marshy edges, and sod banks (Zweifel 1955). These frogs are rarely found in small or ephemeral streams which frequently have insufficient depth and hydroperiods for adequate refuge and overwintering habitat (Jennings and Hayes 1994).

The timing of breeding varies annually, but occurs shortly after snowmelt, typically between May and July (the dry season). Females lay clutches varying from 15 to 350 eggs (Vredenburg et al. 2005) attached to rocks, gravel, and vegetation or under banks (Wright and Wright 1949, Pope 1999). Eggs hatch in about 2.5 to 3 weeks (Pope 1999). Tadpoles may take more than 1 year (Wright and Wright 1949), and often require 2 to 4 years, to reach metamorphosis (Bradford et al. 1993; Knapp and Matthews 2000) depending on local climate conditions and site-specific variables. In aquatic habitats of high mountain lakes, the adult frogs typically move only a few hundred meters (Matthews and

Pope 1999; Pope 1999), but single-season distances of up to 2.05 miles have been recorded along streams (Wengert 2008). Adults may move between selected breeding, feeding, and overwintering habitats during the course of the year. Though typically found near water, overland movements by adults of over 217 feet have been routinely recorded (Pope 1999). The farthest reported distance from water is 1,300 feet (Federal Register 2013a).

Some factors that may impact the MYLF-complex include recreation activities, dams and water diversions, livestock grazing, timber management, road construction and maintenance, and fire management activities. Timber harvest activities can remove vegetation and cause ground disturbance and compaction, leading to erosion (Helms and Tappeniner 1996; Federal Register 2013a). A large increase in sedimentation could potentially damage breeding habitat. Timber harvest may also alter the annual hydrograph, possibly lowering the water table in riparian habitat. Roads, including those associated with timber harvests, may contribute to habitat fragmentation and species disturbance, but have not been implicated as primary factors in this species' decline.

In some areas, long-term fire suppression has created conditions vulnerable to increased fire severity and intensity (McKelvey et al. 1996; Federal Register 2013a). Excessive erosion and siltation of habitats following wildfire is a concern in shallow, lower elevation areas below forested stands. Severe and intense wildfires may reduce amphibian survival (Russell et al. 1999). Amphibians may avoid direct mortality from fire by retreating to wet habitats or sheltering in subterranean burrows (Federal Register 2013a). Because these species generally occupy high-elevation habitats, where fire is less likely to occur, this is likely a low threat.

Table 3.03-3 Sediment depths for CRLF and SNYLF suitable breeding habitat

Name	100%/100%[1]				50%/100%[1]				50%/50%, 100%/25% or 25%/100%[1]				25%/50% or 50%/25%[1]			
	PF[2] Alt 2	PI[3] Alt 1	PI Alt 3	PI Alt 4	PF Alt 2	PI Alt 1	PI Alt 3	PI Alt 4	PF Alt 2	PI Alt 1	PI Alt 3	PI Alt 4	PF Alt 2	PI Alt 1	PI Alt 3	PI Alt 4
Birch Lake[4]	0.24	0.29	0.22	0.22	0.12	0.15	0.11	0.11	0.06	0.07	0.06	0.06	0.03	0.04	0.03	0.03
Mud Lake	0.00	NC[5]	NC	NC	0.00	NC	NC	NC	0.00	NC	NC	NC	0.00	NC	NC	NC
Drew Creek	27.75	27.77	26.94	26.94	11.50	13.89	13.47	13.47	6.94	6.94	6.73	6.73	3.47	3.47	3.37	3.37
Harden Flat Pond 1	4.96	5.03	4.76	4.76	2.48	2.51	2.38	2.38	1.24	1.26	1.19	1.19	0.62	0.63	0.59	0.59
Harden Flat Pond 2	0.05	NC[5]	NC	NC	0.02	NC	NC	NC	0.01	NC	NC	NC	0.01	NC	NC	NC
Homestead Pond	3.04	NC	NC	NC	1.52	NC	NC	NC	0.76	NC	NC	NC	0.38	NC	NC	NC
Hunter Creek	16.65	16.63	16.32	16.32	8.32	8.31	8.16	8.16	4.16	NC	4.08	4.08	2.08	NC	2.04	2.04
Hunter Creek Pond 1	3.08	3.06	3.08	3.08	1.54	1.53	1.54	1.54	0.77	NC	NC	NC	0.39	0.38	0.39	0.39
Hunter Creek Pond 2	10.39	10.55	10.40	10.40	5.20	5.27	5.20	5.20	2.60	2.64	2.60	2.60	1.30	1.32	1.30	1.30
Hunter Creek Pond 3	1.64	NC	NC	NC	0.82	0.82	0.82	0.82	0.41	NC	NC	NC	0.21	NC	NC	NC
Hunter Creek Pond 4	6.22	6.23	6.16	6.16	3.11	3.12	3.08	3.08	1.56	NC	1.54	1.54	0.78	NC	0.77	0.77
Hunter Creek Pond 5	13.65	13.78	13.60	13.60	6.83	6.89	6.80	6.80	3.41	3.44	3.40	3.40	1.71	1.72	1.70	1.70
Bear Creek	40.18	35.96	25.92	36.90	20.09	17.98	12.96	18.45	10.05	8.99	6.48	9.22	5.02	4.50	3.24	4.61
Cherry Creek Trib.	21.45	21.38	19.80	19.80	10.73	10.69	9.90	9.90	5.36	5.35	4.95	4.95	2.68	2.67	2.48	2.48
Jawbone Creek	18.54	18.08	16.64	16.64	9.27	9.04	8.32	8.32	4.64	4.52	4.16	4.16	2.32	2.26	2.08	2.08
Little Reynolds Creek	2.11	2.17	2.07	2.07	1.06	1.09	1.03	1.03	0.53	0.54	0.52	0.52	0.26	0.27	0.26	0.26
Looney Creek	2.59	2.60	2.58	2.58	1.30	NC	1.29	1.29	0.65	NC	0.64	0.64	0.32	0.33	0.32	0.32
Lost Creek	1.50	1.63	1.40	1.40	0.75	0.81	0.70	0.70	0.38	0.41	0.35	0.35	0.19	0.20	0.18	0.18
Niagara Creek	17.03	16.54	13.45	16.17	8.51	8.27	6.72	8.09	4.26	4.14	3.36	4.04	2.13	2.07	1.68	2.02
Reynolds Creek Trib.	13.61	12.98	10.44	13.38	6.80	6.49	5.22	6.69	3.40	3.24	2.61	3.35	1.70	1.62	1.31	1.67
Richards Creek	18.46	18.97	18.33	18.33	9.23	9.49	9.17	9.17	4.61	4.74	4.58	4.58	2.31	2.37	2.29	2.29
White Fir Creek	5.75	5.84	4.62	4.62	2.88	2.92	2.31	2.31	1.44	1.46	1.15	1.15	0.72	0.73	0.58	0.58
Little Kibbie Pond	0.02	0.03	NC	NC	0.01	NC	NC	NC	0.01	NC	NC	NC	0.00	NC	NC	NC
Big Kibbie Pond	0.02	0.03	NC	NC	0.01	0.02	NC	NC	0.01	NC	NC	NC	0.00	NC	NC	NC

[1] Percent transport/storage scenarios (i.e. 100%/100% = 100 percent transport / 100 percent storage)
[2] PF=post-fire
[3] PI=post-implementation
[4] All depths are in inches
[5] NC is no change from post-fire values

The SNYLF has been found throughout the Stanislaus National Forest in streams, meadows and lakes at elevations between 5,400 feet and 9,700 feet, most commonly in high alpine lake habitats. No SNYLF (extant or historic) have been found within the Rim Fire perimeter according to Forest and CNDDB records. With few exceptions, the stream occurrences associated with wet meadow systems are in streams adjacent to or connected to lakes and ponds. The majority of habitats within the project area are atypical of habitats where SNYLF are known to occur on the forest.

Within the Rim Recovery project area there are72.4 miles of potentially suitable breeding and non-breeding perennial stream habitat, 19 breeding and non-breeding ponds with 2.6 miles of shoreline and 25.9 acres of habitat, and 2,155.1 acres of upland habitat. All other aquatic habitats were ruled out as suitable. Suitable habitats included in the analysis include sections of ten different streams: Bear Creek, Little Reynolds, Looney Creek, Lost Creek, Niagara Creek, Reynolds Creek Tributary, Jawbone Creek, Richards Creek, Wrights Creek, and an unnamed west shore tributary to Cherry Lake, and two ponds (Little Kibbie Pond and Big Kibbie Pond). Table 3.03-3 displays sediment depths for CRLF and SNYLF suitable breeding habitat.

SENSITIVE SPECIES

Foothill yellow-legged frog

The FYLF is a stream breeding frog that spends essentially all of its time in or in very close proximity to water. Breeding occurs in late spring (small streams) or early summer (larger streams) when predictable or receding flows occur and water temperatures warm. Breeding females typically attach egg masses to stable substrates (rocks) in shallow, slow water. Tadpoles emerge in a few weeks and begin feeding on algae and diatoms attached to streambed substrates. As tadpoles develop, they become wary of potential predators and seek refuge around and under streambed substrates. Tadpoles metamorphose into “froglets” by early fall and probably stay near the breeding area for the first winter. Adult and sub-adult frogs adopt one of a couple of dispersal strategies outside of the breeding season. One strategy involves moving up- or downstream of the breeding area and the frogs remain on the same stream. Another strategy involves dispersal into small tributary streams near the breeding site. They may remain in these smaller streams associated with very small pools for most of the year. Sunny areas for basking and shady areas for refuge are likely important attributes in allowing the frog to regulate its body temperature. With the onset of spring, males will move to the breeding areas to establish territories and females follow several weeks to months after the males. Females probably leave the breeding site immediately following breeding. The FYLF has a known local elevation range of 900 to 4,000 feet. On the forest, the highest elevation recorded for breeding on a large river is 3,000 feet (North Fork Tuolumne River) and 3,600 feet in a small stream (Bull Meadow Creek).

The FYLF is known to occur in the following streams: Drew Creek, Grapevine Creek, and Tuolumne River (Tuolumne River watershed); Basin Creek, Hunter Creek, North Fork Tuolumne River (North Fork Tuolumne River watershed); Bull Meadow Creek, Indian Springs Creek, unnamed tributary, and Clavey River (Clavey River watershed); and Bull Creek, Moore Creek, and North Fork Merced River (North Fork Merced River watershed). Many other streams in the fire area provide suitable habitat for the FYLF, but occupancy is unknown. Below the confluence of Cherry Creek, the Tuolumne River does not provide suitable breeding habitat for the frog. This is because there are drastic fluctuations in water associated with releases from Dion Holm Powerhouse on Cherry Creek. These fluctuations occur rapidly and daily during the breeding period, and are probably large enough to either scour or strand egg masses, both mortality events. Also, the cold water temperatures associated with the discharges may be enough to slow development and prevent metamorphosis in a timely manner. The Tuolumne River likely played an important role in supporting a number of interconnected sub-populations along the river prior to the construction of upstream dams. This assertion is supported by the presence of FYLF populations in most of the main tributaries and in the Tuolumne itself upstream of Early Intake which suggests an earlier, extensive distribution pattern of the frog.

Most of these populations, especially in small streams (e.g., Basin Creek) are believed to be small and consist of less than 20 adults. In the small tributaries that offer dispersal habitat, there could be very few individuals occupying the stream. The Clavey River is probably the largest remaining population of FYLF in the southern Sierra Nevada. Frogs are known to breed at the confluence with the Tuolumne River and above the 1N01 bridge crossing (9 miles) and this analysis assumes multiple breeding locations between these two points. Also, the river provides many more miles upstream of the bridge that are suitable for breeding. For the primary streams providing suitable habitat for the FYLF, Table 3.03-4 shows miles of suitable and occupied FYLF habitat, occupancy status, and whether surveys were conducted on the streams.

Table 3.03-4 Occupied and suitable habitat for FYLF in the Rim Fire area

Watershed (5th level HUC)	Stream	Watershed (acres)	Occupancy	Survey	Suitable (miles)	Upland Habitat Acres (30-meter buffer)
Tuolumne River	Tuolumne River	819,000	Yes	Yes	36.5	870
	Alder Cr.	1,525	Unknown	Yes	5.5	132
	Corral Cr.	4,570	Unknown	Yes	9.6	230
	Drew Cr.	1,697	Yes	Yes	4.6	110
	Grapevine Cr.	4,488	Yes	Yes	10.8	260
	Indian Cr.	2,344	Unknown	No	2.7	64
	Jawbone Cr.	13,136	Unknown	Yes	14.3	343
Middle Fork Tuolumne River	Middle Fork Tuolumne River	46,635	Unknown	Yes	25.5	612
North Fork Tuolumne River	North Fork Tuolumne River	63,849	Yes	Yes	75	1,796
	Basin Cr.	9,030	Yes	Yes	17.8	427
	Hunter Cr.	9,482	Yes	Yes	21.5	515
South Fork Tuolumne River	South Fork Tuolumne River	57,855	Unknown	Yes	29.4	704
Cherry Creek	Cherry Cr.	90,892	Unknown	No	17.8	428
	Eleanor Cr.	59,906	Unknown	No	2.3	55
	Granite Cr.	4,110	Unknown	Yes	6.0	144
Clavey River	Clavey River	100,645	Yes	Yes	29	696
	Reed Cr.	24,527	Unknown	Yes	4.2	101
	Adams Gulch	815	Unknown	No	0.8	18
	Bear Springs Cr.	2,403	Unknown	Yes	1.9	45
	Bull Meadow Cr.	1,430	Yes	Yes	3.0	71
	Indian Springs Cr.	356	Yes	Yes	0.8	20
	Quilty Cr.	1,089	Unknown	Yes	1.8	44
	Unnamed Tributary 1	773	Unknown	No	1.5	36
	Unnamed Tributary 2	373	Unknown	No	1.0	25
	Unnamed Tributary 3	1,343	Unknown	Yes	2.3	56
	Unnamed Tributary 4	490	Unknown	Yes	1.0	24
	Unnamed Tributary 5	688	Yes	Yes	1.7	41
	Cottonwood Cr.	5,307	Unknown	Yes	2.3	56
	Russell Cr.	560	Unknown	No	0.8	20
North Fork Merced River	North Fork Merced River	79,110	Yes	Yes	74.4	1,784
	Bull Cr.	21,064	Yes	Yes	44.7	1,072
	Deer Lick Cr.	3,981	Unknown	Yes	9.7	233
	Moore Cr.	5,896	Yes	Yes	11.9	286
	Scott Cr.	1,627	Unknown	Yes	1.9	46

The analysis area for the FYLF includes the Tuolumne River watershed from Hetch Hetchy in Yosemite National Park to the backwaters of Lake Don Pedro. For this portion of the Tuolumne River watershed, the analysis area extends upstream each tributary stream to the fire boundary. In many instances, the entire watershed area of the smaller tributaries is within the fire area (e.g., Grapevine, Corral, and Alder Creeks). For other tributary watersheds, the fire only burned a portion of the total watershed area (e.g., Clavey and the Middle, North, and South Forks of the Tuolumne). For the North Fork Merced River (about 100,000 acres), the Rim Fire only affected a small portion of several headwater tributaries to the river. In this instance, the analysis boundary only includes the upper portion of the North Fork Merced watershed, or the 37,000 acres in the 6th level HUC.

Western Pond Turtle

The WPT is a species that requires aquatic and terrestrial habitats to meet its life history needs. Aquatic habitats are needed for breeding, eating, overwintering, regulating body temperature, refuge, and rearing hatchlings. Terrestrial habitats are needed for nesting, aestivation, overwintering, and regulating body temperature. The WPT mates under water and the females excavate a nest adjacent to aquatic habitat. Nests are typically constructed in open areas (little or no canopy cover) with well-drained soil and on gentle slopes with good solar aspect (south to west facing). The nests are typically found within 300 feet of the aquatic feature used by adults, but can be found almost a quarter of a mile away from the water. The eggs hatch in several months, but the hatchling turtles remain in the nest until the following spring or early summer. The hatchlings seek slow, shallow, and warm water where they can forage and grow. Adult and sub-adult turtles can spend much of their year within a small geographic area; however, they sometimes make long overland or upstream-downstream movements (Reese 1996). Like the FYLF, the turtle prefers a variety of microhabitats for regulating body temperature, but basking sites are particularly needed in the early season when air and water temperatures are relatively low. Basking also plays an important role for females in that elevated body temperature contributes to the development of the eggs.

Table 3.03-5 Occupied and suitable habitat for WPT in the Rim Fire area

Watershed (5th level HUC)	Stream	Occupancy	Survey	Suitable (miles)	Upland Habitat Acres (30-meter buffer)
Tuolumne River	Tuolumne River	Yes	Yes	36.5	8,711
	Drew Cr.	Yes	Yes	4.6	1,011
	Grapevine Cr.	Yes	Yes	10.8	2,565
	Jawbone Cr.	Unknown	Yes	14.3	3,411
	Three unnamed ponds	Unknown	No	10 acres	277
Middle Fork Tuolumne River	Middle Fork Tuolumne River	Yes	Yes	25.5	5,365
	Abernathy Meadow	Yes	Yes	7.5	132
	Grandfather Pond	Yes	Yes	0.2 acre	82
	Mud Lake	Yes	Yes	3 acres	115
North Fork Tuolumne River	North Fork Tuolumne River	Yes	Yes	75	16,718
	Basin Cr.	Unknown	Yes	17.8	3,902
	Hunter Cr.	Yes	Yes	21.5	4,912
South Fork Tuolumne River	South Fork Tuolumne River	Yes	Yes	29.4	6,411
Cherry Creek	Cherry Cr.	Unknown	No	17.8	3,737
	Eleanor Cr.	Unknown	No	2.3	599
	Big Kibbie Pond	Yes	Yes	1 acre	98
	Little Kibbie Pond	Yes	Yes	0.5 acre	86
Clavey River	Clavey River	Yes	Yes	29	3,460
	Reed Cr.	Unknown	Yes	4.2	904
North Fork Merced River	North Fork Merced River	Yes	Yes	74.4	16,908
	Bull Cr.	Yes	Yes	44.7	9,879
	Deer Lick Cr.	Unknown	Yes	9.7	2,234
	Moore Cr.	Yes	Yes	11.9	2,767
	Scott Cr.	Unknown	Yes	1.9	453

While water is required for some life history aspects, the WPT can use seasonally wet habitats. During periods when the aquatic feature is dry, turtles can depart the feature for another nearby aquatic habitat or can venture into the terrestrial environment to aestivate. Aestivation is a seasonal reduction in activity and body function similar to hibernation. The turtles will locate a site where they can dig into the leaf duff, preferably with some overhead cover (shade), and wait until the rain replenishes the aquatic habitat. Turtles can also use the terrestrial environment during the winter. The behavior, overwintering, is similar to aestivation because they leave the water (around October), bury themselves into the leaf litter under trees or shrubs, and wait until spring. During this time, they may move about on the landscape or move to water then back to land.

The WPT is found frequently in habitats also occupied by the FYLF because they share many of the same habitat needs. On the Forest, almost all occurrences of turtles in streams are at elevations less than 3,500 feet, but several populations are in ponds at elevations up to 5,400 feet. Table 3.03-5 shows the streams, ponds, and meadow with known WPT populations and lists the primary streams that provide suitable habitat for the turtle.

Hardhead

The hardhead is a large species of minnow that historically occurred in a narrow low-elevation zone, approximately 100 to 1,500 feet in elevation, in the foothills of the Sierra Nevada (Moyle 2002). Moyle (2002) included the hardhead as one component of an assemblage of native warm water species called the pikeminnow-hardhead-sucker assemblage. On the Stanislaus National Forest, California roach (a minnow), riffle sculpin, and rainbow trout could also occur with the hardhead in rivers with unregulated flows (no dams). The species description given in Moyle (2002) is the basis for the species and habitat description that follows.

Hardhead can be found in a variety of flowing water habitats from large intermittent foothill streams to large rivers. Larger individuals are typically associated with deep pools while smaller individuals are associated with shallow waters along the edge of the stream. For most of the year, the fish does not move extensively up- and downstream, opting to remain in a pool or series of pools linked by deep run habitat. Hardhead spawn in the spring (April and May) and may migrate upstream long distances in larger streams, especially those impacted by reservoirs. Like other minnows, hardhead likely spawn in gravel substrates in run habitat or at the tail out of pool habitat. Older fish are omnivorous, feeding on a mix of filamentous algae (where present) and invertebrates (e.g., crayfish, aquatic insects). Smaller fish tend to feed more on aquatic insects or other small invertebrates (e.g., snails). Hardhead appear to prefer warm (greater than 20 degrees Centigrade (68 degrees Fahrenheit)) water, but like to have access to deeper, cool water as water temperatures increase throughout the summer. Alteration of habitat and streamflow by dams and the introduction of predatory fish (mainly bass) have had major impacts on the distribution and abundance of the hardhead.

The status of hardhead in the Tuolumne River is unclear. There are no records of hardhead from above Don Pedro Reservoir, but Moyle (2002) indicates a dramatic population decline following impoundment of the Tuolumne River. This indicates the fish was present in the river previously. However, streamflow is regulated in the Tuolumne all of the way up to O'Shaughnessy Dam, Dion Holm Powerhouse on Cherry Creek, a main tributary to the Tuolumne. Forest Service personnel have conducted snorkel surveys of the lower Clavey River and observed schools of large minnows; but, hardhead are difficult to differentiate from Sacramento pikeminnow when observed from a distance. There is a possibility that hardhead continue to persist in the lower Clavey River, North Fork Tuolumne River, and possibly Cherry Creek upstream of Holm Powerhouse. Fish surveys conducted on the Tuolumne River upstream of Early Intake have not determined the presence of hardhead in that stream reach (personal communication with Mike Horvath, San Francisco Public Utilities Commission (Hetch Hetchy Regional Water System, Natural Resources Division).

Expected Post-Fire Watershed Response

Since the Rim Fire affected a large portion of the Tuolumne River watershed, including many of the smaller watersheds listed above, the previously forested landscape has been altered sufficiently that many of the "normal" watershed processes have been altered, sometimes dramatically. These processes include erosion of soil from hillslopes and stream channels, storage and transport of sediment in stream channels, stream flow, LWD recruitment, and maintenance of cool or cold water temperatures.

Hillslope erosion is a natural process that typically occurs at very low rates (0.1 to 0.5 tons per acre (USDA 2013)) in forested conditions. This rate can increase tremendously in landscapes affected by wildfire, sometimes greater than four orders of magnitude (10 to greater than 100 tons per acre). Under high soil and vegetation burn severity conditions, very little ground cover is left, soil structure is highly altered, and water repellent (hydrophobic) conditions exist in the upper soil layers. Rainfall on these high severity conditions can detach individual soil particles and the water repellent conditions allow the water to flow across the soil surface rather than soak into the soil. As the water moves across the soil, it can erode the soil surface (as sheet, rill, and gully erosion) and transport the sediment downslope to streams. Factors that contribute to the extent to which the soil erodes include, but are not limited to, soil texture, steepness of hillslope, amount of ground cover, and rainfall intensity.

Given large increases in erosion in the fire area, there will be areas with large volumes of sediment delivered to stream channels. Many of the small streams will be drastically altered by this sediment with the most obvious change being the streambed covered with fine sediment (the stream is "silted in"). Using the recent Bagley Fire on the Shasta-Trinity National Forest as an example, Forest Service employees measured sediment depths in excess of one meter (3.3 feet) in some stream channels (USDA 2013). While this example is a "worst case scenario" (caused by two uncommonly large storm events separated by a short period of time), our observations at one stream in the fire area, Skunk Creek, indicated the sediment was 1-2 inches deep following a below average precipitation year with relatively low intensity precipitation (to date). When large volumes of sediment are delivered to a stream channel, habitat complexity is reduced as pool and run habitats fill in and the stream bottom becomes relatively uniform. In larger streams like the Clavey River, extensive sedimentation could occur, but major reductions in pool volume are not likely because the energy of the streamflow is enough to keep the sediment moving downstream. Post-fire erosion rates can return to pre-fire rates within five to ten years.

With the loss of vegetation and leaf duff layer on the ground, the amount of flow in the streams, both base flow and peak flow, is generally expected to increase. This is because the trees are no longer taking up water through their roots and transpiring that water through their leaves (base flow) and the water repellent layers will cause the water to run off of the soil surface without being absorbed into the leaf duff layer and soil (peak flow). Peak flows can increase many times over in watersheds with extensive high severity burn conditions, especially following periods of high intensity rainfall, or rainfall of long duration and large amounts. As the streamflow begins to peak after a heavy rainfall in a burned watershed, the channel and streambanks are scoured by the water and the banks are eroded away. This is called channel erosion and it can be a significant source of sediment after a fire. With the loss of trees and other vegetation transpiring water, base flows can increase several fold throughout the year. Exaggerated peak flows (compared to pre-fire) should continue for three to five years after the fire, and increased base flows could continue for many decades.

The amount of sediment in the channel that is moved downstream or stored in the channel (and floodplains) depends on several factors, primarily streamflow and the gradient, or steepness, of the stream. In general, the steeper the stream is, the easier it is to transport the fine sediment downstream. Large streamflows have more energy than lesser flows and are capable of moving large quantities of sediment. In the five to ten years after the fire, channel conditions should be close to pre-fire conditions.

LWD recruitment generally increases after a fire because fire-killed trees eventually fall. Some of the trees fall into streams where they can influence stream morphology by catching sediment upstream of the tree and creating pool habitat downstream of the tree. Log jams can effectively trap and store large volumes of sediment for very long periods of time (greater than 50 years). The sediment stored behind the LWD can become important habitat for many aquatic species. The recruitment of LWD in streams is highest in the 10-20 years following a fire.

Water temperatures generally increase in the post-fire environment. This is largely due to the loss of vegetation providing shade to the surface of the water. In heavily forested conditions, very little direct sunlight hits the water and cool or cold water temperatures are maintained. When canopy cover is lost, stream temperatures can increase five degrees Fahrenheit or more for several years following the fire. Obligate riparian vegetation (examples, willow and alders) typically re-grows quickly and provides enough shading to be beneficial for maintaining cool and cold water.

For the FYLF, the impact to aquatic habitat is based on expected post-fire watershed response at various watershed scales. The estimates rely on (1) the extent to which a watershed was affected by fire, (2) the extent of high and moderate severity fire in a watershed, (3) stream gradient, and (4) sediment yield calculations when compared to pre-fire conditions. The Watershed Report (project record) provides a general narrative for how the primary watersheds (5^{th} and 6^{th} level HUC) are expected to respond in the post-fire environment, and those evaluations were used to put the FYLF watersheds into categories of watershed response.

Three general categories were used for these watersheds: low, moderate, and high post-fire response. For the low category, the post-fire watershed responses may not be readily observable at suitable breeding sites. The ability to reproduce is considered to be a key factor in maintaining recruitment as the watersheds recover, because most populations are small and the loss of a recruitment class could have a population-level consequence. In high concern watersheds, major impacts are expected to all habitat types, especially significant reduction of pool and other deep water habitat. Deep water habitats are refuges and critical to overwintering success and escape from perceived predation attempts. In moderate concern habitats, extensive sedimentation of all habitats is expected, but deep water habitats should be maintained by the scouring action of water. Table 3.03-6 lists the watersheds suitable for FYLF and expected level of watershed response.

Table 3.03-6 Watersheds and streams with suitable habitat for FYLF with watershed response

HUC Level and Name	Stream	Watershed Response
5 – Big Creek-Tuolumne River	Big Creek	Low
6 – Grapevine Creek-Tuolumne River	Tuolumne River, Indian	Low
	Grapevine	Moderate
6 – Jawbone Creek-Tuolumne River	Tuolumne River	Low
	Drew	Moderate
	Alder, Corral, Jawbone	High
5 – North Fork Tuolumne River	North Fork Tuolumne River, Basin	Low
	Hunter	Moderate
5 – Clavey River	Clavey River	Low
6 – Lower Clavey River	Clavey River	Low
	Unnamed Tributaries 1-5, Adams Gulch, Bear Springs, Bull Meadow, Indian Springs, Quilty	High
6 – Middle Clavey River	Clavey River, Cottonwood	Low
	Russell	Moderate
6 – Reed Creek	Reed Creek	Low
7 –Lower Reed Creek	Reed Creek	Moderate
5 – Cherry Creek	Cherry	Moderate
6 – Lower Cherry Creek	Granite	High
5 – Eleanor Creek	Eleanor Creek	Moderate
5 – Falls Creek-Tuolumne River	Tuolumne River	Low
5 – Middle Fork Tuolumne River	Middle Fork Tuolumne River	Moderate
5 – South Fork Tuolumne River	South Fork Tuolumne River	Moderate
5 – North Fork Merced River	North Fork Merced, Bull, Deer Lick, Moore Creek, Scott	Low

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

General Effects Common to all Species

Mortality and Injury

The operation of equipment and the falling of trees and removal of trees have the potential to injure or kill aquatic organisms, particularly those occupying upland habitats. While most organisms close to water would be expected to escape into the water, a typical behavioral response by the FYLF and WPT, equipment can run over individuals that fail to flee or are unable to move.

The application of a registered borate compound to freshly cut stumps is proposed under this alternative. The risk assessment prepared for the project indicated only one scenario where a threshold would be exceeded and that was for an accidental spill of 25 pounds of the compound into a small pond (1,000 cubic meters or 324,000 gallons). Under this condition, the concentration of borate compound in the water (1.27 milligrams per liter) would barely exceed the "no observable effects concentration" (or NOEC) threshold for amphibians. A similar threshold has not been calculated for reptiles (like the WPT) and the NOEC for amphibians was applied to the turtle. As the name implies, below this threshold, no observable effects to health or reproduction would occur. If the organism is exposed to the spill scenario, the animal could become sick, immobile, or even die. This type of exposure scenario is unlikely because workers typically carry five or less pounds of the borate compound at a time. However, these species can occupy small pools with less volume than the pond modeled, and individuals could have their health compromised or die. If only one or very few individuals are affected, this to have an effect on the persistence of any of the populations in the project area. This is the extent of discussion of borax application for this analysis.

Physical Disturbance

When equipment is operated or forest workers are close to a stream, they could affect the behavior of aquatic organisms that are in the terrestrial environment. The typical response is for the individual to flee from the disturbance which would typically involve retreating into the water. The individuals typically hide under the streambank, rocks, or logs for up to 30 minutes and then return to the edge of the stream. They seek refuge if disturbed again and typically stay submerged longer or move away from the disturbance. Physical disturbance may interrupt basking, sleeping, or foraging, thereby creating the potential to affect physical well-being. A single instance of disturbance may have negligible or no effect on the physiology of an individual, but repeated disturbance has the potential to affect the physiological fitness of individuals (Rodriguez-Prieto and Fernandez-Juricic 2005).

Modification of Habitat

The primary impact to habitat expected from tree removal and road actions is an increase in sediment delivery caused by equipment operations on fire-affected soils. The operation of rubber-tired skidders, feller-bunchers, and harvesters on fire-impacted soils and in near stream environments can result in ground disturbance and soil compaction. Most of the timber harvest units coincide with areas of moderate and high burn severity, conditions that are more sensitive to disturbance. These areas typically have alterations in soil structure that make them more vulnerable to erosion and lack beneficial ground cover which can reduce erosion rates. Robichaud, et al. (2011) found a significant increase in sediment production originating from the skid trail network in salvage logged units. Increased erosion from the skid trails was attributable to increased compaction from repeated passes by equipment and the lack of ground cover on the trails (Robichaud et al. 2011). In general, the compaction caused by rubber tired skidders is greater than feller-bunchers or forwarders (Robichaud et al. 2011). Further discussion of erosion is in the Watershed and Soils sections of this EIS.

Habitat modifications caused by excess sediment generally include the reduction of deep water habitats (pools and runs), loss of microhabitat complexity, and filling the streambed with fine sediment. Pool and run habitats can be filled by excess sediment, especially in low gradient (less than 2 percent) stream reaches. The energy of water in higher gradient reaches (greater than 5 percent) tends to have enough erosive force to keep pools scoured and deep water maintained, but the overall pool volume may be reduced in low energy sites as sediment accumulates at the edges and tail of the pool. Excess sediment also reduces microhabitat complexity and the spaces between streambed substrates by filling the streambed with finer sized sediments (silts and sands). In lower gradient streams, the overall depth of the stream is typically reduced as the streambed fills with sediment and the water spreads out in a thin layer across this sediment. The loss of the small changes in streambed depth reduce microhabitat elements by eliminating velocity refuges and filling the spaces between larger substrates (gravel, cobble, and boulder) that are used by some species for breeding, foraging, and hiding. The change in streambed also influences the production of aquatic insects that use, including very specialized use, microhabitats in otherwise unimpaired streams. Aquatic insects play key roles in the breakdown of organic matter entering streams, nutrient cycling, and as sources of food for many aquatic and terrestrial species.

The recovery of fire-killed timber near streams would reduce the amount of LWD falling into the stream or onto the floodplain. LWD plays very important roles in the development of habitat complexity and sediment retention in a stream (USDA 1988; Montgomery et al. 1996; May and Gresswell 2003). Salvage logging tends to remove the largest trees because they have higher value, but the large pieces tend to decay slower and be retained longer. It may take several centuries (greater than 300 years) for some portions of the forest to regrow large trees.

California Red-legged Frog

Effects to Individuals

Because the CRLF has not been detected in the project vicinity since 1927, has not been detected on the Forest since 1967, and is considered extirpated from the Tuolumne River watershed by the Fish and Wildlife Service (USFWS 2002) the risk of injury, mortality, or behavioral disturbance to individual CRLF from the actions proposed under Alternative 1 is low. However, since occupancy cannot be absolutely ruled out, possible effects to individuals may occur.

Tree Felling and Removal

Breeding and Non-breeding Aquatic Habitat: The amount of suitable breeding habitat within 1 mile of project activities is very limited (9.47 miles of stream and 8.87 acres of pond habitat). No project activity overlaps with a suitable breeding stream and only one 0.17 acre breeding pond (Homestead Pond) representing only 1.92 percent of the suitable pond breeding habitat available in the project area (Table 3.03-7). Additionally, there are 332.8 miles of non-breeding stream habitat available although only 60.5 miles (18 percent) are perennial or intermittent. Project activities proposed under Alternative 1 overlap with only 2 percent of the available CRLF non-breeding perennial and intermittent streams (Table 3.03-7). Management requirements are proposed that would reduce the risk of harm to individuals: (1) directional felling of trees within RCAs away from stream channels and Special Aquatic Features, (2) excluding ground based mechanical equipment within 15 feet of water bodies, (3) implementing a 30 foot no cut and no equipment buffer around Homestead Pond (breeding), a portion of the Middle Fork Tuolumne River (non-breeding) and the unnamed stream flowing out of Birch Lake (non-breeding), and (4) prohibiting mechanical operations within 1 mile of suitable CRLF breeding habitat during the wet season (when CRLF are most likely to be present in non-breeding habitats). Because CRLF should be found very close (less than 16 feet) from water (Tatarian 2008) the exclusion of ground based mechanical equipment within 15 feet of water bodies would reduce risk to an individual frog.

Despite these management requirements, a frog, if present, could be disturbed by personnel and equipment in the vicinity of the aquatic habitats provoking an individual to avoid the threat and seek cover. A period of time would elapse before that individual would resume pre-disturbance behavior. The frog may spend less time feeding, resting, or breeding, and therefore result in a short term change in their energy budget. If an individual is repeatedly disturbed in an area, they may avoid the area, essentially being temporarily displaced from their habitat. Prolonged changes to an individual's energy budget or displacement from its habitat may impact an individual's fitness (Rodriguez-Prieto and Fernandez-Juricic 2005) or make them more susceptible to predation. However, the period of project related disturbances in any given area is expected to be 1 to 3 days which would not have a long lasting or measurable effect to an individual's fitness or impact the population size or persistence.

Table 3.03-7 CRLF and SNYLF direct and indirect effect indicators for each alternative

Indicator	Alt 1	Alt 2	Alt 3	Alt 4
California red-legged frog				
Miles of stream or acres of pond of occupied breeding habitat	0(0)	0(0)	0(0)	0(0)
Miles or acres of occupied non-breeding aquatic habitat	0(0)	0(0)	0(0)	0(0)
Acres of occupied upland habitat	0(0)	0(0)	0(0)	0(0)
Miles of breeding stream within units/hazard tree	0(0)	0(0)	0(0)	0(0)
Acres of breeding ponds within units/ hazard tree	0.17(1.92)	0(0)	0.12(1.35)	0.12(1.35)
Number of road treatment intersections with breeding stream in analysis area	0	0	0	0
Miles of perennial and intermittent non-breeding aquatic habitat within units/hazard tree				
Perennial, Intermittent, and Ephemeral	33.33(10.01)	0(0)	29.52(8.87)	29.52(8.87)
Perennial and Intermittent	6.65(2.00)	0(0)	5.80(1.71)	5.80(1.71)
Number of perennial and intermittent non-breeding stream intersections with road treatments in analysis area	4	0	17	17
Acres of upland habitat within units/hazard tree treatments	2,680(12.41)	0.0(0)	2,467(11.43)	2,467(11.43)
Miles of road treatment within upland habitat buffer	9.11	0.0(0)	46.63	46.63
Maintenance	0.0	0.0(0)	36.75	36.75
Reconstruction	8.16	0.0(0)	8.30	8.30
Temporary	0.95	0.0(0)	1.59	1.59
Sierra Nevada yellow-legged frog				
Miles of stream or acres of pond of occupied breeding/non-breeding aquatic habitat in analysis or project area	0(0)	0(0)	0(0)	0(0)
Miles of breeding /non-breeding stream within units/hazard tree	6.25(8.63)	0(0)	6.13(8.47)	5.38(7.43)
Acres of breeding/non-breeding pond within units/hazard tree	1.28(4.93)	0(0)	0(0)	0.74(2.90)
Number of breeding and non-breeding stream intersections with road treatments in analysis area	5	0	9	9
Acre of upland habitat within units/hazard tree treatments	248.91(11.50)	0(0)	246.18(11.42)	163.73(7.60)
Miles of road treatment within upland habitat buffer	1.21	0.0(0)	1.69	1.69
Maintenance	0.0	0.0(0)	0.38	0.53
Reconstruction	1.21	0.0(0)	1.31	1.16

Percent values are included in parenthesis and represent the percent of the total in the Rim Fire perimeter.

Upland Habitat: Although there may be a slightly more elevated risk of injury, mortality, or behavioral disturbance for individuals while in the upland habitat the risk is still considered to be low. Table 3.03-7 shows project activities are proposed to occur on only 12.41 percent of the total upland habitat under Alternative 1. The greatest amount of project activities will occur in the upland habitat associated with Birch and Mud Lakes, where 28 percent of the available upland overlaps with project activities proposed in Alternative1 as stated in Table 3.03-18. Because CRLF have a close affinity to water during the summer months (dry season) they are unlikely to be found in the upland habitat during this time. They are more likely to be found in, and make movements to and from, upland habitats from the first fall rain through April (Bulger et al. 2003; Fellers and Kleeman 2007; Tatarian 2008). Because the majority of project activities will occur during the dry season and a limited operating period restricting mechanical operations within the upland habitat would be applied during the wet season, the risk of injury, mortality, or behavioral disturbance to CRLF in these habitats is negligible.

Burn Piles

Individuals that may have taken refuge in burn piles could be killed, injured, or disturbed if they are still present when piles are ignited. Management requirements would reduce the risk to individual CRLF by not permitting piles within the zone of most expected movements (i.e., a minimum of 50 feet from perennial and intermittent streams and SAF and a minimum of 100 feet from CRLF breeding and perennial and intermittent non-breeding aquatic habitats). Tartarian (2008) found that longer duration upland habitat use by CRLF occurred in close proximity (less than 80 feet) to streams. Requiring ignition of burn piles on only one side would further reduce the risk to individuals by giving them a way to exit the pile.

Road Treatments

Because the roads and their treatments are included in the existing road prism, an increased risk of injury, mortality, or behavioral disturbance to the CRLF is not expected to be greater than those occurring under normal uses and operations of these routes.

Water Drafting

The required use of drafting boxes with low entry velocity pumps would greatly reduce the risk of injuring or killing individual CRLF.

Effects to Habitats

Increases in Sediment

Increases in sediment to an aquatic system could increase turbidity, reduce pool volume, fill interstitial spaces in substrates that can be used as refuge, and impact egg deposition sites making egg masses more susceptible to being washed downstream. Very large amounts of sediment could decrease the volume of preferred pool habitats which could reduce the habitat's suitability by increasing the potential for drying out during late summer. For these reasons, the CRLF breeding and non-breeding aquatic habitats may experience a reduction in both habitat quality and quantity if the habitats experience an increase in sediment and subsequently adversely affect their ability to complete their life cycle. As stated in the Rim Watershed Report, increases in post-fire sediment production are so elevated that identifying any additional effects of salvage logging on sedimentation is minimal.

Tractor skidding and road treatments have the greatest potential to result in sediment generating ground disturbance during logging operations. The combination of exclusion zones and the retention or augmentation of ground cover is intended to leave an adequate buffer for assimilating most sediment that may come from soil disturbance caused by log retrieval. In addition, BMPs and management requirements have been demonstrated to be effective at preventing sediment from reaching streams during timber harvest of live trees (USDA 2007; USDA 2008a; USDA 2009; USDA 2010). In the context of existing CRLF aquatic habitat conditions, sediment related effects of the project are expected to range in magnitude and be of a quantity that will not be meaningfully compared to the sediments generated by the effects of the Rim Fire (Table 3.03-3 and Table 3.03-19).

Increased sedimentation from road maintenance activities is expected to be negligible. Over a longer time period (5-10 years) these road treatments would likely reduce sedimentation by shortening hydrologically connected segments, reducing the risk of culvert failure, and increasing surface infiltration and surface cover.

Breeding and Non-breeding Aquatic Habitat: Sediment levels are expected to increase post-fire regardless of the implementation of any proposed actions (Table 3.03-3 and Table 3.03-19). Post-implementation levels within suitable breeding habitats are predicted to result in a reduction, no measurable change, or a further increase in sediment depths as compared to post-fire (existing condition) values (Table 3.03-3 and Table 3.03-19). The maximum predicted change when compared to post-fire values is an increase of 0.15 inch (Table 3.03-19) which will not change the habitat suitability any more than the sediment generated by the Rim Fire.

High quality CRLF non-breeding aquatic habitat includes areas that are moist year round and offer dense vegetation or other protection from predators. In moderate to high burn severity areas, the non-breeding habitat suitability is generally low in quantity and quality, due to limited intermittent and perennial water and a lack of riparian cover to prevent predation. An increase in sediment depth may cause a further reduction in habitat suitability, but it would be expected to be minor and localized.

Large Woody Debris

In aquatic habitats downed logs can provide important habitat for aquatic organisms and can be an important component of overall stream morphology and functioning (Bisson et al. 1987; Sedell et al. 1988) and may affect sediment distribution, pool formation, and the biological community composition. Of the roughly 250,000 acres burned during the Rim Fire, post-fire salvage logging is proposed to occur on less than 28,500 acres (11.4 percent of the landscape). The management requirements proposed as part of Alternative 1 would ensure adequate cover and future LWD recruitment to both aquatic and upland habitats within salvage units. Furthermore, in most streams, localized deficiencies of LWD in harvest units should be balanced by upstream unharvested burned areas where woody debris recruitment is expected to increase significantly as fire killed trees fall into the channel.

Breeding and Non-breeding Aquatic Habitat: No salvage, hazard tree abatement or road treatments are proposed within or adjacent to suitable breeding habitat and no losses of LWD are expected.

Table 3.03-7 shows the extent to which CRLF non-breeding aquatic habitat overlaps proposed project activities (2 percent).Any reductions in woody debris recruitment would be highly localized and would not have a measurable impact on habitat suitability.

Upland Habitat: Ground disturbing activities in the upland habitat may affect burrows or other structures commonly used by amphibians for cover such as down trees (Ford et al. 2013). The riparian exclusion zones may help mitigate these risks.

Downed logs can be a preferred suitable refuge for CRLF (Tatarian 2008) and removal of trees that would have eventually fallen to the ground will result in a lesser quantity of downed logs than if no action were taken. Implementation of management requirements, abundant downed wood outside of units and future recruitment from low to moderate burn severity areas ensures future LWD across the landscape.

Sierra Nevada Yellow-legged Frog

Effects to Individuals

Despite extensive surveys of water bodies and suitable habitats no SNYLF have been found within the Rim Fire perimeter making the risk of injury, mortality, or behavioral disturbance to individual SNYLF from the proposed actions low. Because occupancy cannot be absolutely ruled out, possible effects to individuals are considered.

Tree Felling and Removal

Breeding and Non-breeding Aquatic Habitat: Proposed activities overlap only 6.25 miles of stream and 1.28 acres of pond habitat (Table 3.03-7). This equals 8.63 percent and 4.93 percent of the total available habitat in the project area. The potential risk is greatest at Little Kibbie and Big Kibbie Ponds, Bear Creek, Niagara Creek, Richards Creek, and White Fir Creek where greater than 50 percent of each of habitat overlap with project activities (Table 3.03-18). SNYLF are highly aquatic and rarely found greater than 4 feet from water when available. The project management requirements should ensure the injury, mortality, or behavioral disturbance risk to individual SNYLF is low. Furthermore, surveys at Looney Creek, the only potentially suitable habitat in the analysis area not surveyed, would be completed before project implementation and an 82-foot no-cut buffer would be applied if SNYLF were detected at any site. Despite the high overlap in a few sites, the risk of injury or mortality to individuals while in breeding or non-breeding aquatic habitat is low.

Despite the proposed management requirements, a frog, if present, could be disturbed by personnel or equipment in the vicinity of the aquatic habitats. Similar to the reasons described for the CRLF; however, no measurable effect to individual SNYLF would occur.

Upland Habitat: Although a slightly more elevated risk of injury, mortality, or behavioral disturbance for individual SNYLF exists in the upland habitat, the risk is still considered to be low. Project activities would occur on 11.55 percent of the total upland habitat (Table 3.03-7). However, overland movements are rare. While SNYLF are rarely found greater than 4 feet from water, they will disperse between sites if located within close proximity to one another (generally less than 984 feet). Thus, SNYLF are most likely to be found in the upland habitat between Little Kibbie and Big Kibbie Ponds as they are only 410 feet from one another (all other habitats are greater than 3,280 feet apart). If dispersal were to occur between the two ponds during project implementation, individual SNYLF could be injured, killed, or disturbed. The management requirement prohibiting operations within 300 feet of Little Kibbie Pond between March 1 and June 1 is designed to mitigate this risk.

Burn Piles

SNYLF hiding in burn piles could be killed, injured, or disturbed if they are present when piles are ignited. Requiring burn piles to be located a minimum of 50 feet from perennial and intermittent streams and other SAF would successfully mitigate this risk.

Road Treatments

Road reconstruction treatments (1.21 miles) are proposed in Alternative 1 within the SNYLF upland habitat buffers (i.e., 82 feet from stream banks and 984 feet from ponds). Because these roads already exist and are utilized, it is unlikely activities would create a greater risk to individual SNYLF than those already occurring under normal uses and maintenance of these routes.

Water Drafting

Same as CRLF.

Effects to Habitats

SNYLF habitats have a higher risk of being directly impacted by project activities than CRLF because of the greater overlap with both suitable breeding and non-breeding aquatic and upland habitats (Table 3.03-7 and Table 3.03-18). The following management requirements would successfully mitigate the potential for project activities to directly impact SNLYF habitats: (1) directional felling of trees within RCAs away from stream channels and other SAFs, (2) excluding ground based mechanical equipment within 15 feet of water bodies, (3) prohibiting skidding within 50 feet of perennial and intermittent aquatic features, (4) increasing the ground based mechanical exclusion zone to 100 feet along portions of Bear Creek and Jawbone Creek that burned at high severity with slopes between 25 and 35 percent and lengths greater than 100 feet, and (5) the mechanical exclusion zone around Little Kibbie Pond described previously. A larger portion of the breeding and non-breeding habitats would be impacted by the proposed actions as compared to those of the CRLF, making them more susceptible to increases in sediment loads in aquatic habitats and potentially habitat degrading reductions in LWD.

Increases in Sediment

Breeding and Non-breeding Aquatic Habitat: As discussed for CRLF habitats, sediment levels in SNYLF aquatic habitats are expected to increase post-fire regardless of the implementation of

Alternative 1. Sediment generated by the implementation of Alternative 1 would neither benefit or further degrade SNYLF aquatic habitat suitability because post-fire increases in sediment depth are anticipated to be high (Table 3.03-3 and Table 3.03-19) and the differences in the estimated sediment depths calculated for the implementation of Alternative 1 would vary marginally from post-fire estimates (Table 3.03-19),.

Large Woody Debris

Breeding and Non-breeding Aquatic Habitat: The importance of LWD to SNYLF is not well documented, but woody debris may provide cover from predators (Federal Register 2013a) and may promote formation of pools suitable for breeding. The proportion of stream and ponds with suitable breeding and non-breeding aquatic habitat within proposed treatment units is only 8.63 percent of the stream lengths and 4.93 percent of the pond area compared to the total amount available in the project area. A reduction in LWD recruitment would be limited to those areas in which project activities occur. As discussed in the CRLF LWD section (including the listed project management requirements), localized reductions of LWD would not alter recruitment to the degree where habitat suitability of SNYLF breeding and non-breeding aquatic habitats would be degraded.

Upland Habitat: Habitat criteria for SNYLF described by the USFWS (Federal Register 2013b) state that the canopy overstory within the upland should be sufficiently thin and not generally exceeding 85 percent to allow sunlight to reach the aquatic habitat and provide basking areas. In some areas the fire reduced canopy cover and provided this localized beneficial effect for the SNYLF. However, a reduction in canopy cover and LWD could lead to increased air and soil temperatures and hence a less suitable habitat because amphibians require cool, moist and stable microclimates to maintain their respiratory physiology. Furthermore, if SNYLF utilized down woody debris for refuge and moisture, a reduction of LWD could make SNYLF more susceptible to predation and desiccation. The potential for a reduction in LWD diminishing SNYLF upland habitat suitability is expected to be minor and not detrimentally affect their overall survivorship.

Foothill Yellow-legged Frog

Salvage and Roadside Hazard Tree Removal

There is no potential for direct effects to the FYLF in the following occupied locations: Basin, Drew, Grapevine, and Hunter Creeks, and North Fork Tuolumne and main Tuolumne Rivers. Proposed activity location relative to the potential habitat in the creek channel and Table 3.03-8 show no project related activity (hazard tree removal, salvage, or road treatments) is in close proximity to any of these six streams occupied by the frog. There is no potential for direct effect at the following streams providing suitable habitat for the FYLF: Adams, Alder, Bear Springs, Quilty and Russell Creeks, and Unnamed Clavey Tributary 2. No project activities would occur in close proximity to the streams which negates the potential for direct effect.

Based on the limited amount of habitat affected by project activities, there is a very low risk of direct effect to occupied sites because there is very little project activity within the 30-meter buffers (Table 3.03-8). These occupied sites include Bull, Bull Meadow, Drew, Grapevine, and Moore Creeks, and the Clavey and North Fork Merced Rivers. The hazard tree areas and roads are at the upper headwaters of Bull, Drew, Grapevine, and Moore Creeks and the North Fork Merced River. Even though these streams were buffered as suitable habitat, there is a negligible chance of occupancy. Within Bull Meadow Creek watershed, salvage unit L206, a plantation from the 1987 fire, is a proposed deer forage unit. A review of the post-fire aerial imagery indicates low mortality of trees along the stream. A road on the east side of the stream would have hazard trees removed, but imagery indicates limited mortality between the stream and road. Only roadside hazard tree removal would occur along 1N01 at the bridge crossing of the Clavey River. This is outside of the merchantable conifer elevation and the hazard trees are likely to be oaks. If the oaks are cut down the steep bank, there is a very low chance that they could fall to the river over 100 feet away and directly affect an individual frog. Furthermore, this is considered to be an unlikely occurrence as the fallers would likely leave the tree close to the road for firewood. The river is far below the road and there is a negligible chance for physical disturbance unless the tree falls down to the river.

Table 3.03-8 Watershed area, buffers and road treatments in FYLF suitable habitat in Alternative 1

Watershed (5th level HUC)	Stream	Percent FYLF Watershed Treated	FYLF Buffer Affected (acres)			Road Treatments (miles)			
			Hazard Tree	Salvage	Percent of total	Reconstruct	Maintain	New	Temp
Tuolumne River	Tuolumne River								
	Alder Cr.	10	5	0	4	0.8	2.5	0	0
	Corral Cr.	58	2	81	35	14.8	5	0.5	0
	Drew Cr.	12	12	0.4	11	0.5	4.5	0.1	1.1
	Grapevine Cr.	18	29	0	11	0.7	17.4	0	0
	Indian Cr.	2	1	0	less than 1	0	2.2	0	0
	Jawbone Cr.	25	5	46	14	18.5	8.8	0.2	3.4
Middle Fork Tuolumne River	Middle Fork Tuolumne River	17	22	255	46	58.3	12.5	0	5.3
North Fork Tuolumne River	North Fork Tuolumne River	2	0	0	0	0.4	22.7	0	0
	Basin Cr.	1	0	0	0	0.4	2.1	0	0
	Hunter Cr.	9	0	0	0	0	19.9	0	0
South Fork Tuolumne River	South Fork Tuolumne River	38	30	140	24	76.6	26.8	1.6	2.7
Cherry Creek	Cherry Cr.	11	8	67	18	34.6	9.9	0	1.0
	Eleanor Cr.	1	0	12	22	2.5	0	0	0
	Granite Cr.	27	2	50	36	12.4	1.1	0	0.1
Clavey River	Clavey River								
	Reed Cr.	20	1	49	49	25.4	17.8	0.2	2.2
	Adams Gulch	18	0	0	0	1.6	1.4	0	0
	Bear Springs Cr.	18	9	0.1	20	10	0.7	0	0
	Bull Meadow Cr.	36	5	1	8	3.9	0.7	0	0.8
	Indian Springs Cr.	19	3	2	25	1.4	0.1	0	0
	Quilty Cr.	5	0	0	0	0.1	1.1	0	0
	Unnamed Trib 1	16	3	0	8	0	2.9	0	0
	Unnamed Trib 2	24	0	0	0	0	2.5	0	0
	Unnamed Trib 3	69	0	26	46	11	0	0	0
	Unnamed Trib 4	43	3	0	13	2	1.7	0	0
	Unnamed Trib 5	43	7	8	37	2.2	2.7	0	0
	Cottonwood Cr.	31	0	3	5	21.4	7.2	0	0
	Russell Cr.	30	0	0	0	2.2	1	0	0
North Fork Merced River	North Fork Merced River	2	22	18	less than 0.1	11.6	11.8	0	0.3
	Bull Cr.	2	5	0	less than 0.1	0.5	5.5	0	0
	Deer Lick Cr.	8	4	13	7	3.4	2.3	0	0.2
	Moore Cr.	4	5	5	3	1.6	4.1	0	1
	Scott Cr.	22	2	0	8	3.6	3.4	0	0

Direct effects would be a low risk at the following streams (occupancy unknown) because of the limited amount of activity within the buffer as shown in Table 3.03-8 or the hazard tree and salvage actions would occur along stream segments with very low habitat suitability. These streams include Cottonwood, Deer Lick, Eleanor, and Indian Creeks, and Clavey River Tributaries 1, 4, and 5. At Deer Lick Creek and Clavey River Tributaries 1 and 5, the roadside hazard tree and salvage units are at the upper headwaters of the streams and habitat suitability is very low if at all suitable. For Clavey River Tributary 4 and Indian Creek, aerial imagery shows very little mortality to conifers at the road crossing. Independently, the very low suitability habitat and low number of dead trees make the risk of a direct effect occurring very low.

A moderate risk could occur to individuals at the following locations: Cherry and Indian Springs Creeks. Table 3.03-8 shows 75 acres of salvage actions in the Cherry Creek watershed, but 52 acres alone are in Granite Creek which is discussed immediately below. The 23 acres of buffer treated is at the upper elevation limit established for the frog; therefore, the potential for occupancy is very low, especially in a relatively large stream like Cherry Creek. The level of activity in the buffer does pose a risk for injury, disturbance or mortality in these helicopter salvage units (O3, O6, O7 and P201), but the risk may be slightly lower because ground-based equipment would not operate in the units. Within Indian Springs watershed, a salvage unit runs along the north side of the creek at a distance of 1,200 feet. This site has known occupancy by FYLF and low numbers of frogs disperse from the Clavey River breeding sites to this stream. Direct effects to individuals are plausible at Indian Springs. A management requirement mitigates some of the direct effects (injury and mortality) by having timber directionally felled away from the stream. Physical disturbance is probably the most likely effect to individuals and the disturbance could last up to three weeks at the 11-acre unit. Due to the almost complete tree mortality in this unit, it is likely that there would be only one salvage entry.

A high risk of direct effect to individual FYLF could occur for the following streams: Corral, Granite, Jawbone, Reed, Middle and South Fork Tuolumne Rivers. The level of risk is simply associated with the amount of activity within FYLF buffers (Table 3.03-8). Due to the high levels of activity close to streams, the risk of injury, mortality, and physical disturbance would increase. Although there is a management requirement to directionally fall trees away from the stream to limit injury/mortality, a considerable amount of machinery would operate in close proximity to the streams. The occupancy status of these six streams is unknown, but occupancy is assumed to occur in order to allow for disclosure of impact. If individuals are killed, a minor impact to population status could occur because all populations are assumed to be small. The number of reproducing individuals could be decreased for up to two years at the localized breeding site scale. The elevated risk of individual mortality would not be likely to result in a localized extinction of a population or subpopulation. The likely outcome of this extensive operation close to streams is increased physical disturbance associated with equipment and forest workers in close proximity to the streams. As with Indian Springs, the disturbance could last up to four weeks (likely 2 to 3). Repeated disturbance could affect basking or foraging and/or increased stress, with a low to moderate risk of temporarily reducing physiological fitness (body condition).

The primary anticipated indirect effect is the increase of sediment delivery to the streams following roadside hazard abatement and salvage logging. Of the two activities, salvaging is assumed to have the greater potential effect because it would generate a larger skid trail network than the area immediately within the 200-foot hazard tree buffer along roads. Skid trails tend to yield greater quantities of sediment than undisturbed areas and yield increased sediment for a longer period of time (Robichaud et al. 2011). The longer duration of erosion from skid trails is due to the machinery created disturbance negatively affecting the recovery of ground cover, especially vegetation, on the trails (Robichaud et al. 2011).

The extent of salvaging in a watershed was the basis for estimating the potential for increased sediment and is represented as proportion of watershed area treated in Table 3.03-8. Additional consideration was given to the amount of buffer treated. The closer the activity is to a stream, the shorter the distance for runoff to travel, and the greater the likelihood that sediment is delivered to the stream. The logging system proposed (tractor, skyline, helicopter) in an affected watershed was also considered because helicopter logging results in much less ground disturbance than ground-based logging. The lower levels of ground disturbance translate into lower erosion rates and less sediment routed to streams. A longer discussion of anticipated erosion effects from salvage logging is provided in the Soils and Watershed Chapters. The risk categories follow those used for direct effects and are low, moderate, and high. It should be noted that erosion and sediment modeling was completed for post-fire and post-project implementation for each alternative and this modeling showed very little difference in erosion rates or sediment yield. The modeling indicated broad scale decreases in erosion rates that were attributable to increased ground cover from salvage logging in high soil burn severity units (non-merchantable material is left behind).

For streams in the low category (less than 15 percent of watershed area affected), there would be negligible to very minor increases in fine sediments. These fine sediments would mainly affect slow water habitats found in low gradient reaches (less than 2 percent), along the margins of the stream, and in pools. In these watersheds, it may not be possible to differentiate between post-fire erosion and treatment related sediment. This type of habitat impact would not affect habitat suitability for any life stage or the ability of a FYLF population to persist. Streams in the low category include Alder, Basin, Cherry, Deer Lick, Eleanor, Hunter, Indian, Moore, and Quilty Creeks and the Clavey, Tuolumne, and North Fork Merced Rivers.

In the moderate category (15-25 percent of watershed area affected), there would be minor increases in sediment from treated areas. For some reaches in the affected watersheds, it would be possible to differentiate the project related sediment from the post-fire erosion and the spatial extent of the effect on habitat would be localized (up to several hundred square feet below the deposition point). At the smaller reach scale (small streams within a watershed), there could be moderate levels of sediment affecting pool volume or reducing other deeper water habitats (less than 50 percent reduction in volume), but adequate depth should be maintained for individuals needing refuge habitat. Breeding habitat in larger streams could have detectable increases in sediment, but there should be limited impairment of the capability of the habitat to allow for eggmass to tadpole to metamorphosis development. The primary observable change in habitat at breeding sites would be a reduction in the spaces between larger stream substrates which would reduce the abundance and availability of escape habitat. Also, the increase in fine sediments could partially cover large substrates (large gravel to cobble sized) and limit the amount of foraging habitat on the substrates (tadpoles scrape or suck algae from the surface of rocks). There would be a discountable to minor effect on adult and sub-adult habitat in general aquatic habitat because the small amounts of sediment would not substantially reduce habitat suitability. Adult and sub-adults would still have ample deep water habitat to escape a perceived predation attempt. Streams in the moderate category include Adams, Bear Springs, Clavey River Tributaries 1 and 2, Drew, Grapevine, Indian Springs, and Scott Creek, and the Middle and North Fork Tuolumne Rivers.

For the remaining streams (Bull Meadow, Clavey River Tributaries 3-5, Corral, Cottonwood, Granite, Jawbone, Reed, and Russell Creeks and the South Fork Tuolumne River) there would generally be minor sedimentation at the stream scale and moderate sedimentation of localized habitats. Moderate impact at the local scale would mean a less than 30 percent reduction in volume of deep water habitats, widespread streambed sedimentation (less than 1 inch deep), and temporary reduction of shallow water habitats. Small, low gradient streams would see the greatest level of impact, while higher gradient sections of larger streams would effectively transport this sediment. The effective transport of sediment from some stream reaches would insure the availability of patches of high suitability habitat.

For the moderate and high watershed response categories, the duration of increased project-related sediment would be one to two years, and it may be difficult to differentiate between the post-fire erosion and the treatment related sediment at a watershed scale in the second year. Any repeated entries to remove additional dead material would not be expected to generate detectable sediment because there would be a limited skid trail network and few equipment passes on the skid trails limiting the extent of compaction.

Road Treatments

The proposed action would include several types of road management activities including maintenance and reconstruction. All action alternatives would propose the construction of new and temporary roads to access salvage units. These actions and activities are further detailed in the Transportation Chapter of this document.

Table 3.03-8 shows the types and mileage of road system related actions proposed under this alternative. Several factors determine the extent to which the road actions could affect aquatic habitats, including, but not limited to, the degree of connectivity to a stream or drainage network, approach angle of the road near the stream, spacing of water diversion structures, level of outsloping of the road surface, erodibility of the road surface (soil type), and road surface type. Given the short timeframe allowed for the preparation of this document, extensive field review of the road-stream connectivity was not possible. As such, this analysis lacks site-specificity and instead relies on a generalized approach using the (1) amount of activity in close proximity to streams and (2) total number of miles of road treated in each watershed. A miles per acre calculation was considered for analysis, but this type of simple averaging was not considered to be an accurate indicator of potential effect because road density (and thus, treatment intensity) varied considerably in any given watershed. The FYLF buffer (30 meters) was used as an indicator of road activity close to streams which includes the road surface area most likely to deliver sediment directly to a stream. The exceptions to this rule were the new and temporary road construction actions.

Road maintenance and reconstruction are similar treatments, but reconstruction typically includes a major reworking of the road surface and can include actions outside of the existing road prism. Both activities include the reworking of the road surface, typically with a road grader or other machine with a blade. This action loosens the compaction of the road surface and makes more fine sediment available to erosion via dust and rain runoff (Coe 2006, Stafford 2011). Stafford (2011) indicated a fairly high rate of connectivity between roads and the stream network; 11-30 percent of roads were connected hydrologically to a stream. Reconstruction and maintenance actions are primarily intended to facilitate vehicle use, but limiting hydrologic connectivity to streams is another important aspect of these treatments. Outsloping roads and installing effective water diversion structures can have long term benefits to aquatic systems by reducing the amount of sediment delivered from the road. So, there is a tradeoff for streams with road treatments with increased sediment delivery in the short term (1-2 years) and decreased delivery in the long term (greater than 2 years). Since the road treatments would occur prior to or during salvage operations in a unit, the sediment from the roads would be expected to combine with sediment generated from salvaging for up to two years.

Relatively little to no road-related sediment would be expected in the following FYLF watersheds: Adams, Alder, Basin, Bull, Clavey Tributaries 1, 2, and 4, Deer Lick, Eleanor, Indian, Indian Springs, Moore, Quilty, Russell, and Scott Creeks, and the North Fork Merced and Tuolumne Rivers. Sediment from maintenance and reconstruction should have no detectable effect on any habitat required by the FYLF. Minor amounts of road treatment related sediment would be expected in Bear Springs, Bull Meadow, Clavey Tributary 3, Cottonwood, Granite, Grapevine, Hunter, and Jawbone Creeks. Effects would be primarily localized and noticeable downstream of road crossings, and, depending on stream size and gradient at the crossing, could affect and area of less than 10 square feet to 100 square feet. In the remaining streams (Cherry, Clavey Tributary 5, Drew, and Reed Creeks and Middle and South Fork Tuolumne Rivers), there would be more areas with localized effects, especially in smaller tributaries. In all the rivers (Clavey, Tuolumne, Middle, North and South Fork Tuolumne Rivers, and Cherry Creek), sediment from the roads may not be detectable after the first year following road improvement and is unlikely to impair any biological function at these large watershed scales.

Corral Creek and the South Fork Tuolumne River have the most new road construction. The segment of new road in the Corral Creek watershed would cross the creek in the uppermost portion of the watershed and would require the installation of a culvert. Sediment would be anticipated from this crossing and persist for two years as the fill compacts and vegetation grows on the bare ground. Also, excavating the channel to place the culvert would generate sediment. The sediment from the fill and channel disturbance would be detectable for about 100 feet downstream. This section of stream does not provide suitable habitat for the FYLF, and the overall gradient of the channel indicates a high potential for this sediment to be transported out of the system within two or three years. The new road construction in the South Fork watershed would occur in upper watershed of Rush Creek. The road does not appear to cross any perennial or intermittent streams and could have very limited impact on Rush Creek. Because this stream is above the elevation range of the species on the Stanislaus, it is unlikely that habitat for FYLF downstream in the South Fork would have a measurable impact on suitability.

Water Sources and Rock Quarries

Water sources used for the road management activities and logging have management requirements that would result in minimal adverse direct and indirect effects to the FYLF. Rock pits are not located in or in close proximity to FYLF habitat, so no direct or indirect effects to the FYLF are expected to occur.

Fuels Treatments

Fuels treatments are proposed for the roadside and salvage units to reduce fuel loading created by non-merchantable tree material. This post-salvage material would be piled by hand or machine (bulldozer or grapple). Hand piling does not create any ground disturbance and erosion would not be expected in areas treated in this manner. Dozer piling has the potential for the greatest amount of ground disturbance and erosion. Since the extent of this activity would only occur in the salvage and hazard tree units, the categories of watershed concern relate directly to erosion related to dozer piling. Erosion from the machine treated units would be detectable primarily in the moderate and high response watersheds, with slight impairment of FYLF habitat in the moderate response watersheds and minor, localized impairment of habitat in the high response watersheds.

The proposed treatments (salvage, roadside hazard, road improvement and construction) would have little impact on stream shading or the recovery of obligate riparian vegetation. The trees that would be removed are dead and no longer provide much shade to the stream surface. The actions to remove the dead trees would have little or no reduction in shading. The relative importance of shading to the frog is largely unknown, but as discussed earlier, a mix of shaded conditions is likely optimal for thermoregulation. The recovery of obligate woody riparian vegetation is unlikely to be significantly hindered by salvage and hazard tree removal because equipment would not be operating within the typically narrow riparian zone. The resprouting riparian vegetation may be damaged by falling trees, but further resprouting would limit the duration of this impact to less than a year.

The removal of dead trees in riparian areas has the potential to reduce the availability of LWD that falls into the stream or riparian area. While the importance of LWD to FYLF is unstudied, the general role and function of LWD in creating habitat complexity in a stream may be important to the frog. Therefore, this habitat element could be affected (reduced) by logging. There are requirements for recruiting the largest trees in salvage units that would potentially mitigate the overall reduction in recruitment. However, this is considered to be a minimal amount of retention (5 trees per acre) and there would be a very long term (greater than 150 years and up to 300 years for very large trees) reduction in LWD recruitment rate in streamside salvage units.

Western pond turtle

The risk of detrimental direct effects to the WPT is higher than for the FYLF because the turtle uses the uplands more extensively during different times of the year. As discussed earlier, the WPT can use upland habitats up to 400 meters away from an aquatic habitat and can occur in upland habitats for overwintering, nesting, and aestivation. In general, turtles remain close to water from early spring through early fall, but in habitats with seasonal water, they can move into upland habitat when the seasonal feature is dry. Table 3.03-9 provides a description of the amount of area treated by hazard tree and salvage logging activities for this alternative.

Table 3.03-9 WPT buffer affected in salvage and roadside hazard tree units in Alternative 1

Watershed (5th level HUC)	Stream	WPT Buffer (percent total buffer treated)	
		Salvage Units	Hazard Tree Units
Tuolumne River	Drew Cr.	30 (3%)	89 (9%)
	Jawbone Cr.	701 (22%)	102 (3%)
	Homestead Pond	18 (20%)	0 (0%)
	Three unnamed ponds	27 (10%)	4 (1%)
Middle Fork Tuolumne River	Middle Fork Tuolumne River	2077 (39%)	304 (6%)
	Abernathy Meadow	66 (50%)	6 (5%)
	Grandfather Pond	11 (13%)	2 2%)
	Mud Lake	21 (18%)	0 (0%)
North Fork Tuolumne River	North Fork Tuolumne River	0 (0%)	411 (2%)
	Basin Cr.	0 (0%)	0 (0%)
	Hunter Cr.	0 (0%)	407 (2%)
South Fork Tuolumne River	South Fork Tuolumne River	1373 (21%)	534 (8%)
Cherry Creek	Cherry Cr.	424 (11%)	61 (2%)
	Eleanor Cr.	97 (16%)	0.1 (less than 1%)
	Big Kibbie Pond	86 (88%)	0 (0%)
	Little Kibbie Pond	54 (60%)	2 (2%)
Clavey River	Reed Cr.	443 (49%)	11 (1%)
	Cottonwood Cr.	29 (5%)	24 (5%)
North Fork Merced River	North Fork Merced River	176 (1%)	491 (3%)
	Bull Cr.	35 (less than 1%)	106 (1%)
	Deer Lick Cr.	42 (2%)	109 (5%)
	Moore Cr.	56 (2%)	60 (2%)

Salvage and Roadside Hazard Tree Removal

There is very low to no risk of direct effect to turtles in the following locations: Basin, Bull, Deer Lick, Hunter, Moore Creeks and the North Fork Merced and Tuolumne Rivers. In these watersheds, salvage and hazard tree treatment areas are located on headwater reaches where habitat suitability is very low or unsuitable. The WPT needs fairly big pools which these habitats lack.

There is a low risk of adverse direct effect to turtles in the following locations: Cherry, Cottonwood, Drew, Eleanor, and Reed Creeks, and the three unnamed ponds at Yosemite Lakes and Grandfather Pond. At Drew Creek, all of the salvage and roadside treatments are in the upper half of the watershed where the stream only has water during the winter months. During the time when salvage activities would occur, this stream is dry and turtles would be expected to occur in the lower section of stream that retains perennial water. Cherry, Cottonwood, Eleanor, and Reed Creeks are at the upper elevation limit of the WPT in streams on the Forest, and potential for occupancy is low. These sites also retain perennial water and turtles would be expected to be streamside when salvage activities would occur. A review of the aerial imagery for Homestead Pond indicates a limited amount of dead timber to the north, west, and south of the pond and a limited amount of equipment operation would likely occur in these areas (greater than 70 percent of available habitat). There is a higher level of activity to the east of the pond, but the estimated volume of timber is relatively low (less than 15,000 board feet) which suggests a fairly low level of logging activity. The most likely type of direct effect to WPT in these watersheds when water is present would be physical disturbance and the duration would be relatively short (less than 4 weeks) at any given location. This limited amount of disturbance would not have an appreciable effect on physical well-being, and the highly mobile turtle can move up- or downstream to avoid the disturbance.

For WPT habitat in and along Jawbone Creek and the Middle and South Fork Tuolumne Rivers, salvage operations present a moderate risk of direct effect to the WPT, mainly due to the amount of activity that would occur in the 300-meter buffer. At these locations, turtles may overwinter in the upland from October through April, but logging activity would be unlikely at this time of year due to machinery operational constraints associated with soil compaction risk. During June and July, the WPT could use the uplands for nesting, but the availability of nesting habitat is very limited and restricted to relatively open, herbaceous dominated slopes. These open areas lack salvageable trees and the risk of direct effect is self-mitigating. In the Middle and South Fork Tuolumne Rivers, a majority of the salvage activity would occur in headwater tributaries and along low order streams (1st and 2nd order) with heavy pre-fire forest that typically provide low to very low suitable aquatic WPT habitat. The risk is decreased simply based on this low habitat suitability. However, for the mainstems of the rivers, salvage logging would occur close to the channel and the potential for physical disturbance is moderate. This disturbance could last up to four weeks at any given salvage unit, but long-term impacts to physical well-being are not expected. For all four locations, the potential for injury or mortality of individuals is low because of the year-long availability of water means the turtle would likely be streamside during operations. The risk increases to moderate in October if logging activities continue late into the year because the turtles move into the upland habitat as the weather gets colder. The level of potential impact at these locations would not be sufficient to affect the long term viability of any existing population.

Abernathy Meadow, Mud Lake, and Grandfather, Big, and Little Kibbie Ponds have the highest potential for direct impact to individuals. At Abernathy Meadow, the turtles move into upland habitats during the summer when the seasonal pond goes dry. Previous radio telemetry tracking of individuals at this location confirms the turtles move into the upland and aestivate until the rainy season fills the pond. Because the turtles could be in the upland during salvage operations, there is a high risk of injury or mortality. The same conditions apply to Big and Little Kibbie Ponds, because these wetlands occasionally go dry (as they were during the Rim Fire) and the WPT would be expected to move into the uplands to aestivate. Because of this consideration, a management requirement was imposed for all action alternatives to prohibit the operation of equipment within a quarter-mile of the ponds and meadow if the features are lacking water. This management requirement helps to limit risk of injury and mortality. Also, equipment operation is prohibited within a quarter-mile from June through July would help to prevent disturbance to nesting turtles.

Grandfather Pond and Mud Lake tend to retain perennial water and the turtles are expected to remain close to the aquatic habitat during the period when salvage operations would occur close to the ponds. Still, some individuals could make overland journeys to and from Birch Lake at Camp Mather or move into the uplands to aestivate. This would pose a risk of injury or mortality during salvage operations. The overall risk to any one individual is considered to be low, but there would be a moderate to high risk of physical disturbance during salvage operations. The consequence would be a short duration (less than 4 weeks) change in behavior where terrestrial basking would be reduced. This would have a minor impact on physiological fitness, but would not be enough to alter a function like reproductive or overwintering fitness. This means a female would produce eggs as in a typical year and the bodily energy reserves entering winter would be sufficient to get individuals through to spring. No long-term consequences to these populations would be expected.

The primary adverse indirect impact to individuals would be sedimentation of stream habitats. As with the FYLF, the degree of impact is related to the extent of activity, particularly activity in close proximity to the aquatic features. The same categorization used for the FYLF applies to the WPT because the deep water features are important elements for both species. The description of impacts to deep water habitat described for the FYLF applies to the WPT and the reader is encouraged to read the FYLF description. Deep water habitats are important to all life stages of the WPT (except hatchlings) for escaping from disturbance (a perceived predation attempt), foraging, and thermal retreat. Sediment that reduces the volume of a deep water habitat by more than 50 percent is considered excessive and degrades habitat suitability from high to low. In larger streams and rivers (examples, Cherry Creek and Middle Fork Tuolumne River), the energy of the water during annual peak flows is enough to maintain extensive areas of high quality, deep water habitat. For hatchling turtles, excess sediment could fill backwater areas that provide high quality suitable habitat for this life stage. If this occurs, some hatchlings may not find sufficient food resources to keep the hatchling alive during the summer or following winter. This impact to habitat could last for 2-3 years, a low level impact to a population, because population growth could be decreased for several years. This should not affect the persistence of any population, however.

A secondary indirect effect that could affect the WPT is that salvage operations would remove standing dead trees from around the aquatic feature. This impact could be beneficial and detrimental to the WPT. The detriment is that these trees provide good overwintering and aestivation habitat when they fall. Turtles will dig themselves under the logs, which provide protection from predators and a moister microclimate during aestivation. Salvage logging would reduce the short- and long-term recruitment of LWD and reduce habitat suitability from high to moderate or low. Salvage logging would also potentially provide a benefit to the WPT because the removal of the trees would provide open, sunny habitat conducive to nesting. Pre-fire areas with dense overstory reduced the quality and quantity of nesting habitat, but areas with high vegetation mortality now give the WPT ample nesting habitat. Salvaging the dead material would provide a more open ground surface which would allow nestlings to easily navigate to the water.

Another secondary indirect effect associated with salvage operations is the reduction of LWD in aquatic systems (as noted previously for the FYLF). The habitat associations between LWD and the WPT are clearer because LWD provides high quality basking habitat when accessible from the water. Jennings and Hayes (1994) indicate the amount of basking habitat improves over-all habitat quality; therefore, abundant LWD in a stream would enhance habitat quality. The rate of recruitment of LWD from salvaged areas would be greatly reduced in localized areas. However, recruitment from upstream areas that were burned and unsalvaged should maintain relatively high LWD recruitment rates, and a management requirement is in place to retain five pieces of LWD (the largest trees) per acre for riparian areas in salvage units. The retention of this minimum amount of LWD would be beneficial for streamside habitat. The expected reduction in LWD recruitment rate is expected to have a very long term effect (greater than 150 years) and is related to the time when mature forests are re-established on the landscape.

Road Treatments

Same as FYLF.

Water Sources and Rock Quarries

Water sources used for the road management activities and logging have management requirements that would result in minimal adverse direct and indirect effects to the WPT. Rock pits are not located in WPT habitat, so no direct or indirect effects to the WPT would occur.

Fuels Reduction

The effects of fuels treatments on the WPT aquatic habitats would be the same as for the FYLF. As with the salvage logging, treatments occurring within the buffer established for the WPT would increase the risk of directly impacting individuals occurring in upland habitats. There is a very low risk of injury and mortality in units using hand piling to treat surface fuels. Physical disturbance is the most likely direct impact and there would little to no adverse impact to an individual’s well-being. Units with machine piling would increase the risk of direct impact to relatively high levels because the intensity of operations would likely be high, especially in areas with high levels of mortality in small diameter (non-merchantable) stands. Machine piling would likely occur only in one year and could occur one to five years following the salvage activities. As with the salvaging, low levels of mortality could affect population size for several years and until new individuals enter the population.

Hardhead

As noted earlier, suitable habitat is restricted to the lower reaches of the North Fork Tuolumne and Clavey Rivers and the Tuolumne River to approximately Lumsden Bridge. Because there are very few harvest or roadside units in close proximity to these river sections, there would be no direct effect to hardhead. There is a hazard tree unit along Lumsden Road, but trees would not be felled into the Tuolumne, thereby eliminating the risk of direct effect to any individual.

The indirect effect to hardhead is only related to sediment. Because a very small portion (less than 3 percent) of the North Fork Tuolumne River watershed burned at moderate severity (no high severity soil burn conditions), there would be no observable change to habitat conditions in the lower river. The fine sediment generated in the Hunter Creek watershed would be assimilated by the mainstem of Hunter Creek and then the North Fork Tuolumne above the reach suitable for hardhead. Because the Tuolumne River does not provide suitable breeding habitat for the hardhead (due to regulated streamflow), there would be no indirect impact on spawning habitat suitability. There would be no detectable effect to deep water habitats used by sub-adult and adult fish because the annual peak and base flows in the river are enough to mobilize and redistribute this sediment. There could be localized accumulations of sediment near the mouths of tributary streams that had a high proportion of high and moderate severity fire, but the sediment from all watershed sources would not be sufficient to have much of an effect on pool and deep run habitats.

CUMULATIVE EFFECTS

The primary pathways considered for cumulative effects to the CRLF and SNYLF are (1) the potential risk of directly impacting individuals or their habitats, (2) the risk of increased sedimentation in the habitats, and (3) the reduction of LWD in both aquatic and upland habitats.

Salvage harvest on private lands and livestock grazing were the two types of cumulative effect stressors evaluated for the FYLF, WPT, and hardhead. These two types of actions are considered to have the most detectable influence on aquatic systems, especially in the post-fire environment. The impact of post-fire logging has been discussed earlier in this document and this activity has the highest potential to increase erosion and sedimentation rates in a watershed. Livestock grazing is also discussed because the impact of concentrated livestock use in riparian areas (made more sensitive by moderate and high soil burn severity conditions) may have localized impacts to streambanks and the reestablishment of riparian vegetation.

Livestock grazing as a cumulative stressor will be discussed at a general level, because there is uncertainty regarding Forest Service administration of permits for allotments affected by the fire. Livestock may be excluded, partially or fully, from some allotments within the Rim Fire perimeter in 2014. Assuming the Forest Service allows light levels of grazing in portions of the allotments in 2014, livestock could impact sensitive streambanks through trampling. Streambanks are more sensitive post-fire than in unburned conditions because much of the vegetation has been burned and there is little root holding capacity to resist shearing by hooves. This is especially true in low gradient reaches (less than 2 percent) where alluvial (or depositional) banks dominate. In steeper gradient reaches, the streambanks tend to be more armored by larger diameter substrates (rocks like cobble and boulder) and resistant to bank shear. These localized areas of streambank disturbance may not have much of an effect at larger watershed scales, but they can influence sedimentation at locally important scales. If livestock are allowed to graze portions of the allotments, a small increase in sedimentation would be expected along low gradient reaches with no discernible increase along higher gradient sections. Table 3.03-12 shows the cumulative impact would be unnoticeable for watersheds with limited salvage activity. However, any impact in watersheds with high levels of salvage (greater than 50 percent of watershed or FYLF/WPT buffer, Table 3.03-12) could cumulatively contribute to extensive degradation of aquatic habitat. The duration of this combined reduction in habitat suitability would be two to three years. After this period, hillslope erosion rates would quickly decrease and habitat suitability would increase to moderate levels.

Another impact associated with livestock is the potential impaired recovery of riparian vegetation because poorly managed livestock can severely affect the recovery of obligate woody and herbaceous riparian species. The rapidly regrowing riparian vegetation is always a good food source, but especially late in the season when other forage options may have decreased in palatability. The proximity of this forage to water, another critical resource need for livestock, suggests livestock may congregate in sensitive post-fire riparian areas. Salvage logging does not generally impair riparian recovery if adequate equipment exclusion zones are maintained, so there may be very little cumulative effect to riparian recovery.

California Red-legged Frog

Cumulative actions would overlap with 25.83 percent of suitable breeding habitat, 6.99 percent of available non-breeding habitat, and 8.31 percent of upland habitat. The cumulative actions include emergency fire salvage on private lands and the Rim HT project. Table 3.03-10 and Table 3.03-11 show both of these activities have the potential to cause injury, mortality, or disturbance to individual CRLF as well as habitat destruction. Because project activities proposed in Alternative 1 only overlap suitable breeding habitat at Homestead Pond (Table 3.03-10 and Table 3.03-18) and no cumulative actions overlap Homestead Pond (Table 3.03-10), there will be no cumulative impact to individual CRLF found within a breeding habitat or the breeding habitats themselves. Table 3.03-11 shows the amount of cumulative disturbance within each watershed of the breeding habitats would be moderate to high. Additional sediment would likely be delivered to the breeding habitats. Because the level of sediment expected to be delivered to the stream as a result of the Rim Fire are so high, no discernible cumulative effects from additional sediment caused by the cumulative actions are expected to occur.

The non-breeding stream habitat associated with four of the breeding habitat areas (Birch and Mud Lakes, Drew Creek, Harden Flat, and Hunter Creek) would have small increases in the percentage of disturbance as a result of the cumulative actions (Table 3.03-10) but the amount would be less than 5 percent, 14 percent, 5 percent, and 6 percent, respectively. In these four areas the amount of activity proposed in Alternative 1 is low and cumulatively no substantial increase in the potential effects to the non-breeding habitat is expected. Because of the low likelihood of occupancy, disturbance to individuals from other projects would be unlikely and not cause a measurable effect to individual CRLF. Potential for the cumulative actions to contribute additional insignificant amounts of sediment to the non-breeding streams would not further reduce the habitat suitability for the CRLF.

The CRLF upland habitats would have small increases in the percentage treated as a result of the cumulative actions (Table 3.03-10). Due to the negligible level of direct and indirect effects, no discernible effect to CRLF is expected from cumulative actions in the upland habitat.

Recruitment of LWD in CRLF upland habitats may be affected by cumulative salvage and hazard tree actions. Thirty-seven percent of the habitats affected by cumulative actions have proposed plans for salvage operations. The remaining 63 percent of the habitats affected would receive the hazard tree treatments proposed by the Rim HT project. This project proposes to only remove trees deemed hazardous to facilities (i.e., roads, structures, and developed sites). Therefore, potential sources of LWD would be retained at variable densities throughout the Rim HT project area. Despite the potential likelihood for a marked reduction in LWD in the habitats potentially affected by cumulative salvage operations, reductions of LWD within the Rim HT project area would be minor.

Using the CWE modelling, the TOC in the Lower Middle Fork Tuolumne and Jawbone Creek watersheds would be exceeded. Birch Lake, Mud Lake, and Drew Creek are located in these watersheds, but they are not expected to be significantly impacted by the cumulative actions. No actions occur within the area capable of causing an effect at Birch Lake and a management requirement listed in the Rim HT project prohibiting the removal of any trees with 300 feet of Mud Lake and requiring trees felled within this area to be left, would minimize the potential effects to that lake. Proposed cumulative actions occurring in the watershed containing Drew Creek (Jawbone Creek) would occur greater than 1 mile from Drew Creek so the habitat there would not likely be as adversely impacted as other habitats in the watershed.

Table 3.03-10 CRLF and SNYLF habitat effects including Cumulative Effects

Habitat	Percent of Habitat Affected					
	Alt 1	Alt 1 + CE	Alt 3	Alt 3 + CE	Alt 4	Alt 4 + CE
California red-legged frog						
Birch Lake / Mud Lake	0/0	NC/37	0/0	NC/37	0/0	NC/37
Non-Breeding (Per and Int.)	30	35	29	34	29	34
Upland	28	36	28	36	28	36
Drew Creek	0	NC	0	NC	0	NC
Miles of Non-Breeding (Per and Int.)	11	25	2	16	2	16
Acres of Upland	10	19	7	17	7	17
Harden Flat	0	NC	0	NC	0	NC
Miles of Non-Breeding (Per and Int.)	6	11	6	11	6	11
Acres of Upland	14	32	14	32	14	32
Homestead Pond	100	NC	71	97	71	97
Miles of Non-Breeding (Per and Int.)	0	5	0	5	0	5
Acres of Upland	9	21	3	15	3	15
Hunter Creek and Ponds	0/0	NC/25	0/0	NC/25	0/0	NC/25
Miles of Non-Breeding (Per and Int.)	9	15	9	15	9	15
Acres of Upland	10	16	10	16	10	16
Sierra Nevada yellow-legged frog						
Bear Creek	98	100	98	100	2	5
Acres of Upland	96	100	96	100	5	10
Cherry Creek Tributary	6	NC	6	NC	6	NC
Acres of Upland	6	NC	6	NC	6	NC
Jawbone Creek	29	63	29	63	29	63
Acres of Upland	30	60	30	60	30	60
Little Reynolds Creek	24	51	24	51	24	51
Acres of Upland	26	58	26	58	26	58
Looney Creek	5	20	0	17	0	17
Acres of Upland	5	41	0	35	0	35
Lost Creek	15	32	15	32	15	32
Acres of Upland	11	29	11	29	11	29
Niagara Creek	74	77	74	77	74	77
Acres of Upland	47	58	47	58	47	58
Reynolds Creek Tributary	10	NC	10	NC	10	NC
Acres of Upland	12	NC	12	NC	12	NC
Richards Creek	51	NC	51	NC	51	NC
Acres of Upland	37	NC	37	NC	37	NC
White Fir Creek	58	NC	58	NC	58	NC
Acres of Upland	39	NC	39	NC	39	NC
Little and Big Kibbie Ponds	100	NC	100	NC	93	NC
Acres of Upland	78	NC	75	NC	54	NC

Table 3.03-11 CRLF and SNYLF breeding habitat watershed effects including Cumulative Effects

Habitat	Percent of Watershed Affected					
	Alt 1	Alt 1 + CE	Alt 3	Alt 3 + CE	Alt 4	Alt 4 + CE
California red-legged frog						
Birch Lake and Mud Lake	55/0	89/63	55/0	89/63	55/0	89/63
Drew Creek	15	35	14	34	14	34
Harden Flat	24	67	24	67	24	67
Homestead Pond	13	57	1	45	1	45
Hunter Creek and Ponds	9	23	9	23	9	23
Sierra Nevada yellow-legged frog						
Bear Creek	73	89	73	89	18	34
Cherry Creek Tributary	8	NC	16	NC	16	NC
Jawbone Creek	24	45	24	45	24	45
Little Reynolds Creek	19	73	19	73	19	73
Looney Creek	12	73	12	73	12	73
Lost Creek	18	48	18	48	18	48
Niagara Creek	39	42	37	40	19	23
Reynolds Creek Tributary	40	49	42	50	15	23
Richards Creek	33	NC	36	NC	36	NC
White Fir Creek	50	NC	57	NC	57	NC
Little and Big Kibbie Ponds	100/100	NC/NC	0/100	NC/NC	8/68	NC

NC=No Change meaning there are no cumulative actions that would affect that habitat

Sierra Nevada Yellow-legged Frog

Cumulative actions would overlap with only 5.21 percent of suitable breeding and non-breeding habitat and 3.75 percent of upland habitat. The cumulative actions included in this overlap consist of emergency fire salvage on private lands, the Rim HT project, and the Reynolds Creek Ecological Restoration project (culvert and road work, green thinning, and meadow restoration). The SNYLF breeding and non-breeding habitats with the greatest overlap with these cumulative actions is Jawbone Creek where an additional 34 percent of the habitat overlaps with either the Rim HT project or private property emergency fire salvage acres. Because only trees deemed a hazard to public safety or infrastructure would be removed in the Rim HT project, and riparian buffers and other BMPs designed to protect aquatic features and limit erosion will be implemented, the contribution of this project to cumulative effects will be limited. Emergency fire salvage would occur along the most downstream portion of Jawbone Creek and may cause an increase in sedimentation in that area. No cumulative effects will occur in the upper 3.8 miles of Jawbone Creek located above the private emergency fire salvage. Bear Creek, Little Reynolds Creek, Looney Creek, Lost Creek, and Niagara Creek may also experience cumulative effects since the percentages of their habitat treated by cumulative actions range from 2percent (Bear Creek) to 27 percent (Little Reynolds Creek) (Table 3.03-10).

Similar to CRLF habitats, the level of sediment expected to be delivered to the streams as a result of proposed activities are almost unmeasurable in comparison to those expected from the effects of the Rim Fire (Table 3.03-3 and Table 3.03-19) and no discernable cumulative effects from additional sediment caused by the cumulative actions are expected to occur.

Although most of the upland habitat would have increases ranging from 29 percent to 100 percent (Table 3.03-10) in habitat affected, the risk of injury, mortality, or disturbance of individual SNYLF is still low due to their limited use of this habitat. No cumulative actions are proposed in Cherry Creek Tributary, Reynolds Creek Tributary, Richard Creek, White Fir Creek or Little and Big Kibbie Ponds.

Because greater than 56 percent of the habitat affected by cumulative actions would occur during proposed emergency fire salvage on private lands, a potential for LWD loss in these areas is high.

Rim Recovery project management requirements would ensure some level of LWD adjacent to the habitats affected by these cumulative treatments so the cumulative losses of LWD are expected to be minor.

As described in the CRLF section, the CWE modelling TOC would be exceeded in the Jawbone Creek watershed. The SNYLF breeding habitat located within this watershed (Jawbone Creek), however, is located above the portions of the watershed being treated with other projects and is unlikely to be adversely impacted by cumulative actions occurring elsewhere in the watershed.

Foothill Yellow-legged Frog

The following cumulative effects discussion is focused on salvage logging (hazard tree and salvaging) on public and private lands. Table 3.03-12 indicates 16 streams would not have cumulative effects attributable to salvage logging or hazard tree removal on public or private lands. Four streams (Grapevine, Hunter, and Indian Creeks and the North Fork Tuolumne River) would have small increases in percentage of buffer treated and percentage of watershed area treated, but the amount would be less than 20 percent and 25 percent, respectively. In these four streams the amount of activity in the FYLF buffers and watershed is considered to be relatively low, and there would be no substantial increase in potential for direct and indirect effect. The primary direct effect would be increased disturbance, but the extent of this effect would not have an observable impact to overall well-being of any individual. Also, a very slight, if discernible, increase in sediment delivery to these streams is expected, but the increase would be very small and would not further impair the suitability of habitat for the frog.

The amount of cumulative disturbance within FYLF buffers at Bull Meadow, Drew and Cherry Creeks would be moderate and not exceed 35 percent of the total buffer in the watershed. At Drew Creek, most of the cumulative increase in disturbance would be in the upper watershed where habitat suitability for the FYLF is very low. There would be no increase in direct effect to the FYLF, but the increased activity in the watershed could deliver additional sediment to the stream. The increased buffer affected for Cherry Creek actually reflects the amount of activity in the Granite Creek subwatershed (discussed later). For Cherry Creek, there would be no discernible increase in direct effect to FYLF from cumulative salvage actions.

Four streams, Cottonwood and Reed Creeks and the Middle and South Fork Tuolumne Rivers, would see moderate to large amounts of FYLF buffer or total watershed area treated. Cottonwood and Reed Creeks are at the upper elevation range of the FYLF on the forest, and the risk of direct effect may be mitigated by their location. The cumulative amount of watershed area treated in both of these watersheds is between 34 and 43 percent. This extent is considered to be enough to potentially increase sedimentation to the point where habitat suitability begins to be impaired. The suitable habitat in both streams is near the confluence with the Clavey and the “pour point” of all disturbances in the watershed. Impacts to habitat would include decreased depth in slow water habitats, extensive sedimentation along the margins of the streams, and reduced availability of hiding refuges. Habitat suitability would be reduced from moderate-high to low-moderate. The increased sediment would be expected to last up to three years. This amount and duration of sediment would not be expected to affect the persistence of a FYLF population. Using the CWE modeling from the Watershed Chapter, the Reed Creek watershed (6^{th} level HUC) would exceed theTOC from 2014 through 2017, indicating watershed processes could become increasingly unstable during this period. Lesser, lingering watershed effects could continue for up to two years (through 2019) after receding below the TOC.

Table 3.03-12 Watershed area and buffers in FYLF and WPT suitable habitat in Alternative 1

Watershed and Stream	Percent FYLF Buffer Affected		Percent Watershed Treated		Percent WPT Buffer Affected	
	Alt1	Alt 1+CE	Alt 1	Alt 1+CE	Alt 1	Alt 1+CE
Tuolumne River Watershed HUC 5						
Alder Cr.	4	4	10	10	--	--
Corral Cr.	36	78	58	72	--	--
Drew Cr.	17	28	12	29	12	27
Grapevine Cr.	11	18	18	23	--	--
Indian Cr.	1	6	2	4	--	--
Jawbone Cr.	15	43	25	75	25	53
Homestead Pond	--	--	--	--	20	49
Middle Fork Tuolumne River Watershed HUC 5						
Middle Fork Tuolumne River[1]	45	57	48	61	44	57
Abernathy Meadow	--	--	--	--	55	55
Grandfather Pond	--	--	--	--	16	35
Mud Lake	--	--	--	--	18	73
North Fork Tuolumne River HUC 5						
North Fork Tuolumne River	0	2	1	6	2	6
Basin Cr.	0	0	1	5	0	less than 0.1
Hunter Cr.	6	14	9	23	8	19
South Fork Tuolumne River HUC 5						
South Fork Tuolumne River[2]	10	34	36	46	30	39
Unnamed ponds near Yosemite Lakes	--	--	--	--	5	8
Cherry Creek HUC 5						
Cherry Creek	18	34	13	35	13	29
Eleanor Cr.	22	22	1	1	16	16
Big Kibbie Pond	--	--	--	--	88	88
Little Kibbie Pond	--	--	--	--	63	63
Granite Cr.	36	78	27	85	--	--
Clavey River HUC 5						
Reed Cr.	50	54	20	34	50	62
Adams Gulch	0	0	18	36	--	--
Bear Springs Cr.	20	31	18	78	--	--
Bull Meadow Cr.	8	21	36	47	--	--
Indian Springs Cr.	25	25	19	29	--	--
Quilty Cr.	0	0	5	73	--	--
Unnamed Tributary 1	8	8	16	16	--	--
Unnamed Tributary 2	0	0	24	24	--	--
Unnamed Tributary 3	46	50	69	78	--	--
Unnamed Tributary 4	13	13	43	43	--	--
Unnamed Tributary 5	37	37	43	45	--	--
Cottonwood Cr.	5	18	31	43	--	--
Russell Cr.	0	0	30	30	--	--
North Fork Merced River HUC 5						
North Fork Merced River	2	2	10	10	4	4
Bull Cr.	less than 0.1	less than 0.1	2	2	1	1
Deer Lick Cr.	7	7	8	8	7	7
Moore Cr.	3	3	4	6	6	7
Scott Cr.	4	4	22	22	--	--

[1] Percentages calculated for the 6th level HUC Lower Middle Fork Tuolumne and not for the 5th level HUC
[2] Percentages calculated for the 6th level Lower South Fork Tuolumne River HUC

The amount of FYLF buffer treated would be relatively high in the Middle (57 percent) and South Fork (34 percent) Tuolumne River watersheds and the risk of direct effect to individuals would increase at a 5th level HUC watershed scale. The primary direct impact would be physical disturbance and the duration of activity in any given area would be four weeks. The cumulative amount of activity in the watersheds would be extensive, affecting between 46 and 61 percent of the total area in the lower 6th level HUC (excludes the area in the upper Middle and South Fork Tuolumne River 6th level HUC). The extent of activity in these watersheds suggests greater increases in sedimentation are possible and impacts to habitat would be more observable. Again, deep water habitats would be reduced in volume and sedimentation would impair a greater amount of the edgewater habitat. These are relatively large streams with high seasonal peak discharges; therefore, some high suitability deep water habitat should be maintained. The additional sediment along the margins of the rivers could affect tadpole habitat by filling the hiding spaces between larger rocks and limiting the availability of foraging habitat. These effects could lead to reduced survivorship from the tadpole stage due to increased predation or lower individual fitness (body condition) due to limited food resources. If adequate energy is not available from a tadpole's body mass, it may not metamorphose or may not metamorphose in a timely manner as to allow the metamorph the opportunity to adequately forage prior to winter. These two consequences could reduce recruitment to populations, resulting in smaller population numbers over the next 3 to 5 years. Using the CWE modeling, the Middle Fork would exceed the TOC from 2014 to 2017, indicating watershed processes could become increasingly unstable during this period. Lesser, lingering watershed effects could continue for up to two years after receding below the TOC.

Cumulative actions in the watersheds of five streams would potentially have significant impacts on habitat suitability. These streams are Bear Springs, Clavey Tributary 3, Corral, Granite, and Jawbone Creeks. In these streams, 31 to 78 percent of the FYLF buffer and 72 to 85 percent of the watershed area would be affected by cumulative actions (Table 3.03-12). In these streams, there would be a high risk of direct impacts to individuals and high to very high risk of indirect effects to individuals, populations, and habitat. The amount of buffer treated in these watersheds means extensive equipment operation in close proximity to the streams. While the risk of mortality and injury should remain low due to the flight response of the frog, the potential for physical disturbance is high. Duration of disturbance should be limited to 4 weeks in most locations, but the extent of operations suggests more individuals may be subjected to disturbance. The stress of disturbance may combine with the expected reduction in habitat suitability (less deep water habitat in small streams) and impair individual well-being. The added stress could indirectly lead to increased mortality rates over the first winter, effectively lowering population size.

Habitat suitability would also be significantly reduced from excess sediment and some small stream habitats may be unsuitable for the first year post-logging. Suitability would slowly improve over the next two to three years as the sediment is scoured and transported downstream. The sediment increases may make breeding and tadpole rearing habitats unsuitable in Corral and Jawbone Creeks for up to two years. A loss in reproduction in two or more years would decrease populations and potentially affect the long-term viability of some populations. The two most at-risk populations are in Corral and Jawbone Creeks because the Tuolumne River likely effectively prevents the travel of individuals between watersheds. Isolated populations have a greater risk of extirpation than well-connected populations (Dunham et al. 2003). Therefore, if one of these isolated populations is extirpated, there is a very low likelihood that it would be recolonized within the next 20 to 50 years. For Bear Springs and Clavey Tributary 3, the potential for re-colonization would have a moderate to high likelihood because the FYLF is well distributed along the Clavey. It should be noted that surveys have not detected FYLF at any of these locations, but occupancy is assumed in these streams.

In support of the indirect effects to these streams, the CWE modeling was used and indicated the Corral and Granite Creek watersheds would exceed the TOC from 2014 to 2018, indicating watershed processes could become increasingly unstable during this period. Lesser, lingering watershed effects could continue for two to three years after receding below the TOC (through 2021). CWE modeling was also completed for the Bear Springs and Jawbone Creek watersheds and the TOC would be exceeded for two years, and relatively high equivalent roaded area (ERA) impacts would continue for three additional years.

Western Pond Turtle

The discussion of cumulative effects to stream habitat for the FYLF applies to the WPT because they use similar habitats. The main difference is that the WPT is less likely to utilize the very small, intermittent streams where sedimentation effects would be the highest. The discussion of direct effects for the FYLF applies to the WPT because actions within the FYLF buffer reflect the amount of activity in close proximity to the streams.

As with the FYLF, there would be very little to no cumulative effect to individuals or habitats for Basin, Bull, Deer Lick, Eleanor, Hunter, and Moore Creeks; the North Fork Merced and Tuolumne Rivers; and the unnamed ponds near Yosemite Lakes. This assessment of potential effect is based on the small (or no) change in amount of buffer affected in Alternative 1 and cumulative actions as shown in Table 3.03-12 and the location of the actions adding cumulatively to the alternative.

Moderate detrimental cumulative impacts would be expected at Cherry and Drew Creeks and the South Fork Tuolumne River and the magnitude of indirect effect (sedimentation) would impact WPT habitat in the following ways. Moderate sedimentation of deep water habitats would be expected in Drew Creek. If the 2005 Tuolumne Fire is used as a comparative example, high levels of sediment would fill small, shallow pools while the larger, deeper pools found in higher gradient areas would maintain most of their volume. Sediment "lenses" would be evident at the lower end of these larger pools, but the deepest part of the pool would be maintained for escape habitat. The shallow edge water required by hatchlings would be maintained in these larger pools, and the intermittent nature of the stream (in sections) would provide this necessary slow water habitat. The cumulative salvage actions would not occur in the reach occupied by the WPT and no cumulative impact to nesting or overwintering habitat would be expected. The South Fork Tuolumne River and Cherry Creek have sections with high gradient and pool abundance. The water energy in annual peak flows and high gradient sections should maintain more than 50 percent of pool habitat at high suitability levels. The remaining pool habitats would have moderate to high suitability for the WPT.

Moderate to high levels of cumulative impact would be expected at the Middle Fork Tuolumne River, Jawbone Creek, and Reed Creek, similar to that described previously for FYLF. The high overall level of activity in WPT buffers (53 to 62 percent of the buffers affected) suggests a moderate to high likelihood that physical disturbance would occur during salvage activities. The risk is greatest during June and July when females move upland to nest. It is possible that females could abandon nesting in the year salvaging would occur, but a long-term impact to population levels is not expected if only one year of recruitment is missed. The risk of injury or mortality is considered to be low at these locations because they maintain water during the period of time when salvage operations would occur (April through October). The risk of injury or mortality becomes moderate in October when night temperatures approach freezing and turtles move into the uplands to overwinter. Equipment operation in the uplands following nesting has a very low chance of impacting nests because the nests are typically located in areas with sparse overhead vegetation. These are areas that would typically not be harvested, but patches of open areas could occur in areas with merchantable timber.

The discussion of sediment related impacts to WPT habitat in these three locations is similar to what is described for the FYLF. Most deep water habitats would see moderate impacts (reduced pool volume), while patches of high suitability habitat would be found in the largest pools and in areas with higher stream gradient.

High levels of cumulative disturbance would occur in the WPT buffer areas at Abernathy Meadow (55 percent of buffer affected), Mud Lake (73 percent), Homestead Pond (49 percent), and Big Kibbie (88 percent) and Little Kibbie (63 percent) Ponds (Table 3.03-12). The potential for adverse direct effects, mainly physical disturbance, to occur are high during the period when operations occur in these areas and should last for three weeks, but multiple entries into the buffer would be likely for hazard tree removal and salvage logging. This means two periods of disturbance would likely occur during the first year (2014 to 2015), but the intensity and duration of disturbance should not be enough to affect the long-term well-being of individuals. The risk of injury and mortality would also increase at these locations during the summer when the volume of the ponds decreases by greater than 50 percent. The decreased pond volume could trigger an aestivation response and include the departure from the water to the upland habitats or movement between nearby aquatic habitats. If the timing of salvage operations coincides with this movement period, the risk of injury or mortality would increase to moderate levels. Any further loss of individuals from these four locations could effectively suppress population size for 15 years or more. The presence of mostly adult turtles at these locations suggests the recruitment rate of young turtles is very low.

The extent of salvage logging around these four ponds would also reduce the recruitment of LWD and upland habitat suitability would be reduced. In this case, the temporal bounding for analyzing the cumulative effects of LWD recruitment would extend upwards of 150 years (or more), which is commensurate with the re-establishment of trees with a large diameter.

Minor behavioral changes caused by physical disturbance would be the primary effect to WPT at Grandfather Pond. The moderate level of cumulative action within the buffers at this site (35 percent) suggests a relatively short duration of activities for the 29 acres affected. There is a low potential for increased mortality or injury during late summer, as described above, as the pond size decreases. There would be a low to moderate reduction in habitat suitability in the treated area associated with the reduced LWD recruitment potential.

Hardhead

There should be very little cumulative effect on hardhead habitat in the North Fork Tuolumne, Clavey, and Tuolumne Rivers. Very little watershed area would be affected by cumulative actions and the sediment generated from those actions would not be readily detectable in suitable hardhead habitat. The Clavey and Tuolumne Rivers are so large and have such high capacity to transport and store fine sediment that the deep water habitats would be minimally impacted and deep water refuge would be maintained. The sediments that could accumulate in spawning habitats would not be likely to impair spawning success in the Clavey River. The Tuolumne River is unsuitable for breeding, but offers high suitability habitat for adults and sub-adults, especially in late summer.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

General Effects Common to All Species

No direct effect would be expected under Alternative 2. There would be no potential for mortality, injury, or physical disturbance of any of the three Forest Service Sensitive species created by salvage logging, abating the hazard of dead trees along forest roads, or restoring the road infrastructure.

Because the Forest Service would take no action under this alternative, natural watershed recovery processes would occur. Over time, there would be a gradual reduction in the delivery of sediment to stream channels as fire-resilient plant species recolonize burned areas and the soil-repellent layers break up. Erosion rates for most of the burned area would approach pre-fire rates within 5 or 6 years, but some areas could have elevated rates for up to 10 years. Streamflows would continue to be higher than in the pre-fire condition and some of the mapped intermittent streams could support perennial flow or maintain perennial water in pool habitats for 20 years or more. With the increased streamflow and decreased erosion (and sediment delivery to streams) rates, the silt and sand deposited and stored in the stream channels would be largely scoured from the channels within 5-7 years and pre-fire streambed condition would be evident in 10 years.

The recruitment of LWD to the stream would occur at high rates over the next 10-20 years and then slowly taper off as the rot-resistant trees (incense cedar and Douglas-fir) gradually fall. The LWD that lands on the floodplain and not in the channel would continue to be available for many decades. The LWD that falls into the streams should eventually benefit the stream by storing sediment generated by the fire and other events for long periods of time (greater than 20 years). Large debris dams store sediment and create pool habitats for many decades (Montgomery et al. 1996). The benefits of LWD will be most important in smaller streams (1^{st} to 4^{rd} order) and very important in lower gradient sections of streams (Ruediger and Ward 1996). Under this alternative, all sections of stream in the mixed conifer elevations have an unimpaired ability to receive large volumes of LWD. Lower elevation streams (less than 3,000 feet) will primarily recruit LWD from obligate riparian species and oak species.

One important consideration for Alternative 2 regarding the large volumes of LWD potentially recruited to stream channels, is that the LWD could mobilize during very high flows and threaten the road infrastructure. When LWD mobilizes down the channel and encounters a road crossing, the LWD can entrain (capture) other woody debris and sediment, creating a dam and preventing drainage of water and sediment through the culvert. Water could then cross the road surface, be diverted by the road, or cause the crossing to fail. In all three instances, large volumes of road surface and fill could be delivered to the stream channel, with the largest volumes of sediment coming from the failure of the crossing and erosion of the fill.

Stream shading would quickly increase in riparian areas affected by moderate and high vegetation severity fire. The obligate woody riparian species would regrow from stems and root crowns and increase in density via dispersal of seeds along the streams. Over the next 20 years, shading would increase to the point where cool and cold water temperatures would be maintained.

Under Alternative 2, the road system would not receive any treatment to improve drivability and correct drainage problems. Roads can be a primary source of human-caused sediment in forested conditions because they modify drainage networks and accelerate erosional processes (Furniss, et al. 1991). Past surveys of hydrologically connected road segments (HCS) on the forest have indicated considerable connectivity between road runoff and streams. In many cases, relatively uncomplicated techniques can be employed to reduce this road-stream connectivity, including outsloping the road surface, creating water diversion structures (rolling dips), and placing rock on dirt road surfaces. HCSs that deliver large volumes of sediment to streams appear to be relatively uncommon given the very large number of road miles on the forest, but the smaller scale HCS can cumulatively deliver large volumes of sediment. Regular road maintenance can be very effective at reducing sediment from this infrastructure. Alternative 2 would not generate revenue from merchantable timber to improve road function and many years could pass before those funds are made available to implement corrective actions. During this time, road conditions would gradually decline and increasing amounts of sediment could be delivered to streams in the project area.

Roadside hazard trees would be allowed to fall under this alternative limiting ready access to many parts of the fire. Forest Service personnel would not be as capable of conducting storm patrols of the fire area to detect road-related problems such as plugged culverts and gully erosion on the road surface. These potentially undetected problems could increase road crossing failures and extensive erosion of road surfaces, leading to excessive sediment delivery to many stream systems.

California Red-legged Frog

Under this alternative no direct or indirect effects would occur to individuals as a result of project activities. There is a very slight risk of individual being injured or killed by snags (dead trees) falling naturally and directly into aquatic habitats or in suitable upland habitat. Trees falling across roadways, near culverts, or into stream channels causing unwanted sedimentation or undesirable changes in channel morphology could slightly reduce habitat quality. Sedimentation risk may be higher in aquatic habitats surrounded by areas that sustained high vegetation burn severity where ground cover capable of reducing soil run-off is lacking. LWD recruitment rates would be very high in areas that sustained high vegetation burn severity fire.

Sierra Nevada Yellow-legged Frog

Same as CRLF.

Foothill Yellow-legged Frog

The main impacts to FYLF habitat would come from increased sediment delivery to streams, increased streamflow, and reduced stream shading. For the streams shown in Table 3.03-6 categorized as “low watershed response”, very little change in habitat is expected, particularly at the location of breeding sites. Minor sedimentation will occur in the headwater tributaries affected by the fire, but that sediment will be dispersed downstream to the point where it will be undetectable at the breeding site. Some of the stream segments affected by fire provide suitable dispersal habitat for adult and sub-adult FYLF, but the volume of deep water habitats should be adequately maintained, and the reduction in stream shade should have little effect on frog.

Streams categorized as “moderate watershed response” will see moderate to major adverse impact to the small order streams (1^{st}-2^{nd} order or headwaters) affected by fire. Deep water habitats may be extensively filled in dispersal habitats and there could be minor to moderate sedimentation in suitable breeding habitats. In some small tributaries affected by high severity fire, some deep water habitats may be unsuitable for individual frogs and they may have to move up- or downstream to suitable non-breeding aquatic habitat. The increase in sediment at breeding sites will likely have a minor impact to the suitability of the breeding habitat and reproduction should still occur. However, increased sediment in shallow water habitats used by tadpoles may see a reduction in suitability as the spaces between larger substrates are filled. The lack of hiding refuge may increase predation for the breeding season following the fire, but habitat suitability should be restored in the third or fourth breeding season post-fire. Stream shading was substantially reduced at a watershed scale (greater than 50 percent), though patches of shade remain. There could be slight increases in water temperatures, but these would be within the known tolerance range of the frog.

For streams and watersheds in the high watershed response category, major impacts to habitat have occurred or will occur this precipitation year. Excess sediment is likely to fill many of the deep water habitats to the point where they do not provide adequate refuge for frogs. This situation may not hold true for high gradient sections of stream where the water’s energy has enough force to keep some deep pool habitat intact. There may be more individuals concentrated around the remaining pools, which would likely increase competition and territoriality between individuals. The increased interaction between individuals could increase stress levels and reduce physical well-being. In streams like Bull Meadow Creek, the sediment may be enough to inundate breeding habitat and preclude breeding in 2014. Streams in this category will also see extensive decreases in water depth in shallow water habitats, potentially enough to exclude extensive use of those habitats.

The environmental outcomes for this alternative range from major habitat alterations in very small streams to no discernible impact in the larger rivers. The biggest impacts to habitat would be expected to occur in the five Clavey River tributaries and Alder, Bear Springs, Bull Meadow, Corral, Drew, Granite, Indian, Indian Springs, Jawbone, and Quilty Creeks. Moderate localized to minor overall alterations in habitat would be expected to occur in Adams, Cherry, Grapevine, Hunter, Reed, and Russell Creeks, and the Middle and South Fork Tuolumne Rivers. Minimal impacts to habitat would be expected to occur in Basin, Bull, Cottonwood, Deer Lick, Eleanor, Hunter, Moore, and Scott Creeks, and the North Fork Tuolumne and Merced Rivers.

Western Pond Turtle

Much of the discussion for the FYLF applies to the WPT for post-fire watershed response. There would be no risk of direct effect to individuals under this alternative. The post-fire erosion and sediment outcomes discussed for the FYLF apply to the WPT in that small streams with a high post-fire watershed response would see major impacts to the deep water habitats preferred by the turtle. In larger streams, the period of annual peak streamflow would have sufficient energy to maintain high suitability deep water habitats created by scour.

The primary difference for Alternative 2 relates to recruitment rate of LWD into suitable aquatic habitats. The recruitment rate would not be decreased due to salvage harvest and trees would be left to fall naturally. As noted previously, habitat suitability may be positively influenced by the increased abundance of basking sites (Jennings and Hayes 1994). More LWD would be recruited to all channels. The biggest increase in habitat suitability would likely occur in the larger streams and rivers like the Middle and South Fork Tuolumne Rivers.

The discussion of LWD recruitment also needs to include seasonal and perennial ponds and lakes at Abernathy Meadow, Big and Little Kibbie Ponds, Grandfather Pond, and Mud Lake. No trees would be harvested adjacent to lower quality roads or from salvage units surrounding these aquatic features leaving trees available for WPT use as they fall. As noted previously, the turtle will burrow under these objects in the upland to protect themselves from predators and weather elements. The unimpaired rate of recruitment of LWD would improve habitat suitability in the uplands surrounding the aquatic features.

The environmental outcomes under this alternative would follow natural post-fire processes and WPT populations would be maintained.

Hardhead

No direct or detectable indirect effect to hardhead individuals, populations, or habitat would result from Alternative 2. At the scale of the lower Clavey, Tuolumne, and lower North Fork Tuolumne Rivers, the amount of post-fire sediment would not be enough to impair the suitability of the important habitat elements (deep pool, shallow edge water, and spawning habitats) in any of these locations.

CUMULATIVE EFFECTS

No direct effects would result from the implementation of this alternative. The indirect effects described above focus on sedimentation of aquatic habitats and LWD recruitment. Increased sediment would be expected from the road system if maintenance and restoration actions are not taken and LWD recruitment rates would remain very high in areas that sustained moderate and high vegetation severity fire conditions.

California Red-legged Frog

Using Table 3.03-10 and Table 3.03-11 the cumulative actions that would affect CRLF suitable habitats and their breeding watersheds can be extrapolated. No cumulative effects to individuals or their habitats would be expected to occur in the breeding habitats at Birch Lake, Drew Creek, Harden Flat Ponds 1 and 2, Homestead Pond, Hunter Creek, or Hunter Creek Ponds 2 – 5, because no federal or private actions would occur there (Table 3.03-10). Very little or no cumulative impact to individuals or their habitats would be expected to occur at Mud Lake or Hunter Creek Pond 1 because no other federal or private actions would occur there (Table 3.03-10).

Cumulative actions would affect only a small proportion (less than 14%) of the non-breeding aquatic habitats associated with each CRLF breeding habitat (Birch and Mud Lake, Drew Creek, Harden Flat Ponds 1 and 2, Hunter Creek, and Hunter Creek Ponds 1 – 5) (Table 3.03-10). In these habitats there could be localized impacts to the habitats including destruction, increases in sedimentation, and loss of LWD recruitment, but the small cumulative percentage of habitat affected would not affect the overall habitat suitability in these habitats.

Cumulative actions would affect only a small to moderate proportion (6% to 18%) of the upland habitat associated with each CRLF breeding habitats (Birch and Mud Lakes, Drew Creek, Harden Flat Ponds 1 and 2, Hunter Creek, and Hunter Creek Ponds 1 – 5) (Table 3.03-10). This amount of activity is considered to be so low there would be no increase in the potential for direct effects. The primary direct effects that could occur in the areas where treatments overlap with the upland habitat would include an increase in individual behavioral disturbance and a reduction in LWD. The extent of these effects, however, would not be expected to cause an impact to the overall well-being of any individual CRLF, and only a slight reduction in amount of cover opportunities for CLRF in the form of LWD in the areas affected. Habitat suitability would not be expected to be impacted by this level of disturbance.

There would be no cumulative disturbances leading to increased sedimentation in the watersheds associated with the suitable breeding habitats at Birch Lake, Mud Lake, Harden Flat Pond 2, or Hunter Creek Ponds 3 – 5 (Table 3.03-11).The watersheds associated with the suitable breeding habitats at Drew Creek, Harden Flat Pond 1, Homestead Pond, and Hunter Creek would have small to moderate cumulative disturbance, at 20%, 43%, 44%, and 14%, respectively (Table 3.03-11). In the Drew Creek watershed this activity could cause additional sediment to be transported to the stream because a large majority of the vegetation in the watershed burned at moderate to high severity (i.e. 73%, Table 3.03-2). As discussed earlier, sediment transport is more likely in areas where vegetation burned at moderate to high severities. In the Harden Flat Pond 1 watershed, there would be a low risk of increased sedimentation in the pond, because the area surrounding the pond is relatively flat and remained primarily unburned. Despite a moderate level of disturbance in the Homestead Pond watershed, no additional sedimentation would be expected at this site, because the amount of sediment generated by the cumulative action occurring there (i.e. Rim Fire HT project) would be so minimal there would be no cumulative impact. In the Hunter Creek Watershed, most of the cumulative actions associated with emergency fire salvage on private lands would occur outside of suitable habitat (i.e. at greater than 4,000 feet in elevation). The other cumulative actions in the watershed would occur as a result of the Rim Fire HT project. Although, these activities could cause increased sedimentation in the stream, because only 14% of the watershed would be affected, the amount of sedimentation generated would be expected to be low and would not result in a change in habitat suitability.

The amount of cumulative disturbance within the watersheds associated with the suitable breeding habitats at Hunter Creek Ponds 1 and 2 would be high, at 81% and 68%, respectively (Table 3.03-11). Since the watersheds of these two ponds overlap, the risk of that additional sediment would be delivered to the ponds as a result of the emergency fire salvage planned to occur there is similar for both ponds. It is possible these ponds habitat suitability would be affected by increases in sedimentation caused by the emergency fire salvage because the design criteria for this salvage are unknown at this location. Protective measures to mitigate the risk of runoff from ground disturbance may not exist. Therefore, these habitats may be at risk.

Sierra Nevada Yellow-legged Frog

Using Table 3.03-10 and Table 3.03-11 the cumulative actions that would affect SNLYF suitable habitats and their breeding watersheds can be extrapolated. No cumulative impacts to individuals or their habitats would be expected to occur in the following aquatic habitats because no federal or private actions are planned to occur there: Cherry Creek Tributary, Reynolds Creek Tributary, Richards Creek, White Fir Creek, Little Kibbie Pond and Big Kibbie Pond (Table 3.03-10). Very little to no cumulative impacts would be expected to occur at Bear Creek and Niagara Creek because cumulative actions (i.e. emergency fire salvage), would affect only 2% and 3% of the habitats at these locations, respectively. This level of affect is considered to be so low, that the risk that individuals or the habitat would be impacted by the activity would be highly localized and not likely to affect the species persistence or overall habitat suitability of the site. A moderate level of cumulative impacts may occur to individuals and the habitats associated with Jawbone Creek, Little Reynolds Creek, Looney Creek, and Lost Creek, although cumulative disturbances would not exceed 34% in these habitats (Table 3.03-10). The primary direct effects that could occur in the areas where the cumulative action overlap the habitat would include an increased risk of injury, mortality, or behavior disturbance to individuals, or a reduction in LWD. The extent of these effects, however, would be highly localized, and would not be expected to cause an impact to the overall well-being of any individual SNLYF, and only a minor reduction in LWD recruitment to the streams. Habitats would likely remain intact, and not be measurably degraded by the levels of disturbance at these habitats.

Cumulative actions would not affect the upland habitats associated with Cherry Creek Tributary, Reynolds Creek Tributary, Richards Creek, White Fir Creek, Little Kibbie Pond, or Big Kibbie Pond (Table 3.03-10). A small proportion of the upland habitat associated with Bear Creek would be impacted by cumulative actions, but the amount of activity is considered to be so low, individuals would not be expected to be impacted by these actions, and habitat suitability would remain unaffected. There would be a moderate level of cumulative disturbances within the upland habitats associated with Jawbone Creek, Little Reynolds Creek, Looney Creek, Lost Creek, and Niagara Creek, although the cumulative disturbances would not exceed 36% (Table 3.03-10). The primary direct effects that could occur in these habitats are the same as those described for the aquatic habitats above, but the overall risk to individuals and their habitats would increase proportionately with the amount of habitat affected.

There would be no cumulative disturbances attributable to cumulative actions in the watersheds associated with the suitable breeding habitats at Cherry Creek Tributary, Richard Creek, White Fir Creek, Little Kibbie Pond, or Big Kibbie Pond (Table 3.03-11).The amount of cumulative disturbance within the watersheds associated with the suitable breeding habitats at Bear Creek, Niagara Creek, and Reynolds Creek Tributary would be small, 16%, 3%, and 9%, respectively (Table 3.03-11). However, the total cumulative disturbances in these watersheds are considered to be so minor, that there would be no substantial increase in the potential for indirect effects (i.e. sedimentation).

The amount of cumulative disturbance within the watersheds associated with the suitable breeding habitats at Jawbone Creek, Little Reynolds Creek, Looney Creek, and Lost Creek would be moderate at 21%, 54%, 25%, and 30%, respectively (Table 3.03-11). Habitat suitability at Jawbone Creek is expected to be reduced to low-unsuitable for up to two years as a result of the predicted post-fire increases in sedimentation. The cumulative actions occurring in this watershed could contribute to additional sedimentation and cause a longer duration of reduced suitability for breeding and rearing. The habitat suitability would not be measurably affected by cumulative impacts in Little Reynolds Creek, Looney Creek, or Lost Creek; because the estimated increases in sediment from post-fire runoff are expected to be so minor they would not cause a change in habitat suitability in comparison to pre-fire conditions for any life stage of the SNYLF.

Foothill Yellow-legged Frog

Using Table 3.03-12, the cumulative actions within each watershed can be derived for other actions on public and private lands. Very little or no cumulative effects would be expected in the following watersheds because there would be no other federal or private actions: Adams, Alder, Basin, Bull, Deer Lick, Eleanor, Indian Springs, Moore, and Russell Creeks, Clavey Tributaries 1, 2, 4, and 5, and the North Fork Merced River. Increased sedimentation from other salvage operations would not occur and LWD recruitment potential would coincide with the existing condition.

Minor to no discernible cumulative effect would be expected from the following watersheds because the other private or federal actions would only affect a very small percentage (less than 15 percent) of the FYLF buffer in the watershed or total watershed area: Bull Meadow, Cottonwood, Grapevine, Hunter, Indian, Indian Springs, and Reed Creeks, Clavey Tributary 3, and the Middle, North, and South Fork Tuolumne Rivers. In these streams, there would be localized increases in sedimentation, but the small cumulative percentage of FYLF buffer and watershed affected would not be sufficient to impair any biological function in the streams. FYLF habitat suitability would remain in the moderate suitability category until post-fire sediment is flushed from the systems (1-2 years) and relatively unimpaired habitat suitability would recover after 2 years.

There would be minor to moderate localized effects to aquatic habitats in the following locations: Bear Springs, Cherry, Corral, Drew, Jawbone, and Quilty Creeks. At these sites, the percentage of FYLF buffer affected ranges from 0 to 42 percent and the percentage of watershed area affected ranges from 14 to 60 percent. Relatively minor changes would be expected in Cherry and Drew Creeks, but the remaining streams could have moderate reductions in habitat suitability, compared to a pre-fire condition, in extensive areas of the watershed. The increases in sedimentation could affect breeding and rearing success in Jawbone and Corral Creeks for up to two years. Adult and sub-adult habitats should not be significantly compromised by sediment because high energy pools and sections of steep stream gradient should maintain good pool depth for refuge habitat. Bear Springs and Quilty Creeks likely serve as dispersal habitats for frogs breeding in the Clavey River. In these streams, slow water habitats, especially in low gradient headwater streams, could have low suitability for up to two years, but larger stream sections with higher gradient should maintain moderate to high suitability, deep water habitats.

Suitable habitats in the Clavey and Tuolumne River would not be measurably affected by cumulative impacts. These river systems are so large that the increases in sediment from all sources, including post-fire runoff, would not be sufficient to cause a reduction in suitability of habitat for any life stage or impair any biological function associated with the frog (e.g., algal growth (tadpole food) during the summer baseflow period).

Western Pond Turtle

The following locations would not have cumulative effects because there would be no risk of direct effect, a very low risk indirect effect (discountable effect on individuals and habitat), and no other federal or private action: Basin, Big Creek, Bull, Deer Lick, Eleanor, Moore, and the North Fork Merced and Tuolumne Rivers, Big Kibbie Pond, Little Kibbie Pond, and the three unnamed ponds near Yosemite Lakes Campground.

Very minor to no discernible effect to individuals would occur at the following locations: Cherry, Drew, and Hunter Creeks, and the Middle and South Fork Tuolumne Rivers. Other federal or private actions would affect up to 16 percent of the WPT buffer in these streams which would correlate to a low risk of direct impact, primarily physical disturbance. Localized areas of increased sedimentation would be apparent, but deep pool habitats would retain moderate to high suitability for the turtle. Shallow water habitats used by hatchlings should see minor reductions in suitability, but the habitat should meet the growth and development needs of the turtle.

Moderate levels of cumulative effect would be apparent at the following locations: Jawbone Creek, Grandfather and Homestead Ponds, Mud Lake, and Abernathy Meadow. For Jawbone Creek, the most apparent indirect impact would be increased sedimentation because 50 percent of the watershed would be treated and 27 percent of the buffer would be treated. Deep water habitats would have minor to moderate reductions in volume, but the gradient and stream flow increases should maintain high quality pool habitat along most of the stream. The risk of direct effect is relatively low because the majority of the WPT buffer affected is in small tributary streams that provide low suitability habitat for the turtle. As for the ponds and meadow, between 20 and 55 percent of the buffer area would be treated by other private and federal actions. Mud Lake would be affected the most with over half of the buffer treated. At this location, the risk of physical disturbance is moderate and the risk of injury or mortality is relatively low. Operations would likely occur over a three to four week period and could occur when turtles are moving into the upland if the lake volume is reduced by 50 percent or more or if salvage activities occur into October when the turtles move into the upland. The potential recruitment of LWD would be reduced on the 63 acres treated, resulting in a habitat suitability reduction from just above moderate to just below moderate. For Homestead Pond, Grandfather Pond and Abernathy Meadow, more than 68 percent of the upland habitat would be unaffected by any action. There would be a low risk of physical disturbance because operations would only last a week or two at each location (16 to 42 treatment acres). Habitat suitability relative to LWD recruitment would be maintained in most of the upland area around each habitat.

Hardhead

There would be no cumulative effects to hardhead and habitat suitability would be maintained at high levels for all streams providing suitable habitat.

Alternative 3

DIRECT AND INDIRECT EFFECTS

California Red-legged Frog

The direct and indirect effects of Alternative 3 are similar to those described in Alternative 1. Differences only exist in the quantity of breeding, non-breeding and upland habitats affected and the relative risk project activities may have on them. Those differences and how they may affect the relative risk to individual CRLF and their habitats are discussed further.

Effects to Individuals

Tree Felling and Removal

Breeding and Non-breeding Aquatic Habitat: Similar to Alternative 1, no proposed activities in Alternative 3 would overlap with suitable breeding streams. The proposed actions in Alternative 3 would overlap with 5.67 percent less of Homestead Pond (the only breeding pond directly affected) than the actions proposed in Alternative 1 (0.12 acres versus 0.17 acres, Table 3.03-7 and Table 3.03-18). Although the overall area affected is less, the risk of injury, mortality, or behavioral disturbance posed by treatments may be slightly higher because the 30 foot no cut and no equipment buffer included in Alternative 1 is not proposed in Alternative 3. In this alternative, the management requirement associated with Homestead pond requires trees be felled away from the pond. Although less prohibitive, directional felling in conjunction with other management requirements would successfully reduce the risk of injury or mortality to individuals to levels comparable to that in Alternative 1. Because, however, activities would be permitted to occur in closer proximity to the pond, behavioral disturbances are more likely in Alternative 3. Although, a disturbance would still only occur over 1 to 3 days and would not cause a long lasting, measurable effect.

Alternative 3 treatments overlap perennial and intermittent non-breeding stream habitat 14.65 percent less than Alternative 1 (5.80 miles versus 6.65 miles, Table 3.03-7 and Table 3.03-18). The reduction in overlap occurs in the streams associated with Drew Creek and also in those areas associated with Birch and Mud Lake (Table 3.03-18). The risk of injury, mortality, or disturbance to individual CRLF in these habitats would be reduced in magnitude.

Upland Habitat: Alternative 3 would overlap 8.61 percent less with CRLF upland habitat than Alternative 1 (Table 3.03-7 and Table 3.03-18). This reduction occurs within the upland habitats associated with Homestead Pond, Drew Creek and Birch and Mud Lake (Table 3.03-18). The risk of injury, mortality, or behavioral disturbance in these habitats would be measurably lower than in Alternative 1.

Burn Piles

Same as Alternative 1.

Road Treatments

Although 46.63 miles of road treatments are proposed within the CRLF upland buffer, only 1.02 miles are outside the existing road prism. The risk of injury, mortality, or disturbance is not expected to exceed that occurring under normal operations of these routes. The additional 1.02 miles of temporary road proposed in Alternative 3 is within the Birch and Mud Lake upland habitat and would be decommissioned after use. Because there are no suitable non-breeding streams in the vicinity of this temporary road, the risk of causing injury, mortality, or disturbance to CRLF is low.

Water Drafting

Same as Alternative 1.

Application of Registered Borate Compound

Same as Alternative 1.

Effects to Habitats

The amount of breeding, non-breeding, and upland habitat potentially impacted by proposed project activities in Alternative 3 is lower than in Alternative 1. Although the number of road treatment intersections with streams and the length of roads proposed to receive treatment are higher than Alternative 1, the majority of the road treatments would occur on roads already in the existing road prism. Although the actions proposed under Alternative 3 pose the same general risks and potential effects to CRLF habitats as those in Alternative 1, the overall magnitude of effect is less because project activities in Alternative 3 overlap with a smaller proportion of suitable CRLF habitats.

Increases in Sediment

Breeding and Non-breeding Aquatic Habitat: Alternative 3 would produce less sediment than Alternative 1 (Table 3.03-3), but would not impact sediment depths in breeding habitats at a level capable of altering the habitat suitability (positively or negatively) compared to the sediment generated by the effects of the Rim Fire.

The risk of increased sedimentation in CRLF non-breeding habitats is the same as Alternative 1.

Large Woody Debris

Breeding and Non-breeding Aquatic Habitat: The proportion of perennial and intermittent CRLF non-breeding aquatic habitat directly overlapping proposed project activities in Alternative 3 is small (1.71 percent). A management requirement for Alternative 3 retains 5 standing dead trees per acre within RCAs adjacent to and within 100 feet of all perennial channels to provide for future recruitment of LWD to the stream. This management requirement in conjunction with the other management requirements common to each alternative would ensure reductions in LWD recruitment would be highly localized. Therefore, the loss of LWD would not have a measurable impact on habitat suitability or be measurably different than Alternative 1.

Upland Habitat: The relative risk to CRLF upland habitats is 8.61 percent less than in Alternative 1, but the effects would be the same as those described in Alternative 1. The greatest reductions in the risk to habitat would occur within the upland habitats associated with Homestead Pond (-196 percent) and Drew Creek (-35 percent).

Sierra Nevada Yellow-legged Frog

Effects to Individuals

Tree Felling and Removal

Breeding and Non-breeding Aquatic Habitat: The actions proposed in Alternative 3 would overlap 1.96 percent less SNYLF breeding and non-breeding habitat than those proposed in Alternative 1 (Table 3.03-7 and Table 3.03-18). Units in Looney Creek have been dropped under

Alternative 3, eliminating the risk of injury, mortality, or behavioral disturbance. All other effects described under Alternative 1 apply.

Upland Habitat: The proposed actions overlap 1.34 percent less SNYLF habitat than those in Alternative 1 and the reduction occurs all within Looney Creek, eliminating the risk to frogs in the Looney Creek upland habitat. All other effects described under Alternative 1 apply.

Burn Piles

Same as Alternative 1.

Road Treatments

A total of 1.69 miles of road treatments are proposed within the SNLYF upland habitat in Alternative 3 (0.48 miles more than in Alternative 1); however, activities would occur within the existing road prism and would not create a greater risk to individual SNYLF than those under normal operations and only a minor increase in risk compared to Alternative 1.

Water Drafting

Same as Alternative 1.

Application of Registered Borate Compound

Same as Alternative 1.

Effects to Habitats

In general the direct effects of Alternative 3 would be the same as those in Alternative 1. The only difference exists at Looney Creek where no project activities are proposed in Alternative 3. The risk that proposed activities would cause an increase in sediment depth or a loss of LWD differs slightly from those described in Alternative 1 due to differences in management requirements.

Increases in Sediment

Breeding and Non-breeding Aquatic Habitat: The implementation of Alternative 3 would contribute to less sediment than Alterative 1 in every SNYLF habitat (Table 3.03-3 and Table 3.03-19). Excluding Bear Creek, the average difference between the predicted sediment depths after the implementation of Alternatives 1 and 3 is a reduction of 1.0 inch. However, at Bear Creek, Niagara Creek and Reynolds Creek, the differences may be great enough (-14.26, -3.58, and -3.17 inches respectively, Table 3.03-18) to indicate a potential beneficial effect of implementing Alternative 3. Additional management requirements in Alternative 3, including proposed acres of drop and lop to provide ground cover to mitigate the potential for erosion, are the likely drivers of the greater reduction in sediment in these three habitats. These mitigations would not occur under Alternative 1. At all other sites, Alternative 3 would not change the habitat suitability compared to Alternative 1 or the post-fire conditions.

Large Woody Debris

Breeding and Non-breeding Aquatic Habitat: The proportion of suitable SNYLF aquatic breeding habitat directly overlapping the proposed project activities in Alternative 3 is only 1.96 percent less than Alternative 1. The effects of implementing Alternative 3 would be similar to those described for Alternative 1. Despite the difference in management requirements between Alternatives 1 and 3 regarding the retention of LWD, the impact on habitat suitability would not differ from that described for Alternative 1.

Upland Habitat: Same as Alternative 1.

Foothill Yellow-legged Frog

The potential for direct and indirect effects for Alternative 3 are largely the same as those in Alternative 1. Table 3.03-13 indicates the extent to which salvage and roadside hazard abatement would affect the amount of buffer and overall area of each watershed. Table 3.03-13 also shows the number of miles of road treatment by activity type for Alternative 3. Comparing Table 3.03-13 to Table 3.03-8, there are no differences between salvage treatments (hazard tree and salvage units) between Alternatives 1 and 3. These watersheds include North Fork Merced and Tuolumne Rivers and Basin, Clavey Tributaries 1-3 and 5, Deer Lick, Grapevine, Hunter, Indian, Indian Springs, Quilty, Moore, Russell, and Scott Creeks. Direct and indirect effects described in Alternative 1 directly apply to these watersheds for Alternative 3.

There are very minor differences (less than 10 percent and mainly decreases) in either amount of salvage treatment in buffer areas or percentage of watershed area in the following watersheds: Adams, Bear Springs, Bull, Cherry, Clavey River Tributary 4, Cottonwood, Drew, Eleanor, Granite, and Reed Creeks, and the Middle and South Fork Tuolumne Rivers. The small differences between the amounts of area treated by salvage activities would not be discernible between Alternatives 1 and 3. The sediment modeling reflects little or no change in sediment delivery for these watersheds.

The following watersheds would see increases in activity from Alternative 1 to Alternative 3: Alder, Corral, and Jawbone Creeks. In Alder Creek, the amount of treatment in FYLF buffer areas increases from 0 (Alternative 1) to 34 acres and the percentage of watershed treated increases from 10 (Alternative 1) to 45 percent. This alternative includes unit L204, a forage unit in critical winter deer range, where dead trees would be removed as biomass. A review of the aerial imagery indicates widely scattered small, dead pines. The amount of disturbance created by equipment in this unit would be limited greatly (spatially) and there should be no discernible changes in sediment delivery to suitable habitat located downstream of the treatment unit.

A similar situation exists in Corral Creek where the amount of treatment in FYLF buffers increases from 81 (Alternative 1) to 106 acres (Alternative 3) and the percentage of watershed treated increases from 58 percent to 78 percent, between Alternatives 1 and 3, respectively, in critical winter deer range. The increased amount of disturbance created by additional equipment operation would increase the amount of sediment delivered to Corral Creek, especially in the lower third of the watershed. The additional sediment would slightly diminish suitability of FYLF aquatic habitat in the first year following treatment, but the steep gradient would likely transport the sediment out and to the Tuolumne River in the subsequent year.

The percentage of FYLF buffer affected by salvage logging in Jawbone Creek would increase from 13 percent in Alternative 1 to 24 percent in Alternative 3, but the total watershed area treated would decrease from 25 percent (Alternative 1) to 15 percent under Alternative 3. The increased activity in FYLF buffers would occur in the lower fourth of the watershed, and there would be a slight increase in sediment delivered to Jawbone Creek from the additional treatment units. This increase would slightly decrease aquatic habitat suitability for the FYLF because deep water refuge habitats would be reduced. The duration of effect would remain the same between alternatives because the steep gradient of the creek in this part of the watershed would effectively transport out the sediment.

For the Tuolumne and Clavey Rivers, there would be no discernible difference in impact to aquatic and riparian habitats between Alternatives 1 and 3 because the amount of sediment predicted for both alternatives is very similar (at this large watershed scale) and there would be very little or no activity in close proximity to the rivers. High suitability habitat would be maintained in these rivers and no biological impairment would occur.

Table 3.03-13 Watershed area, buffers and road treatments in FYLF suitable habitat in Alternative 3

Watershed (5th level HUC)	Stream	Percent FYLF Watershed Area Treated	FYLF Buffer Affected (acres)			Road Treatments (miles)			
			Hazard Tree	Salvage	Percent of total	Reconstruct	Maintain	New	Temp
Tuolumne River	Tuolumne River								
	Alder Cr.	45	0	34	30	3.2	0.2	0	0
	Corral Cr.	78	0	106	46	18.9	0	0	2.5
	Drew Cr.	12	12	0.4	11	1.9	3.6	0	0.6
	Grapevine Cr.	18	29	0	11	0.7	17.4	0	0
	Indian Cr.	2	1	0	less than 1	0	2.2	0	0
	Jawbone Cr.	27	5	81	25	18.6	7.3	0	5.3
Middle Fork Tuolumne River	Middle Fork Tuolumne River	17	22	255	46	57.2	12.5	0	11.9
North Fork Tuolumne River	North Fork Tuolumne River	2	0	0	0	0.4	22.7	0	0
	Basin Cr.	1	0	0	0	0.4	2.1	0	0
	Hunter Cr.	9	0	0	0	0	19.9	0	0
South Fork Tuolumne River	South Fork Tuolumne River	38	29	144	24	75.5	27.3	0	4
Cherry Creek	Cherry Cr.	13	6	36	9	29.3	9.9	0	1.6
	Eleanor Cr.	1	0	12	22	2.5	0	0	0.5
	Granite Cr.	21	0.2	36	25	12.4	1.1	0	0.1
Clavey River	Clavey River								
	Reed Cr.	20	1	49	49	18.2	24.7	0	2.1
	Adams Gulch	15	0	0	0	1.2	1.8	0	0
	Bear Springs Cr.	18	9	0.1	20	10	0.7	0	0
	Bull Meadow Cr.	36	0	36	50	4.0	0.4	0	0.8
	Indian Springs Cr.	19	3	2	25	1.4	0.1	0	0
	Quilty Cr.	5	0	0	0	0.1	1.1	0	0
	Unnamed Trib 1	16	3	0	8	0	2.9	0	0
	Unnamed Trib 2	24	0	0	0	0	2.5	0	0
	Unnamed Trib 3	69	0	26	46	0.8	10.3	0	0
	Unnamed Trib 4	48	2	1	13	3	0.7	0	0
	Unnamed Trib5	43	7	8	37	2.2	2.7	0	0
	Cottonwood Cr.	31	0	3	5	19.1	8.8	0	0.1
	Russell Cr.	30	0	0	0	0.9	2.3	0	0
North Fork Merced River	North Fork Merced River	2	22	18	less than 0.1	12.3	11.2	0	0.2
	Bull Cr.	2	5	0	less than 0.1	3.95	2	0	0.5
	Deer Lick Cr.	8	4	13	7	3.4	2.3	0	0.2
	Moore Cr.	4	5	5	3	2	3.8	0	1
	Scott Cr.	22	2	0	8	3.6	3.4	0	0

Western Pond Turtle

For 23 of the 25 aquatic features identified in Table 3.03-14, there is either no difference or very small differences (less than 2 percent) in the amount and type of treatment within WPT buffers. As such, the descriptions of environmental consequences provided for the WPT under Alternative 1 apply to Alternative 3. The two aquatic features where treatment amounts within the buffer are different are Abernathy Meadow and Mud Lake. At Abernathy Meadow, the percentage of buffer surrounding the meadow affected by salvage operations decreased from 66 acres (50 percent of total buffer area) to 26 acres (20 percent of total buffer area). The decrease in logging activity in the buffer would result in a lower potential for direct impacts to individuals, especially when the seasonal pond is losing volume and the turtles move into the upland for the summer to aestivate. The decreased logging around the meadow under this alternative would mean more trees would be available to fall and provide cover for turtles in 40 additional acres (when compared to Alternative 1). The additional amount of LWD would improve the overall upland habitat suitability, from moderate to high, in Alternative 3 compared to Alternative 1.

At Mud Lake, a similar situation would occur because the amount of buffer area treated would decrease by 9 acres (from 21 to 12 acres). This means only 10 percent of the buffer area would be treated. The direct and indirect effects discussed for Abernathy Meadow apply to Mud Lake.

Table 3.03-14 WPT buffer affected by salvage and roadside hazard tree units in Alternative 3

Watershed (5th level HUC)	Stream	WPT Buffer (acres and percent of buffer treated)	
		Salvage Units	Hazard Tree Units
Tuolumne River	Drew Cr.	27 (3 percent)	89 (9 percent)
	Jawbone Cr.	701 (22 percent)	102 (3 percent)
	Homestead Pond	15 (16 percent)	0 (0 percent)
	Three unnamed ponds	27 (10 percent)	4 (1 percent)
Middle Fork Tuolumne River	Middle Fork Tuolumne River	2113 (39 percent)	307 (6 percent)
	Abernathy Meadow	26 (20 percent)	6 (5 percent)
	Grandfather Pond	7 (9 percent)	2 (2 percent)
	Mud Lake	12 (10 percent)	0 (0 percent)
North Fork Tuolumne River	North Fork Tuolumne River	0 (0 percent)	411 (2 percent)
	Basin Cr.	0 (0 percent)	0 (0 percent)
	Hunter Cr.	0 (0 percent)	407 (2 percent)
South Fork Tuolumne River	South Fork Tuolumne River	1441 (22 percent)	537 (8 percent)
Cherry Creek	Cherry Cr.	365 (10 percent)	59 (2 percent)
	Eleanor Cr.	97 (16 percent)	0.1 (less than 1 percent)
	Big Kibbie Pond	86 (88 percent)	0 (0 percent)
	Little Kibbie Pond	52 (60 percent)	2 (2 percent)
Clavey River	Reed Cr.	438 (48 percent)	12 (1 percent)
	Cottonwood Cr.	29 (5 percent)	24 (5 percent)
North Fork Merced River	North Fork Merced River	176 (1 percent)	491 (3 percent)
	Bull Cr.	25 (less than 1 percent)	109 (1 percent)
	Deer Lick Cr.	42 (2 percent)	109 (5 percent)
	Moore Cr.	56 (2 percent)	60 (2 percent)

Hardhead

Same as Alternative 1.

CUMULATIVE EFFECTS

California Red-legged Frog

Same as Alternative 1.

Sierra Nevada Yellow-legged Frog

No SNYLF habitat will have an increase in activity and only one watershed (Reynolds Creek Tributary) would have an increase in activity leading to cumulative disturbance greater than that in Alternative 1 (Table 3.03-10 and Table 3.03-11). This disturbance however, is directly related to an increase in the acres of hazard tree treatment under Alternative 3 and not from cumulative actions. Furthermore, this treatment would only affect an additional 1 percent of the watershed and the impacts would not measurably affect habitat suitability. All other habitats would either have no change or a slight decrease in the amount of cumulative disturbance (Table 3.03-10 and Table 3.03-11), so the cumulative effects would be very similar to Alternative 1.

Foothill Yellow-legged Frog

Comparing Tables 3.03-6 (cumulative effects for Alternative 1) and 3.03-9 (cumulative effects for Alternative 3), only four watersheds (Alder, Bull Meadow, Corral, and Jawbone Creeks) would have an increase in activities. The remaining watersheds would have no change or very little decrease in the amount of buffer or watershed area treated and the cumulative effects discussions under Alternative 1 are the same or very similar for this alternative.

The four streams with increases in buffer and watershed area treated have cumulative total increases directly related to the amount of increased activity proposed under Alternative 3 and not from additional sources. That is, no cumulative effects increase is associated with private or other public activities. The environmental outcome discussed for Alder Creek would be the same for cumulative impacts in terms of risk to individuals and habitats. Jawbone and Bull Meadow Creeks would likely see high cumulative levels of physical disturbance to individuals because extensive areas of the buffer would be treated by salvage activities. The total amount of watershed area affected would also lead to extensive modification of aquatic habitats (channel filling from sedimentation) in the first two or three years following treatment. This extent of aquatic habitat modification would potentially impact breeding and tadpole development for the first two years following treatments. As a result, lower population numbers would be expected for five to seven years. Reproduction and recruitment rate in these streams would return to “normal” levels within four years of treatment and high habitat suitability would return.

Essentially all of the buffer and watershed area of Corral Creek would be impacted by some type of salvage logging. The watershed response would be uncertain and it is possible that aquatic habitat in most of Corral Creek would be unsuitable for the FYLF due to excessive sedimentation. Based on field experience during physical habitat surveys prior to the Rim Fire, there are some high gradient sections that, when combined with the anticipated increase in stream flow, should maintain small patches of moderate suitability deep water habitat. This may provide enough of a refuge for the frog to persist until additional habitat becomes available in the next two or three years. Breeding would likely not occur under these conditions for up to two years, resulting in decreased recruitment and population size for over ten years. From two to four years from present, preferred tadpole habitat could be considerably compromised because the anticipated amount of sediment would likely fill the spaces between the larger streambed substrates and reduce foraging and escape habitats. Low suitability foraging and escape habitats could lead to poor rates of survivorship and increased predation. The cumulative effects modeling for this watershed and alternative indicate the TOC would be exceeded for the next six years suggesting the channel and streambanks could be highly unstable for up to a decade. It should be noted that the erosion and sediment modeling completed for the project indicated a reduction in sediment delivery compared to the post-fire (no action) conditions and those expected from implementing Alternative 1.

Western Pond Turtle

Comparing Table 3.03-12 (cumulative effects for Alternative 1) and Table 3.03-15 (cumulative effects for Alternative 3) indicates most values in Alternative 3 for percentage of buffer affected were the same or slightly (less than 5 percent) increased or decreased from those in Alternative 1. Given the limited amount of change (or lack of change) between the values, the extent of impact and risk to individuals is very similar between alternatives and the cumulative effects discussion for Alternative 1 applies to this alternative.

Hardhead

Same as Alternative 1.

Table 3.03-15 Watershed area and FYLF and WPT buffers affected by salvage in Alternative 3

Watershed (5th level HUC) and Stream	Percent of FYLF Buffer Affected		Percent of Watershed Area Treated		Percent of WPT Buffer Affected	
	Alt 3	Alt 3+CE	Alt 3	Alt 3+CE	Alt 3	Alt 3+CE
Tuolumne River						
Alder Cr.	30	30	45	45	--	--
Corral Cr.	46	88	78	93	--	--
Drew Cr.	17	28	12	29	11	27
Grapevine Cr.	11	18	18	23	--	--
Indian Cr.	1	6	2	4	--	--
Jawbone Cr.	25	54	15	68	25	53
Homestead Pond	--	--	--	--	16	46
Middle Fork Tuolumne River						
Middle Fork Tuolumne River[1]	45	57	48	61	45	57
Abernathy Meadow	--	--	--	--	24	56
Grandfather Pond	--	--	--	--	11	30
Mud Lake	--	--	--	--	10	65
North Fork Tuolumne River						
North Fork Tuolumne River	0	2	1	6	2	6
Basin Cr.	0	0	1	5	0	less than 0.1
Hunter Cr.	6	14	9	23	8	19
South Fork Tuolumne River						
South Fork Tuolumne River[2]	10	34	36	46	31	40
Unnamed ponds near Yosemite Lakes	--	--	--	--	5	8
Cherry Creek						
Cherry Cr.	10	26	13	34	29	45
Eleanor Cr.	22	22	1	1	16	16
Big Kibbie Pond	--	--	--	--	88	88
Little Kibbie Pond	--	--	--	--	63	63
Granite Cr.	25	67	21	78	--	--
Clavey River						
Reed Cr.	50	54	20	34	50	61
Adams Gulch	0	0	15	32	--	--
Bear Springs Cr.	20	31	18	78	--	--
Bull Meadow Cr.	50	59	65	77	--	--
Indian Springs Cr.	25	25	19	29	--	--
Quilty Cr.	0	0	5	73	--	--
Unnamed Trib 1	8	8	16	16	--	--
Unnamed Trib 2	0	0	24	24	--	--
Unnamed Trib 3	46	50	69	78	--	--
Unnamed Trib 4	13	13	43	48	--	--
Unnamed Trib 5	37	37	43	45	--	--
Cottonwood Cr.	5	18	31	43	--	--
Russell Cr.	0	0	30	30	--	--
North Fork Merced River						
North Fork Merced River	2	2	3	4	4	4
Bull Cr.	less than 0.1	less than 0.1	2	2	1	1
Deer Lick Cr.	7	7	8	8	7	7
Moore Cr.	3	3	4	6	6	7
Scott Cr.	4	4	22	22	--	--

[1] Percentages calculated for the 6th level HUC Lower Middle Fork Tuolumne and not for the 5th level HUC
[2] Percentages calculated for the 6th level Lower South Fork Tuolumne River HUC

Alternative 4

Direct and Indirect Effects

As with Alternative 3, there would be very little difference implementing Alternative 4 when compared to Alternative 1 for the three sensitive aquatic species (FYLF, WPT, and Hardhead). Further, for the watersheds that differed between Alternatives 1 and 3, there are no substantial differences in amount of watershed treated between Alternatives 3 and 4. That is, the salvage and road treatments are very similar in Alternatives 3 and 4. For 30 of the 34 watersheds listed in Table 3.03-16, there are no differences in actions proposed under Alternative 3 and 4. The following watersheds have differences between Alternative 3 and 4: Cherry and Eleanor Creeks and the South Fork Tuolumne River.

California Red-legged Frog

Same as Alternative 3.

Sierra Nevada Yellow-legged Frog

Effects to Individuals

Tree Felling and Removal

Breeding and Non-breeding Aquatic Habitat: The proposed actions in Alternative 4 would overlap 16.57 percent and 8.11 percent less SNYLF breeding and non-breeding stream and pond habitat respectively, than the actions proposed in Alternative 1 and 14.37 percent and 8.11 percent less than Alternative 3 (Table 3.03-7 and Table 3.03-18). Risk of injury, mortality, or behavioral disturbance to SNYLF at Looney Creek, or along the areas of Bear Creek and Little and Big Kibbie Ponds, would not occur in Alternative 4. All other areas have the same potential effects as those described under Alternatives 1 and 3.

Upland Habitat: The proposed actions in Alternative 4 would overlap 25.91 percent less SNYLF upland habitat than Alternative 1 and 24.24 percent less than Alternative 3 (Table 3.03-7 and Table 3.03-18). The risk to SNYLF in upland habitats would be the same as those described under Alternative 1 and Alternative 3, but the overall risk to individual SNYLF is reduced.

Burn Piles

Same as Alternatives 1 and 3.

Road Treatments

Same as Alternative 3.

Water Drafting

Same as Alternatives 1 and 3.

Application of Registered Borate Compound

Same as Alternatives 1 and 3.

Effects to Habitats

In general the risk of actions proposed in Alternative 4 would be lower than those proposed in either Alternative 1 or Alternative 3 because as mentioned previously, the amount of SNYLF habitat with the potential to be directly impacted by the actions of Alternative 4 would be lower than that in the other two action alternatives (Table 3.03-7 and Table 3.03-18). The risk that actions proposed in Alternative 4 would cause an increase in sediment depth in SNYLF aquatic habitats and a loss of LWD, however, differ slightly from those described in Alternatives 1 and 3 at Bear Creek, Little and Big Kibbie Ponds, Niagara Creek, and Reynolds Creek Tributary. Those differences are discussed below.

Increases in Sediment

Breeding and Non-breeding Aquatic Habitat: For most SNYLF aquatic habitats, the changes in sediment loads are the same as those expected in Alternative 3 (Table 3.03-19) which are either less than or the same as those expected to occur from the effects of the Rim Fire. While sediment levels would be reduced at Bear Creek, Niagara Creek, and Reynolds Creek, in comparison to post-fire effects, because less salvage and hazard tree treatments are proposed in Alternative 4 in comparison to Alternative 3in the areas near and adjacent to these habitats, erosion modelling indicated that increases in sediment would be greater (Table 3.03-3 and Table 3.03-19). Modelling assumes that project activities and management requirements will add ground cover capable of mitigating erosion on the landscape. Thus, the lack of project activities and their associated management requirements in Alternative 4, result in an elevated risk of sedimentation in Bear Creek, Niagara Creek and Reynolds Creek in comparison to Alternative 3. Nonetheless, in comparison to the existing condition, the differences are expected to be so minor that any effects will be unmeasurable.

Large Woody Debris

Breeding and Non-breeding Aquatic Habitat: The actions proposed in Alternative 4 would contribute to a lesser risk of a measurable loss of LWD in the suitable habitats at Bear Creek and Little and Big Kibbie Ponds compared to both Alternatives 1 and 3, and just as in Alternative 3, project activities would cause no loss of LWD in the Looney Creek breeding or upland habitat because no project activities will occur there in Alternative 4. All of the other suitable habitats would have the same risk of effect as that described in Alternative 1 because there is no difference between the actions proposed in Alternative 4 and those proposed in Alternative 1 in these habitats (Table 3.03-18).

Upland Habitat: The proposed actions would overlap 25.91 percent less SNYLF habitat than those in Alternative 1 and 24.24 percent less than Alternative 3 (Table 3.03-7 and Table 3.03-18). The reduction in overlap exists because none of the acres of salvage units or hazard tree abatement under Alternative 1 within the Looney Creek, Bear Creek, and Little Kibbie Pond habitat exist under Alternative 4. The risk to upland habitats would be the same for areas where project activities still overlap as those described under Alternatives 1 and 3. However, the proposed actions in Alternative 4 would reduce the overall risk of impacting SNYLF upland habitat due to fewer disturbances.

Foothill Yellow-legged Frog

Similar to Alternative 1 acreage, salvage activities would treat 54 acres of buffer in Cherry Creek. The environmental outcome based on this amount of buffer treated would be very similar to the outcome stated for Alternative 1; however, the total amount of watershed area treated in this alternative would be 594 acres less than what would be treated in Alternative 1 (3,302 acres in Alternative 1 versus 2,708 acres in Alternative 4). There may be a tradeoff in terms of sediment delivery to Cherry Creek between more acres treated in the FYLF buffer and fewer acres treated in total for the watershed, meaning slightly more sediment may come from the additional buffer areas and less from the non-buffer watershed acres. The sediment modeling indicated a 4 percent overall decrease in sediment delivery to the creek between Alternative 4 and Alternative 1. A change this small means there may be no detectable difference between the two alternatives and the categorization of Cherry Creek under Alternative 1 applies to this alternative.

Eleanor Creek would have no change to the amount of FYLF buffer affected by salvage operations, but there would be an 83 acre decrease in total watershed area affected by salvaging. This is a 15 percent reduction in acres treated compared to Alternative 1. The reduced amount of salvage activity would mean a slight reduction in sediment delivery to Eleanor Creek, but the magnitude of effect would be very small and may not be discernible from Alternative 1. The sediment modeling indicated a slight decrease in sediment delivery for this watershed between this alternative and Alternative 1, a difference of 482 tons (13,982 tons in Alternative 1 versus 13,496 tons in Alternative 4) or 3 percent.

For the South Fork Tuolumne River, the percentage of buffer treated in all action alternatives is the same, but the amount of watershed area treated decreases by 132 acres between Alternative 1 and Alternative 4. This difference in area treated would not have a detectable difference than that of Alternative 1. The discussion for Alternative 1, therefore, applies to this alternative.

Table 3.03-16 Buffer and watershed area affected in FYLF suitable habitat in Alternative 4

Watershed (5th level HUC)	Stream	Percent FYLF Watershed Treated	FYLF Buffer Affected (acres)			Road Treatments (miles)			
			Hazard tree	Salvage	Percent of total	Reconstruct	Maintain	New	Temp
Tuolumne River	Tuolumne River								
	Alder Cr.	45	0	34	30	3.2	0.2	0	0
	Corral Cr.	78	0	106	46	19.6	0.2	0	1.7
	Drew Cr.	12	12	0.4	11	1.9	3.6	0	0.6
	Grapevine Cr.	18	29	0	11	0.7	17.4	0	0
	Indian Cr.	2	1	0	less than 1	0	2.2	0	0
	Jawbone Cr.	27	5	81	25	18.6	7.3	0	5.3
Middle Fork Tuolumne River	Middle Fork Tuolumne River	17	22	255	46	57.2	12.5	0	11.9
North Fork Tuolumne River	North Fork Tuolumne River	2	0	0	0	0.4	22.7	0	0
	Basin Cr.	1	0	0	0	0.4	2.1	0	0
	Hunter Cr.	9	0	0	0	0	19.9	0	0
South Fork Tuolumne River	South Fork Tuolumne River	38	29	144	24	75.8	27	0	4
Cherry Creek	Cherry Cr.	13	6	36	9	30.8	8.8	0	1.8
	Eleanor Cr.	1	0	12	22	2.5	0	0	0.5
	Granite Cr.	21	0.2	36	25	12.4	1.1	0	0.1
Clavey River	Clavey River								
	Reed Cr.	20	1	49	49	22.4	20.6	0	3.7
	Adams Gulch	15	0	0	0	1.2	1.8	0	0
	Bear Springs Cr.	18	9	0.1	20	10	0.7	0	0
	Bull Meadow Cr.	36	0	36	50	4.0	0.4	0	0.8
	Indian Springs Cr.	19	3	2	25	1.4	0.1	0	0
	Quilty Cr.	5	0	0	0	0.1	1.1	0	0
	Unnamed Trib 1	16	3	0	8	0	2.9	0	0
	Unnamed Trib 2	24	0	0	0	0	2.5	0	0
	Unnamed Trib3	69	0	26	46	0.8	10.3	0	0
	Unnamed Trib 4	48	2	1	13	3	0.7	0	0
	Unnamed Trib 5	43	7	8	37	2.2	2.7	0	0
	Cottonwood Cr.	31	0	3	5	19.1	8.8	0	0.1
	Russell Cr.	30	0	0	0	0.9	2.3	0	0
North Fork Merced River	North Fork Merced River	2	22	18	less than 0.1	12.3	11.2	0	0.2
	Bull Cr.	2	5	0	less than 0.1	3.95	2	0	0.5
	Deer Lick Cr.	8	4	13	7	3.4	2.3	0	0.2
	Moore Cr.	4	5	5	3	2	3.8	0	1
	Scott Cr.	22	2	0	8	3.6	3.4	0	0

Western Pond Turtle

For the WPT, all timber removal activities (hazard tree and salvage) proposed in Alternative 4 are the same as those proposed in Alternative 3; therefore, the effects analysis for Alternative 3 applies to this alternative. There are two exceptions to this statement and they involve Big and Little Kibbie Ponds (Table 3.03-17). Under Alternative 4, the total amount of combined salvage activity would affect 63 acres of the WPT buffer at Big Kibbie Pond and 29 acres of buffer area at Little Kibbie Pond. This is compared to the 86 and 54 acres proposed for treatment under Alternatives 1 and 3. The amount of activity in WPT buffers under Alternative 4 would lessen the potential for direct and indirect effects to individuals and upland habitat suitability. The lower amount of activity around these two ponds would decrease the total amount of time equipment and personnel spend in upland habitats which should decrease the potential for direct effect to any given individual. This would reduce the potential for injury, mortality, or physical disturbance.

From an indirect effect perspective, the primary difference between Alternative 4 when compared with Alternatives 1 and 3 would be an increase in LWD in upland habitats. Full recruitment potential would occur for all trees in the 25 or so acres that would not be treated. These unaffected acres would have the highest habitat suitability for the capability of the site when compared to the other action alternatives. The LWD is used by turtles as refuge habitat. There would be no detectable difference in sediment delivery to either feature when compared to Alternative 1 because the hillslopes next to these two ponds have very low gradient (less than 10 percent). Low gradient hillslopes are typically capable of retaining sediment and not transporting it downslope.

The differences in road treatment actions are discussed under FYLF and apply to the WPT at the watershed scale. The discussion of effects to FYLF habitat applies to the WPT because there is high habitat association between the two species and because the road-stream interaction occurs in a predictable way regardless of the species involved.

Table 3.03-17 WPT buffer affected by salvage and roadside hazard tree units in Alternative 4

Watershed (5th level HUC)	Stream	WPT Buffer (acres and percent of buffer treated)	
		Salvage Units	Hazard Tree Units
Tuolumne River	Tuolumne River		
	Drew Cr.	27 (3%)	89 (9%)
	Jawbone Cr.	701 (22%)	102 (3%)
	Homestead Pond	15 (16%)	0 (0%)
	Three unnamed ponds	27 (10%)	4 (1%)
Middle Fork Tuolumne River	Middle Fork Tuolumne River	2,113 (39%)	307 (6%)
	Abernathy Meadow	26 (20%)	6 (5%)
	Grandfather Pond	7 (9%)	2 (2%)
	Mud Lake	12 (10%)	0 (0%)
North Fork Tuolumne River	North Fork Tuolumne River	0 (0%)	411 (2%)
	Basin Cr.	0 (0%)	0 (0%)
	Hunter Cr.	0 (0%)	407 (2%)
South Fork Tuolumne River	South Fork Tuolumne River	1,441 (22%)	537 (8%)
Cherry Creek	Cherry Cr.	365 (10%)	59 (2%)
	Eleanor Cr.	97 (16%)	0.1 (less than 1%)
	Big Kibbie Pond	63 (64%)	19 (19%)
	Little Kibbie Pond	29 (34%)	19 (19%)
Clavey River	Clavey River		
	Reed Cr.	438 (48%)	12 (1%)
	Cottonwood Cr.	29 (5%)	24 (5%)
North Fork Merced River	North Fork Merced River	176 (1%)	491 (3%)
	Bull Cr.	25 (less than 1%)	109 (1%)
	Deer Lick Cr.	42 (2%)	109 (5%)
	Moore Cr.	56 (2%)	60 (2%)

Hardhead

Same as Alternatives 1 and 3.

CUMULATIVE EFFECTS

California Red-legged Frog

Same as Alternatives 1 and 3.

Sierra Nevada Yellow-legged Frog

The cumulative effects described under Alternative 3 are the same as Alternative 4 except at Bear Creek, Niagara Creek, and Reynolds Creek Tributary where the amount of habitat cumulatively affected is decreased because fewer acres are proposed in Alternative 4.

Foothill Yellow-legged Frog

The cumulative actions proposed under Alternative 4 are the same as Alternative 3 except for Cherry and Eleanor Creeks. For these two exceptions, the amount of buffer affected increased to about the levels in Alternative 1. The cumulative effects discussion for these two streams can be found under Alternative 1.

Western Pond Turtle

The types and extent of activities described in Alternative 3 are unchanged for Alternative 4 for all but two locations: Big and Little Kibbie Ponds. For the remaining locations, the cumulative effects analysis for Alternative 1 applies to the WPT in Alternative 4. At Big Kibbie Pond, there would be a reduction in cumulative percentage of buffer area affected from 88 percent in Alternatives 1 and 3 to 64 percent under Alternative 4. At Little Kibbie Pond, there would be a reduction in cumulative percentage of buffer area affected from 63 percent in Alternatives 1 and 3 to 29 percent under Alternative 4. These reductions are related to the differences in actions proposed in the alternatives rather than from cumulative sources. There would be no other actions around the ponds other than those described for Alternative 4. Cumulatively, though, there would be a lower risk of direct impact to individuals in aquatic or upland habitats with the largest reduction occurring at Little Kibbie Pond. LWD supply and recruitment as a habitat element would be higher under this alternative and the habitat suitability would be high given the current capability.

Hardhead

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

California Red-legged Frog

The implementation of Alternative 1 poses the greatest risk to individual CRLF and their habitats although the risk is low. Breeding habitat overlaps with project activities at only 1 site (Homestead Pond) and overlap with non-breeding habitat is also relatively low (Table 3.03-7 and Table 3.03-18). Upland habitats have the greatest proportion of overlap with project activities (Table 3.03-7 and Table 3.03-18). In general the risk to CRLF and their habitats is lower under Alternatives 3 and 4 because there is less overlap with project activities.

Possible direct effects to individuals include injury, mortality, or behavioral disturbance. The direct effects to aquatic habitats are minimized by management requirements prohibiting operations within and adjacent to aquatic features. The upland habitat would be at a greater risk of direct effects from microclimate alterations affecting temperature and moisture levels required by the CRLF and a loss of LWD and other structures commonly used by CRLF as refuge. A limited operating period in conjunction with other management requirements should mitigate these risks.

A potential increase of sediment depth in breeding and non-breeding habitat is the most likely effect to CRLF habitats, but the effects under Alternatives 1, 3 and 4 are likely to be negligible in comparison to the increases in sediment from the effects of the Rim Fire (Table 3.03-3 and Table 3.03-19).

Sierra Nevada Yellow-legged Frog

Similar to the CRLF, the implementation of Alternative 1 poses the greatest risk to individual SNYLF and their habitats although the risk is low, and little difference exists between the action alternatives. For the majority of SNYLF suitable habitat the Alternatives are the same (Table 3.03-11). Looney Creek would have the least risk under Alternatives 3 and 4 while Bear Creek, Little Kibbie Pond, and Big Kibbie Pond would have the least risk under Alternative 4 (Table 3.03-18).

Table 3.03-18 Comparison of CRLF and SNYLF suitable habitat at risk of direct effects

Habitat	Alternative 1[1]	Alternative 2	Alternative 3	Alternative 4
California red-legged frog				
Birch and Mud Lakes[2]	0(0)	0(0)	0(0)	0(0)
Miles of Non-Breeding (Per and Int.)	2.22(29.96)	0(0)	2.12(28.61)	2.12(28.61)
Acres of Upland	801.49(27.66)	0(0)	800.53(27.63)	800.53(27.63)
Drew Creek[3]	0(0)	0(0)	0(0)	0(0)
Miles of Non-Breeding (Per and Int.)	0.97(10.99)	0(0)	0.21(2.37)	0.21(2.37)
Acres of Upland	352.06(9.77)	0(0)	260.20(7.22)	260.20(7.22)
Harden Flat[2]	0(0)	0(0)	0(0)	0(0)
Miles of Non-Breeding (Per and Int.)	0.36(5.71)	0(0)	0.36(5.71)	0.36(5.71)
Acres of Upland	207.32(13.58)	0(0)	207.84(13.62)	207.84(13.62)
Homestead Pond[2]	0.17(100)	0(0)	0.12(70.59)	0.12(70.59)
Miles of Non-Breeding (Per and Int.)	0(0)	0(0)	0(0)	0(0)
Acres of Upland	181.60(8.86)	0(0)	61.42(3.00)	61.42(3.00)
Hunter Creek and Ponds[4]	0(0)	0(0)	0(0)	0(0)
Miles of Non-Breeding (Per and Int.)	3.10(8.83)	0(0)	3.10(8.83)	3.10(8.83)
Acres of Upland	1,137.05(9.87)	0(0)	1,137.05(9.87)	1,137.05(9.87)
Sierra Nevada yellow-legged frog				
Bear Creek[3]	0.77(97.08)	0(0)	0.77(97.08)	0.01(1.59)
Acres of Upland	15.55(95.67)	0(0)	15.55(95.67)	0.79(4.83)
Cherry Creek Tributary[3]	0.08(5.65)	0(0)	0.08(5.65)	0.08(5.65)
Acres of Upland	1.56(5.59)	0(0)	1.56(5.59)	1.56(5.59)
Jawbone Creek[3]	1.30(28.73)	0(0)	1.30(28.73)	1.30(28.73)
Acres of Upland	27.04(29.85)	0(0)	27.04(29.85)	27.04(29.85)
Little Reynolds Creek	0.88(24.41)	0(0)	0.88(24.41)	0.88(24.41)
Acres of Upland	18.46(25.58)	0(0)	18.46(25.58)	18.46(25.58)
Looney Creek[3]	0.12(4.63)	0(0)	0(0)	0(0)
Acres of Upland	2.73(5.34)	0(0)	0(0)	0(0)
Lost Creek[3]	0.28(14.99)	0(0)	0.28(14.99)	0.28(14.99)
Acres of Upland	4.09(10.90)	0(0)	4.09(10.90)	4.09(10.90)
Niagara Creek[3]	1.07(73,95)	0(0)	1.07(73,95)	1.07(73,95)
Acres of Upland	20.17(47.44)	0(0)	20.17(47.44)	20.17(47.44)
Reynolds Creek Tributary[3]	0.08(10.01)	0(0)	0.08(10.01)	0.08(10.01)
Acres of Upland	2.10(12.24)	0(0)	2.10(12.24)	2.10(12.24)
Richards Creek[3]	0.59(50.69)	0(0)	0.59(50.69)	0.59(50.69)
Acres of Upland	8.75(37.18)	0(0)	8.75(37.18)	8.75(37.18)
White Fir Creek[3]	1.09(58.35)	0(0)	1.09(58.35)	1.09(58.35)
Acres of Upland	14.48(38.82)	0(0)	14.48(38.82)	14.48(38.82)
Little and Big Kibbie Ponds[2]	1.28(100)	0(0)	1.28(100)	0.74(93.00)
Acres of Upland	133.97(77.70)	0(0)	133.97(77.70)	65.57(54.36)

[1] Percent values are included in parenthesis represent the percent of each individual habitat affected.
[2] Non-parenthetical values = acres
[3] Non-parenthetical values = miles
[4] Non-parenthetical values represent the acres and miles.

Possible direct effects to individuals include injury, mortality, or behavioral disturbance. Direct effects to aquatic habitats are not expected to occur because management requirements prohibit operations within and adjacent to aquatic features. The upland habitat would be at greater risk of direct effects in comparison to the breeding and non-breeding aquatic habitats, although in comparison to CRLF, the upland habitat of SNYLF are less important to their overall survival because of their close affinity to water and the lack of habitats in close enough proximity to one another to elicit overland movements.

A potential increase of sediment depth in breeding and non-breeding habitat is the most likely effect SNYLF habitats may experience, but the effects of implementing the actions proposed under Alternatives 1, 3 and 4 are negligible to minor in comparison to the increases in sediment from the effects of the Rim Fire (Table 3.03-3 and Table 3.03-19).

Table 3.03-19 Post-fire and post-implementation sediment depths in breeding habitats

Habitat	Post-Fire[1] (Alternative 2)	Alternative 1	Alternative 3	Alternative 4
California red-legged frog				
Birch Lake	0.24	0.05	-0.02	-0.02
Mud Lake	0.00	0.00	0.00	0.00
Drew Creek	27.75	0.02	-0.81	-0.81
Harden Flat Pond 1	4.96	0.07	-0.20	-0.20
Harden Flat Pond 2	0.05	0.00	0.05	0.05
Homestead Pond	3.04	0.00	0.00	0.00
Hunter Creek	16.65	-0.02	-0.33	-0.33
Hunter Creek Pond 1	3.08	-0.02	0.00	0.00
Hunter Creek Pond 2	10.39	0.15	0.01	0.01
Hunter Creek Pond 3	1.64	0.00	0.00	0.00
Hunter Creek Pond 4	6.22	0.01	-0.06	-0.06
Hunter Creek Pond 5	13.65	0.12	-0.06	-0.06
Sierra Nevada yellow-legged frog				
Bear Creek	40.18	-4.22	-14.26	-3.29
Cherry Creek Tributary	21.45	-0.07	-1.65	-1.65
Jawbone Creek	18.54	-0.46	-1.90	-1.90
Little Reynolds Creek	2.11	0.06	-0.05	-0.05
Looney Creek	2.59	0.01	-0.02	-0.02
Lost Creek	1.50	0.12	-0.10	-0.10
Niagara Creek	17.03	-0.49	-3.58	-0.86
Reynolds Creek Tributary	13.61	-0.63	-3.17	-0.23
Richards Creek	18.46	0.52	-0.13	-0.13
White Fir Creek	5.75	0.09	-1.14	-1.14
Little Kibbie Pond	0.02	0.01	0.00	0.00
Big Kibbie Pond	0.02	0.01	0.00	0.00

[1] Post-fire values listed are the worst-case scenario (100 percent transport and 100 percent storage) as shown in Table 3.03-2, all other values listed are the change in inches from post-fire.

Foothill Yellow-legged Frog

Very little difference exists between the action alternatives for most of the aquatic features assessed for the FYLF. There appears to be a direct correlation between the amount of salvage related activity on private and public lands and the prevalence of moderate and high vegetation severity fire. This correlation means that more severely burned watersheds have higher levels of salvage activity in addition to higher levels of post-fire watershed response. The environmental outcomes in the high burn severity and salvage activity watersheds are similar in that there would be more activity in the upland buffer areas for the species and a greater risk of greatly increased sedimentation of aquatic habitats. These excess sediment-related effects would disproportionately decrease habitat suitability in smaller streams because they may not be as effective at mobilizing and transporting the sediment. In some cases, unsuitable habitat could occur at small spatial scales within a watershed, but, in most cases, patches of moderate to high suitability habitat would persist. Within five to seven years, the sediment transport-storage balance should be regained in most streams and more “normal” watershed processes would resume. Reproduction and recruitment may be adversely affected in some aquatic habitats and population size would be expected to decrease for up to ten years in the most severely burned and logged watersheds. In general, the recruitment of LWD should only be affected to a minor degree because most streams would have extensive areas of unsalvaged forest adjacent to the water. However, some streams, like Corral, Jawbone, and Granite Creeks, could have a significant reduction in recruitment rates of LWD and these effects could persist for 150 years or more.

Western Pond Turtle

Same as FYLF.

Hardhead

No differences exist between effects to hardhead or their habitats. High suitability habitat for all lifestages would be maintained in the lower North Fork Tuolumne and Clavey Rivers and habitat for adult and sub-adult lifestages would not be measurably affected by any or all actions.

3.04 Cultural Resources

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The Forest Service is directed to identify, evaluate, treat, protect, and manage cultural resources by several laws. The National Historic Preservation Act (NHPA) as amended (16 U.S.C. 470 et seq.) provides comprehensive direction to federal agencies regarding historic preservation. Executive Order 11593, entitled *Protection and Enhancement of the Cultural Environment*, also includes direction about the identification and consideration of cultural resources in federal land management decisions.

The NHPA extends the policy in the Historic Sites Act of 1935 (49 Stat. 666; 16 U.S.C. 461-467) to include resources that are of State and local significance, expands the NRHP, and establishes the Advisory Council on Historic Preservation and State Historic Preservation Officers. NHPA Section 106 directs all federal agencies to take into account effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. The Advisory Council on Historic Preservation (ACHP) regulations (36 CFR 800) implements NHPA Section 106. NHPA Section 110 sets inventory, nomination, protection, and preservation responsibilities for Federally-owned cultural resources.

Section 106 of the NHPA and the ACHPs implementing regulations, *Protection of Historic Properties* (36 CFR Part 800), require that federal agencies take into account the effect of their undertakings on cultural resources, and that agencies provide the ACHP with an opportunity to comment on those undertakings. Programmatic agreements (36 CFR 800.14(b)) provide alternative procedures for complying with 36 CFR 800.

The Stanislaus National Forest developed a specialized agreement: “Programmatic Agreement Among the United States Forest Service, Stanislaus National Forest, The California State Historic Preservation Officer, and the Advisory Council on Historic Preservation, Regarding the Compliance with the National Historic Preservation Act for Proposed Actions Pertaining to the Rim Fire Recovery and the Adverse Effects to Historic Properties caused by the Rim Fire Emergency, Tuolumne County, California (Rim PA).” This agreement defines the Area of Potential Effects (APE) (36 CFR 800.4(a)(1)) and includes a strategy outlining the requirements for cultural resource inventory, evaluation of cultural resources, and effect determinations; it also includes protection and resource management measures that may be used where effects may occur. Additionally, this agreement provides unique and necessary opportunities to remove both commercial value timber and hazard trees from within site boundaries utilizing a variety of harvest methods including one-end suspension and rubber tired machinery. Removal of these trees benefits the long term recovery and preservation of cultural resource sites by reducing future fuel build-up and fire weakened trees that could fall and impact already fragile resources.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Cultural Resources

- Removal of salvage timber and hazard trees adjacent to Maintenance Level 2 roads through mechanical, cable and helicopter harvest methods will have no adverse effect to cultural resources.
- New road construction, reconstruction, maintenance and construction of temporary roads will not affect the integrity of cultural resource sites within the project boundary.
- Removal of hazard trees and commercial value logs from within site boundaries can have a beneficial effect on cultural resources. Harvest of these trees would lessen the potential for

damage to already fragile bedrock mortar outcrops and historic earthworks such as ditches, roads trails and railroad grades.

- Use of existing breaches within linear sites such as historic railroad grades, trails, roads and ditches will cause no adverse effect to cultural resources.
- Use of existing water and rock quarry sources and development of new sources are not anticipated to affect cultural resources.
- According to the Rim PA, all archaeological and historical sites identified within the APE for all alternatives are considered cultural resources for the purposes of this undertaking, unless they already have been determined not eligible in consultation with the SHPO or through other agreed on procedures (36 CFR 60.4; 36 CFR 800).
- Activities outlined within the EIS, when combined with the past, present and foreseeable future actions are not expected to cumulatively lead to increased impacts to cultural resources.

Data Sources

- Site specific cultural resource inventories conducted between 1986 to present (which meet current archaeological survey standards) were utilized. The primary objectives of these surveys were to identify cultural resources in the APE that may be affected by the undertaking and collect information on their current condition.
- Existing information from cultural resource records, historic archives, maps, and GIS spatial layers were also used.

Cultural Resources Indicators

Indicators of direct and indirect effects include:

- Exposure of surface and subsurface artifacts through the removal of commercial value timber, hazard trees, and temporary and new road construction.
- The degree to which the integrity of historic property values are diminished.

Cultural Resources Methodology by Action

The 2013 Rim Fire on the Stanislaus National Forest, while destructive, also provided the rare opportunity to have an unimpeded view of the forest floor. Utilizing previous archaeological inventories from past projects that meet current survey standards (1986 to present) nearly 53 percent of the proposed treatment areas were eliminated from further inventory. A strategy was developed to intensively survey (15- to 30-meter interval spacing) the remaining treatment areas. The strategy is consistent with the Rim PA.

Affected Environment

Cultural resources are archaeological, cultural, and historical legacies from our past that are more than 50 years old. Cultural resource information, combined with environmental data, can illuminate past relationships between people and the land. Cultural-ecological relationships, the result of both natural processes and 10,000 years of human interaction in the central Sierra Nevada, are key topics in this region’s anthropological, archaeological, and historical research.

The Stanislaus National Forest currently contains 4,538 recorded prehistoric and historic archaeological sites (cultural resources). The vast majority of these (2,708) represent prehistoric Native Americans and ethnographic Miwok and Washoe land use. These include seasonal villages, temporary camps, toolstone quarries, and bedrock mortar milling locations. Today, the Miwok still actively use the Forest for gathering traditional food and medicine plants, hunting, and conducting ceremonies.

The project area contains 1,501 recorded sites representing historic land use of the Forest. These include emigrant trails, historic cabins, roads, bridges, lumber or mining complexes and camps, ditches, homesteads, grazing camps, arbor glyphs (tree carvings), railroad grades, trestles, mining shafts and adits, and Forest Service administrative buildings and compounds. All of the historic sites found in the Forest date from 1846 to the present.

Since people today favor many of the areas preferred by Native people, 329 sites have both a prehistoric and historic component.

Existing Conditions

This project encompasses the Forest's largest Section 106 compliance project in relation to a catastrophic wildfire event. The scale of the undertaking requires that an extensive field survey be conducted to identify cultural resources within the APE that may be affected by the various projects proposed under the post fire recovery undertaking.

The Rim Recovery project identifies 30,402 acres for salvage with an additional 15,253 acres of Maintenance Level 2 roads for hazard tree removal. These 45,655 acres constitute the Rim Recovery project APE. A pre-field review determined that 26,425 acres of the APE had been previously surveyed for cultural resources through various other projects. An additional 7,921 acres were eliminated due to slopes greater than 40 percent. The result of these surveys identified 1,901 prehistoric and historic properties within the project boundary of which 756 are located within or adjacent to treatment units and adjacent to Maintenance Level 2 roads likely to be affected by this project.

Of these 756 properties, 244 are prehistoric sites related to food processing (bedrock milling features), stone tool processing (lithic scatters) and temporary living areas (rock shelters). These sites are associated to land use by the native inhabitants of the region, known as the Central Sierra Miwok. The 756 properties include 401 historic sites related to railroad logging (camps, grades and associated features), mining (mines, hydraulic mining areas, water conveyance ditches), water development (dams and water conveyance ditches), grazing (structures and fence lines) and homesteading (structure remains). Also, 44 sites are multi-component (both prehistoric and historic) sites. The remaining sites are noted but not recorded through previous undertakings and will be documented prior to implementation.

The remaining 12,685 acres are identified by Heritage Resource Specialists as needing archaeological survey in order to ensure the protection and preservation of cultural resources. This survey will be completed prior to project implementation as stipulated in the Rim PA.

Contemporary Native American Use

From the onset of the Rim Fire incident, the Forest Archaeologist consulted with the Tuolumne Me-Wuk Tribal Council regarding protection of traditional collection areas and sites significant to the Miwok people. Native peoples continue to utilize the area for traditional gathering and will continue to do so.

Historic Use

Historic records, maps and oral accounts encompassing the project boundary indicate intensive land use since the Gold Rush era (1849) especially in the areas of mining, water development, railroad logging, and ranching. Numerous mines were located along the Eastern Belt, a zone of auriferous quartz veins in black slate or grandodiorite which ran parallel and east of the Mother Lode. Gold was also extracted from the Tertiary alluvial gravels with the development of hydraulic mining through 1884. In order to supply the mines and associated communities of Big Oak Flat and Second Garotte with sufficient water, a system of ditches and flumes was built by the Golden Rock Water Company in the late 1850s to distribute water from the Middle and South Fork Tuolumne Rivers. Remnants of the Golden Rock Ditch system and other lesser known systems run through many parts of the Rim

Fire burn area. One of the Golden Rock's major engineering feats, the Inverted Syphon and the Big Gap Flume, is listed on the National Register of Historic Places.

During the first three decades of the last century, four major railroad logging systems were built into the Tuolumne and Merced River drainage basins: West Side Lumber Company (1899); Yosemite / Sugar Pine Lumber Company (1907); Hetch Hetchy Railroad (established 1917) and the associated railroad logging operation; and California Peach and Fig Growers (1917), extending from Hetch Hetchy Junction (5 miles southwest of Chinese Camp) to Hetch Hetchy Valley. The Rim Fire affected portions of all four railroad logging systems to various degrees. Associated features affected by the event include railroad grades, trestles, inclines, cut and fill structures, logging camps, donkey sets and associated equipment.

Presently, 14 grazing allotments are either wholly or partially affected by the Rim Fire. Historic records, maps and oral accounts encompassing the allotment boundaries indicate intensive livestock grazing occurred from the 1850s to the early 1920s. Some of the existing trail system is likely connected to moving livestock to summer pasturage. Associated features affected by the fire include fences, wooden troughs and collapsed wooden structures (range cabins).

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Potential direct effects include displacement and/or obliteration of surface and subsurface deposits from mechanical harvest and road treatments. Activities conducted during this project have the potential to uncover previously unknown cultural resources where deposits are largely subsurface.

Pursuant to the Rim PA, all sites will be delineated with coded flagging and/or other effective marking (i.e., "flag and avoid) for protection prior to project implementation. Where opportunities are identified and approved by the Forest Archaeologist, the Forest will implement Stipulation III (G)(b) of the Rim PA in order to harvest commercial value timber and hazard trees from within site boundaries utilizing a variety of harvest methods including one-end suspension, a feller-buncher and rubber tired machinery. Removal of these trees will benefit the long term recovery and preservation of cultural resource sites by reducing future fuel build-up and fire weakened trees that could fall and impact already fragile resources. These alternative methods are low risk, and pose only minimal temporary impact in the form of light surface scrapes to cultural resources. In all cases Forest heritage resource specialists will be present to authorize and direct access within site boundaries. Also, sites may be avoided through project redesign.

Additionally, Alternative 1 is not anticipated to have any effects on cultural values, particularly plant species important to California Indian Basketweavers or other Native American gatherers.

A potential indirect effect resulting from the Rim Fire incident is the exposure of an infinite number of historic and prehistoric properties to potential human vandalism and to looting for financial and personal gain. However, harvest of timber, removal of hazard trees and treatment of fuels from within and around site boundaries will benefit cultural resources by limiting or eliminating the appearance of "timber/vegetation islands" indicating the location of a cultural site. Post-project monitoring of sites is a requirement to determine the effectiveness of treatments and lessen the potential for unanticipated effects.

Due to implementation of management requirements and monitoring, no effects to historic and prehistoric properties are anticipated under Alternative 1.

Cumulative Effects

All projects listed in Cumulative Effects Analysis (Appendix B) have been or will be subject to NHPA Section 106 compliance and potential effects to cultural resources would be identified at that time following stipulations in the Rim PA.

Alternative 1, when combined with the past, present and foreseeable future actions and events are not expected to cumulatively lead to increased impacts to cultural resources.

Alternative 1 would lessen the effects of future wildfire on these sites, protect fragile resources and return the ecological setting or appearance to the time of the Native American presence, thus preserving those values that would make these sites significant and allow for future studies.

Alternative 2 (No Action)

Direct and Indirect Effects

The no action alternative would present a low risk to cultural resources. There would be no new or increased ground-disturbing activities in the areas of known cultural resource sites, and therefore no direct effects would occur with Alternative 2.

Indirect effects to the cultural resources may occur through inaction. The existing threat of fire-weakened trees falling naturally, and potentially damaging already fragile cultural resources, would continue unabated in the areas of cultural resources. The actions presented in Alternatives 1, 3 and 4 would serve to better control the placement of felled salvage and hazard trees to avoid cultural resources, and therefore reduce the potential for ground disturbance to cultural sites. The lack of action can adversely affect cultural resources through natural mortality where fire-weakened trees may uproot within archaeological sites creating increased ground disturbance and damaging already fragile resources. Additionally, the reduced ground cover resulting from the lack of timber treatments may result in increased site visibility and subsequent site looting and vandalism.

Cumulative Effects

Alternative 2, when combined with the past, present and foreseeable future actions, is expected to cumulatively lead to a potentially moderate increase of impacts to cultural resources. As stated above, Alternative 2 may have an indirect effect to cultural resources where lack of treatments within and around cultural resource sites may increase the potential for ground disturbance and damage to site features.

Alternative 3

Direct and Indirect Effects

The potential effects in Alternative 3 are similar to Alternative 1. Additionally, watershed treatments, including removal of conifers that are encroaching in meadows, not only improve water tables but restore the ecological setting and appearance to the time of the Native American presence. This alternative is not anticipated to have any effects on cultural values, particularly plant species important to California Indian Basketweavers or other Native American gatherers.

Due to implementation of management requirements and monitoring, no effects to historic and prehistoric properties are anticipated under Alternative 3.

Cumulative Effects

Same as Alternative 1.

Alternative 4

Direct and Indirect Effects

Same as Alternative 3.

CUMULATIVE EFFECTS

Same as Alternative 3.

Summary of Effects Analysis across All Alternatives

For all action alternatives, commercial timber harvest, hazard tree removal along lower quality roads, new construction, reconstruction, and construction of temporary roads would have no direct effect, minimal indirect effects and no cumulative effects to cultural resources. Anticipated effects for Alternatives 3 and 4 are the same as Alternative 1. There are no anticipated direct effects and moderate indirect and cumulative effects to cultural resources under Alternative 2 (No Action), as no project activity would occur.

3.05 Fire and Fuels

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Forest Service Handbook includes: All available methods for mitigation of danger tree hazards should be considered and applied as appropriate to local situations. These methods include but are not limited to commercial timber sales, land stewardship contracts, funds for burned area emergency rehabilitation, sales of firewood for personal use, and expenditure of appropriated funds (USDA FSH 7709.59 sec 41.7, 2e).

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan. In addition, the Forest Plan Direction includes broad scale goals for fire and fuels that apply to this project:

- Provide a cost-effective fire management program to protect Forest resources, life and property from the effects of wildfire. Maintain natural and activity fuels at levels commensurate with minimizing resource losses from wildfire (p. 5).
- Treat fuels in a manner that significantly reduces wildland fire intensity and rate of spread, thereby contributing to more effective fire suppression and fewer acres burned (p. 13)
- Treat hazardous fuels in a cost-efficient manner to maximize program effectiveness (p. 13).
- Strategically place treatment areas across landscapes to interrupt potential fire spread, removing sufficient material in treatment areas to cause a fire to burn at lower intensities and slower rates of spread compared to untreated areas, and considering cost-efficiency in designing treatments to maximize the number of acres that can be treated under a limited budget (p. 14).

Effects Analysis Methodology

Assumptions Specific to Fire and Fuels

- Vegetation Condition and Post-Fire Recovery will be similar to past fires in this area.
- Historical Weather represents future conditions in these locations.

Data Sources

- LANDFIRE Data Access Tool
- Forest GIS Shapefiles showing information within the Rim Fire

Fire and Fuels Indicators

- Vegetation burn severity
- Fuel model
- Historical percentile weather (90 percent)

Fuels profiles were gathered and analyzed using representative $1/50^{th}$ acre plots throughout the project area. The data was used with the Forest Vegetation Simulator (FVS) to compare current fuel loading to projected future conditions. In some portions of the project area where FVS projections exhibited a high standard of deviation, additional plots were sampled to produce a more representative fuels profile.

Fire and Fuels Methodology by Action

The Rim Recovery project treatment units are defined as the units where timber salvage harvest and fuels reduction treatments would occur as described by alternative under chapter 2 of the DEIS. The direct and indirect effects analysis area is the Rim Fire perimeter, not including Yosemite National

Park. The analysis area is located in predominately Mediterranean California Mesic mixed conifer forest ranging in elevation from 2,800 feet to 7,100 feet.

The analysis area is based on: 1) acres burned in a distinct geographic area and administrative setting; 2) impacts to forest vegetation from the wildfire and subsequent effects of timber salvage harvest are limited to the burned area; and 3) forest vegetation occurring within the treatment areas, as well as the vegetation outside the treatment areas but within the fire, representing the furthest measurable extent that effects on forest vegetation and fuels would occur as a result of implementing any of the proposed alternatives. Ecologically, the dynamics between vegetation and fire and fuels are inherently linked; fire has a profound effect on vegetation establishment and development and conversely, vegetation treatments (and the absence thereof) have a profound effect on fuels accumulations and fire behavior. The analysis area considers this relationship on the landscape level by including the entire fire perimeter and allows for a congruent analysis of forest vegetation, fuels, and fire at the stand and landscape levels.

The direct, indirect, and cumulative effects analyses are based on a temporal scale. Existing conditions represent past projects, including timber harvesting, wildfires, watershed improvements, and other activities (Appendix B). For the purpose of the vegetation, fire, and fuels analysis, the temporal bounds include a 20-year horizon for future effects because modeling indicates that within 20 years, fuels profiles change dramatically after fire and extend beyond the fire return intervals for the project area.

The effects on Fire Behavior and Fire Suppression capability for each alternative will be analyzed. Fire behavior will be demonstrated using Flame Length and Fireline Intensity.

Fuel loadings represented by fuel models will be described for the Rim Fire area. Fuel conditions resulting from the alternatives will have associated effects on fire behavior including potential fire intensity. The effect that a fire may have on resources depends on fire intensity and the conditions of the environment, including vegetation in which it burns.

The cumulative effects analysis area boundary for fuels is the 257,314 acre Rim Fire perimeter. Analysis for this project is done on an individual treatment unit basis; however, when treatments are concentrated in an area there are additive effects. Treated areas in this project along with past and reasonably foreseeable treatments in the vicinity of the project area will be analyzed.

Predicted fire behavior is estimated using the predicted length of flame measured in feet and the predicted fireline intensity measured in British Thermal Units (BTU) per foot per second at the head of the fire. Increased flame lengths can increase the likelihood of torching events and crown fires. Flame length is influenced in part by fuel type, fuel arrangement, fuel moisture, and weather conditions. Fuel type, flame length, and fireline intensity influence production rates, or how fast firelines can be constructed by different suppression resources, including hand crews and mechanical equipment. Flame lengths over 4 feet or fireline intensities over 100 BTU/FT/sec. may present serious control problems—they are too dangerous to be directly contained by hand crews (Schlobohm and Brain 2002; Andrews and Rothermel 1982). Flame lengths over 8 feet or fireline intensities over 500 BTU/FT/sec. are generally not controllable by ground-based equipment or aerial retardant and present serious control problems including torching, crowning, and spotting.

Flame length and fireline intensity directly affects suppression tactics. Table 3.05-1 outlines how flame lengths and fireline intensities influence fire suppression actions (Andrews et al., 2011).

Table 3.05-1 Relationship of Surface Fire Flame Length and Fireline Intensity to Suppression Interpretations

Flame length		Fireline intensity		Interpretation
ft	m	Btu/ft./s	kJ/m/s	
< 4	< 1.2	< 100	<350	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 – 8	1.2 – 2.4	100 – 500	350 – 1700	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 – 11	2.4 – 3.4	500 – 1000	1700 – 3500	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective
> 11	> 3.4	> 1000	> 3500	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Predicting the potential behavior and effects of wildland fire is an essential task in fire management. Mathematical surface fire behavior and fire effects models and prediction systems are driven in part by fuelbed inputs such as load, bulk density, fuel particle size, heat content, and moisture of extinction. To facilitate use in models and systems, fuelbed inputs have been formulated into fuel models (Scott and Burgan 2005). Table 3.05-2 displays a list of fuel models that are or can be expected to be in the project area over the next 20 years.

Table 3.05-2 Fuel Models

Fuel Model	Description	Predicted Flame Length (feet)	Fireline Intensity (BTU/FT/second)
NB9	Bare Ground	0	0
GR1	Short Grass Low Load	0-3	45
GR2	Short Grass Moderate Load	1-8	300
GS2	Grass and Shrub	4-8	500
SH1	Low Load Shrub	0-1	125
SH2	Moderate Load Shrub	1-4	400
SH5	High Load Shrub	12-25	3700
TL1	Recently Burned	0-1	5
TL2	Low Load Broadleaf Litter	0-1	7
TL4	Small Down Log	1-4	25
TL5	High Load Conifer Litter	1-4	50
TL7	Large Down Logs	1-4	50
TL8	Timber Litter	1-4	150
SB4	Blowdown with brush and small tree intermixed	12-25	3000

FlamMap (Finney 2006.) is designed to examine the spatial variability in fire behavior assuming that fuel moisture, wind speed and wind direction are held constant in time thereby allowing for more direct comparison of fuel treatment effects. FlamMap's features allow the user to easily characterize fuel hazard and potential fire behavior, as well as analyze fire movement and fuel treatment interactions. The fuel models that are used in this analysis are from publication RMRS- GTR-153. Fuel models used are estimates of what the fuel loading and fire behavior are currently and what is predicted in the future. The results of the calculations and estimates are intended to show trends and potential effects and are not statistically accurate.

Fire behavior modeling uses input variables to calculate fire behavior. The three primary variables are fuels, topography and weather. Because fuels are the primary variable that management activity can influence it will be the variable for this analysis. Field inventories were conducted to measure attributes of existing vegetation in the project area. Treatment units within the project area were inventoried using on-site photo interpretation, and the Forest Vegetation Simulator (FVS). These treatment units are representative of the project area and the areas to be treated in all action alternatives. Data was collected on live and dead trees. This data was used in the following analysis, data tables, graphs, and charts and are incorporated by reference. The FlamMap modeling system was used to estimate average fire behavior for each alternative. Flame length and fireline intensities were used to measure the effects of all alternatives.

Field inventory data from the treatment units was stratified by site class to best represent the range in average conditions between higher and lower sites and were used as input to the FVS and the Fire and Fuels Extension (FFE) (Dixon 2002; Rebain 2010). FVS-FFE is a well-established tree and stand growth model that is supported and maintained by the Forest Service. A specifically calibrated variant of FVS is available for the Western Sierra Nevada. Stand development over time is modeled using existing stand conditions, as provided by post-fire field inventories. Salvage harvest and reforestation actions are modeled to provide estimates of future fuels, snags, and stand development based on realistic and predictable inputs. The model was used to quantify existing conditions and to predict the effect of alternative treatments on forest development. Model results are used to highlight relative differences, not absolute conditions. No future activities, fires, or natural regeneration events are included in growth simulations due to the variable and unpredictable nature of such events.

Table 3.05-3 Weather Parameters High Conditions (90th Percentile Weather)

Parameter	Value
1 hour fuel moisture	4 percent
10 hour fuel moisture	5 percent
100 hour fuel moisture	7 percent
1000 hour fuel moisture	9 percent
Herbaceous fuel moisture	30 percent
Woody fuel moisture	70 percent
20’ wind speed	10 miles per hour

For modeling purposes fire weather adjective defined as High (90th percentile weather) was used to predict fire behavior in project area. Table 3.05-3 displays the 90th percentile values taking from the Fire Family Plus (Main 1990) program using the Mount Elizabeth Remote Automated Weather Station during the period of April 1, 1970 to October 31, 2013.

Affected Environment

Existing Conditions

In many places in the western United States, organic matter is produced at a higher rate than it can be cycled by decay. The accumulation of this woody material may increase the likelihood of severe stand replacing wildfires. Fuels buildups continue and become more continuous in distribution. As a consequence, subsequent occurrence of high-severity fires result in generally greater changes in plant compositions and structure than would occur if the communities had been subjected to more frequent low-intensity fires (DeBano 1998). Uncharacteristically high fuel levels create the potential for fires that are uncharacteristically intense (Franklin and Agee 2003). Fire risk is elevated in areas of human development, high-recreational use and along major roads. There is a need to reduce fuel loadings to meet desired levels and reduce adverse impacts from future wildfires.

PRE-FIRE CONDITIONS

As with many areas in the Sierra Nevada, the landscape has been heavily influenced over the last 150 years by past management activities and natural occurrences that include mining, grazing, harvesting, fire exclusion, large high-severity fires, and more recent drought-related mortality during the late 1980's and early 1990's. At the stand level, the combination of past management activities, fire exclusion, and extensive drought related mortality had created relatively homogeneous areas typified by small trees existing at high densities (Oliver 1996).

These high stand densities and high fuel loads created by overstocked stands with high accumulations of ladder fuels and canopy fuels. The combination of these factors increases the potential for stand-replacing high-severity fire events which were unfortunately realized when the Rim Fire burned across the landscape.

Post Fire Conditions

The Rim Fire burned with a range of severities. Within the 257,314 acre project area: 12,120 acres were not burned, 50,609 acres were low severity, 87,966acres were mixed severity, and 106,618 acres were high severity. Trees killed by the Rim Fire pose a hazard to forest workers and the public visiting and traveling in these areas. As snags age and deteriorate, they become less stable and increase the risk to forest users. Once this material is on the ground, it contributes to higher fuel loads and fire intensity is likely to increase. Because of the higher fire intensity and increased risk of hazard trees, suppression strategies will be limited.

In the high severity portions of the fire (106,618 acres) there are no surface fuels other than occasional patches of shrub, duff, and litter that remain. The standing material consists mainly of scorched trees. The patches of litter that remain will burn, but there is no continuity for fire spread. Ladder fuels and standing trees were either completely consumed or resulted in only boles. These severely burned areas will not currently support a new large fire or crown fire.

In the remainder of the burned areas (150,695 acres) the fire created a mosaic, leaving trees with brown needles and surviving trees as well as surface fuels ranging from completely consumed to pre-fire levels. Fires in this area of the project will burn with mixed fire severity. A mixed-severity fire exhibits a wide range of effects on the dominant vegetation from little effect on soil heating or overstory vegetation to complete canopy mortality or extensive soil heating.

A fire regime is a generalized description of fire's role within an ecosystem- characterized by fire frequency, predictability, seasonality, intensity, duration, and scale (Barrett 2010). Figure 3.05-1 displays these five fire regimes:

I. 0 to35 year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

II. 0 to 35 year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);

III. 35 to 100+ year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced);

IV. 35 to 100+ year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced); and,

V. 200 plus year frequency and high (stand replacement) severity.

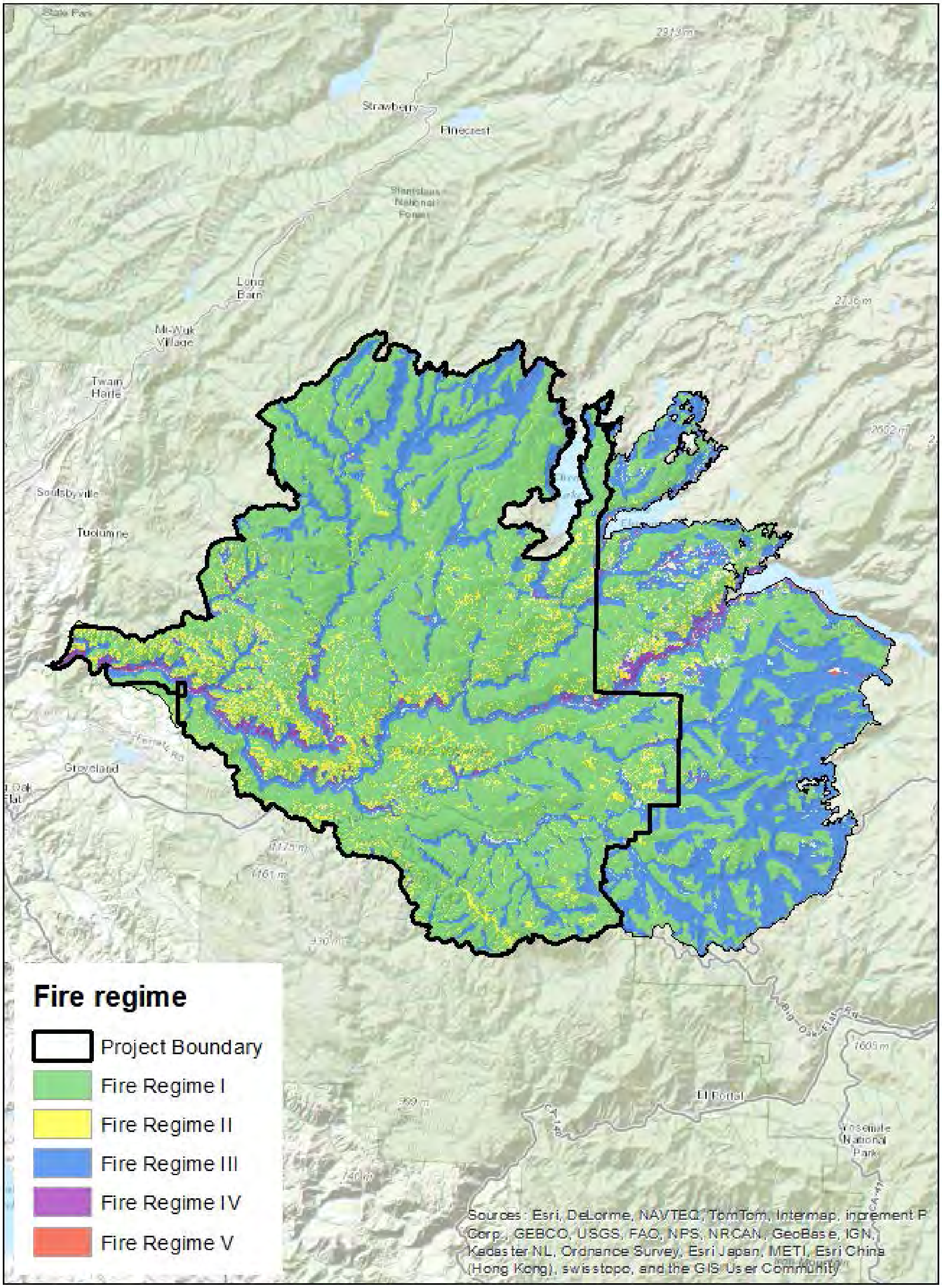

Figure 3.05-1 Fire Regime Map

The majority of the Rim Fire is classified as Fire Regime I. Fires in this regime are generally nonlethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. About 80 percent or more of the above ground dominant vegetation survives fires (Brown and Smith 2000). Areas within the fire perimeter categorized as Fire Regime I exhibited fire severity that was uncharacteristically high on 77,141 acres (48 percent). Actual acres burned at high fire severity within the project area are 61,335 acres (49 percent). Table 3.05-4 compares the expected fire severity with the actual fire severity by Fire Regime within the project area. Figure 1.02-5 shows the Rim Fire Vegetation Burn Severity.

Table 3.05-4 Comparison of Expected Fire Severity and Actual Fire Severity by Fire Regime

Fire Regime	Fire Frequency	Fire Severity	Expected Severity Acres	Actual Fire Severity		
				Low	Mixed	High
I	0-35 years	Low to Mixed	125,046	20,588	43,123	61,335 (49 percent)
II	0-35 years	High	14,641	1,573	5,095	7,972
III	35-100+ years	Mixed	31,079	10,709	11,482	8,888 (54 percent)
IV	35-100+ years	High	3,095	436	1,337	1,322
V	200+ Year	High	197	82	83	32
No burn	N/A	N/A	2,710	2,710		

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

It is recognized that Coarse Woody Debris (CWD) is an essential component of ecosystems within the Rim Fire area, providing wildlife habitat, soil protection, and other important functions. CWD and snags, maintained at required levels, would meet resource needs. An excess of CWD in the project area could result in a fire with intensity similar to that as seen during the Rim Fire of 2013. A fire of this magnitude could result in damage to homes and property, as well as resource damage from the fire and suppression actions associated to contain this type of fire. In addition, fire suppression actions could be hindered by the fire behavior associated with a high loading of CWD (Brown 2003) by slowing fireline production rates and limiting suppression resources to indirect attack with heavy equipment (Andrews et al. 2011). The reduction of CWD through salvage harvest and treatment of non-merchantable fire-killed material encompasses 28,326 acres and 341 miles (16,315 acres) of hazard trees along strategic roads.

Treatments under Alternative 1 would significantly reduce fire intensities and fire effects within the treated units. Suppression forces could enter these areas and take appropriate actions as needed to manage fires to achieve the desired condition. The reduction in snags would result in reduced spotting that is associated with snags when they burn.

Salvage harvest would reduce the larger merchantable material greater than 16 inches in diameter from the site. Yarding of unmerchantable-size material or biomass removal (from 4 inches to 16 inches in diameter), or jackpot burning (JPB) would treat the high density of the unmerchantable material. Piling or jackpot burning would treat the smaller diameter material and material not included in the previous treatment. After treatments the CWD is estimated at 10 tons per acre; these areas could be directly attacked with suppression resources increasing the chance of containing wildfires in the project area while maintaining resource needs (Brown 2003). Fire-killed trees have lost most of their moisture making them brittle and more susceptible to breakage (Lowell et al. 2010).

During the felling and removal process it is anticipated that there would be higher than normal breakage typically associated with green timber felling. CWD left on site, that is smaller than the handpile specifications and does not exceed 10 tons per acre would meet resource needs. This compacted material would have minimal effect on fire behavior.

Proposed units would alter the spread and effect of fire in the project area. Units were strategically placed to affect fire movement on the landscape and provide advantageous areas for fire suppression actions. As managers continue to move the forest toward the desired condition, fire would be able to resume its natural role in developing and sustaining these ecosystems. Continued management practices can and will alter the effects of wildland fire (Agee and Skinner 2005).

Fuel treatments in the salvage harvested stands would result in fuel characteristics reflective of Condition Class 1, where prescribed fire could be used for maintenance and the likelihood of damage to succeeding stands would be reduced.

Completed project activities would reduce CWD, lowering fire behavior and fire effects within the treated units. The fuel model in treated units would be represented by TU1 Low Load Dry Climate Timber-Shrub-Grass. The area outside treated units would burn the same as Alternative 2. Placement of the treated units would reduce overall fire size within the project area by reducing fireline intensities and fire effects providing opportunity for suppression forces to take appropriate actions (Finney 2001). Altering the movement and effects of fire through the project area would result in more natural and mosaic burn patterns.

Fuels on the forest floor would consist of small diameter material and scattered larger logs. Snags and large logs may be present in the units to meet resource needs and Forest Plan Direction. These guidelines were developed with consideration for fire and its role in developing and sustaining these ecosystems. Duff and litter layers are currently not present at a level that would affect fire behavior and retaining the small diameter material on site would help accelerate the development of these layers. Out-year fire behavior is expected to be dominated by young shrubs, small trees, and hardwoods reoccupying the site.

As the vegetation matures, fuel loadings would increase. Continued maintenance designed to achieve the desired condition would maintain fuels profiles that allow fire to resume its ecological role and meet Stanislaus Forest Plan Direction.

Aerial hazards (snags) within the treated areas, excluding those left for resource needs, would be felled. Suppression forces would not be hindered by the high density of snags or high levels of CWD in the units which would allow immediate and appropriate action to be taken. Suppression actions would not be restricted by fire behavior; thus, direct suppression actions would be possible within treated stands.

The effect on fire suppression forces beyond year 20 would depend on the continued maintenance of the stands. Stands that are maintained and managed to achieve the desired condition would not adversely impact future suppression. Table 3.05-5 displays the projected fire behavior and production rates for Alternative 1 within treatment units using the FlamMap 5.0 modeling program.

Road construction and reconstruction would not affect fire and fuels other than allowing firefighters slightly better access than the current existing condition. Hauling logs and rock quarry blasting would have a minor effect on fire and fuels effects due to the project's management requirements.

In comparison to No Action over time, Alternative 1 would result in relatively lower surface fuel loads and potential flame lengths. Fuel loadings and potential flame lengths would be lowest in ground-based salvage harvest units where the treatment of submerchantable material (via biomass harvesting and removal or site preparation) would occur. While there is still potential for mortality in treated areas, it would remain lower than that of Alternative 2 for wildfires occurring under 90th percentile weather conditions. Potential future fires are expected to kill natural regeneration, planted conifers, brush, and residual larger trees.

Table 3.05-5 Predicted average flame lengths, fireline intensity and firefighter production rates under the Alternative 1 within treatment units (FlamMap 5.0).

Alternative 1	Flame Length	Fireline Intensity	Suppression Interpretation
1 Year Post-Activity	≤2	≤100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
Year 5	≤4	≤100	
Year 10	≤4	≤100	
Year 20	≤4	≤100	

CUMULATIVE EFFECTS

Cumulative effects for Alternative 1 include safer access to the area due to the Rim HT project and hazard tree removal along Maintenance Level 2 roads in this project. In addition, fuels treatments would improve the safety for all users. Firefighter safety would be improved with the removal of the overhead snags as they pose one of the greatest hazards to firefighters. The treatment of CWD and smaller fire-killed vegetation would result in a reduction in fire effects thereby increasing safety during a wildfire event. Reduced fire effects would allow suppression forces to take appropriate action. Fire spread on public lands would be altered reducing the chance of fire spreading between the public and private lands interface.

Future wildfires within the project area will be affected on a landscape level by the combination of treatments implemented on privately owned Sierra Pacific Industries (SPI) land, the Rim HT project and the adjacent Forest Service (Rim Recovery project treatment units) lands. Fuels treatments are strategically placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks and private land would further break up fuel continuities in the area, creating more opportunities for future suppression actions.

The treatment units running along the west side of the SPI boundary would create lower fire effects by reducing CWD allowing suppression resources to suppress fires coming into or leaving the private-public land interface. With the removal of fire-killed trees on both the private and public lands, future fuel loading conditions will be reduced and will result in a fire that would burn under more historical conditions. Any residual fuels left on SPI lands would be burned. This would further reduce fuel loading to 10 to 15 tons per acre. On NFS lands, residual fuels would be reduced to 10 to 20 tons per acre. As a result, the treated areas would burn as surface fires with low flame lengths and fireline intensities. These lower-intensity fires could be suppressed using direct attack with handtools. Treatments are expected to be effective for the next 15 to 20 years

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, no actions would be implemented to address the objectives and desired conditions identified in the Purpose and Need (Chapter 1.03). Existing stand conditions would persist and develop unaltered by active management. Standing snags would persist and the site would be rapidly colonized by grasses, forbs, and shrubs within three to five years. It is a reasonable expectation that non-salvaged stands would develop comparable to that of similar non-salvaged stands in local fires that burned in the recent past including the Big Meadow Fire (2009), North Mountain Fire (2008), Early Fire (2004), Stanislaus Complex Fire (1987), and the Ackerson Fire (1996). On those stands, grasses such as cheat grass (*Bromus tectorum*) and shrubs such as Ceanothus (*C. cordulatus, C. velutinus*) and Manzanita (*Arctostaphylos patula*) species occupied the site while standing snags dominate the overstory of the high severity burn areas. Shrub fuels would be established within 10 years similar to shrub regeneration observed in past fires like the 2009 Knight Fire (Figure 3.05-2).

Figure 3.05-2 2009 Knight Fire, photo taken in 2013

Hundreds of dead trees and very few live trees per acre characterize the forest structure. Snag fall rates are highest the first ten years within the smaller diameter classes, while larger snags persist for relatively longer time periods, which is generally documented in existing scientific literature (Cluck and Smith 2007). Nearly all snags would be expected to fall by 20 years post-fire contributing to greater fuel loads. The limbs and boles from these fallen trees would accumulate as surface fuels. This fuel is expected to increase each decade as trees fall over. Within 10 years, surface fuels are projected to be 78 tons per acre. Within 30 years, surface fuels are projected to average 98 tons per acre due to dead trees falling over. In the event of a wildfire this would create serious control problems, high suppression costs, and high volumes of smoke emissions.

Additional snag recruitment would be expected through delayed mortality in the few live trees per acre. Those live trees injured during the fire may be more susceptible to biotic and abiotic agents that hasten delayed conifer mortality due to reduced tree vigor (Wagener 1961; Hood 2007).

Both grass-forb cover and shrub cover present formidable competition for water and light with tree seedlings. This competing vegetation would likely result in decreased survival of tree seedlings and would inhibit growth for years if not decades. Consequently, the site would likely be occupied by brush intermixed with grass and forbs. Over time, ladder and crown fuels would develop where natural regeneration was established via seed from surviving mature conifers.

Large areas of untreated burned areas would exist. Brush species and standing snags would dominate these areas, and, over time, these snags would fall resulting in a brush field with high fuel loads arranged in a jackstraw pattern.

Table 3.05-6 displays predicted flame lengths and fireline intensities. Under Alternative 2, flame lengths exceed 4 feet after five years and are projected to exceed 10 feet within 20 years. Fireline Intensities would exceed 500 BTU/FT/sec after five years and are projected to exceed 1,000

BTU/FT/sec after ten years. These increased flame lengths and intensities are a direct result of fire burning in dead and down logs, branches, and shrubs. Fires burning in stands under 90th percentile weather conditions in Alternative 2 are expected to result in serious control problems. Fires may be too intense for direct attack on the head by persons using hand tools. Handline may not be relied on to hold the fire. Fires may present serious control problems torching out, crowning, and spotting, and control efforts at the fire head will probably be ineffective. Under Alternative 2, the general trend in high flame lengths (>10 feet) and corresponding high fireline intensities are expected to continue at least 20 years into the future.

Table 3.05-6 Flame lengths and fireline intensities under Alternative 2

Alternative 2	**Flame Length** (feet)	**Fireline Intensity** (BTU/FT/sec**)**	**Fireline Interpretation**
Existing Condition	≤2	100	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire.
Year 5	≤4	500-1,000	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
Year 10	10	>1,000	Fires may present serious control problems torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Year 20	13	>1,000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Consequently, accessibility would limit future forest management activities due to the high cost and safety concerns. Without treatments, survival and growth of natural regeneration that does become established would likely be reduced due to competing vegetation. These sites would be dominated by brush very similar to those effects seen on public lands in the Big Meadow Fire (2009) and observed in the North Mountain (2008), Early (2004), Stanislaus Complex (1987), and Ackerson (1996) fires. This could effectively function as a vegetation type conversion from forest cover to brush cover for nearly a century based on observations from areas left to naturally regenerate in the Wright Creek Fire (1949). Over sixty years later, these areas support natural establishment of white fire, incense cedar, ponderosa pine, and sugar pine; however, the area is dominated by brush species and the tree cover is not sufficient to qualify as forest cover.

The No Action Alternative would lead to higher fuel loads from branches and boles of dead and down trees. Over the long term (10+ years), not implementing treatments would result in increased surface fuels. Increased surface fuels would result in increased flame lengths and higher fireline intensities leading to increased firefighter and public risk, and higher costs. Historically fires in the project area were low intensity with less than 25 percent of the stand being killed by fire. Fire effects under the No Action Alternative would result in higher stand loss as seen in the Rim Fire, with over 50 percent of the stand killed. It is expected that some fires, both human and lightning caused, would continue to escape initial attack under more severe weather conditions over the next 20 to 30 years. These fires are expected to kill natural regeneration and residual larger trees. Overall, the No Action Alternative would not reduce potential future surface fuels or predicted fire effects.

Alternative 2 combined with the high fuel loading left in Yosemite National Park would mean that wildfires would cross boundaries with little chance of containing fires under 90th percentile weather conditions. Wildfires would burn until weather conditions changed to allow effective suppression actions to take place, similar to what was observed in the Rim Fire.

CUMULATIVE EFFECTS

Under Alternative 2, the Rim HT project would remove hazard trees along main roads. The maximum extent of these activities would be limited to 150 to 200 feet of either side of main roads. This would provide for safe travel along forest roads; however, due to the scale and scope of the project, large areas of untreated burned areas with brush and standing snags would exist. The access to these areas would be inhibited by hazard trees and downed logs along and on Maintenance Level 2 roads. Limited access to areas within the analysis area would slow firefighter access for direct attack.

When the effects of the Alternative 2 is combined with the effects of implementing the foreseeable private and Forest activities (Appendix B), this alternative would not create strategic fire management points or aid in future fuels management, suppression and beneficial fire planning objectives. The cumulative effects of No Action would be an increase in fire behavior over time and negative fire effects on the landscape.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Similar to Alternative 1, Alternative 3 would reduce CWD through salvage harvest and treatment of non-merchantable fire-killed material. Alternative 3 would encompass 30,399 acres and 315 miles (15,253acres) of Strategic Fire Management Features (SFMF). Treatments would lower fire intensities and provide advantageous areas for fire suppression actions.

Salvage harvest would reduce the larger diameter merchantable material greater than 16 inches from the site; biomass removal (from 4 inches to 16 inches in diameter) and jackpot burning (JPB) would treat the high density of the un-merchantable material. Piling and jackpot burning would treat the smaller diameter material and material not included in the previous treatment. After treatments the CWD is estimated to be between 10 to 20 tons per acre outside SPLAT units and 10 tons per acre inside SPLAT and SFMF units; these areas can be directly attacked with suppression resources increasing the chance of containing wildfires in the project area while maintaining resource needs (Brown et al. 2003). CWD that is below the handpile specifications and does not exceed 10-20 tons an acre would be left on site. This compacted material would have minimal effect on fire (Table 3.05-5).

Over time, Alternative 3 would result in relatively lower surface fuel loads, potential flame lengths, and potential mortality. Fuel loadings and potential flame lengths would be lowest in ground-based salvage harvest units where the treatment of submerchantable material (via biomass harvesting and removal or site preparation) would occur. While there is still potential for mortality in treated areas, it would remain lower than that of Alternative 2 for wildfires occurring under 90th percentile weather conditions. Potential future fires are expected to kill natural regeneration, planted conifers, brush, and residual larger trees.

Fuels treatments are strategically placed and would provide a break in the fuel profiles crossing the project area. This fuelbreak combined with existing fuelbreaks, SPLATS, and SFMF would further break up fuel continuities in the area, creating more opportunities for future suppression actions and safer ingress and egress routes. In addition, the strategic placement would increase fire suppression safety, reduce potential resource damage, and potentially lower suppression costs.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Alternative 4 would reduce CWD through salvage harvest and treatment of non-merchantable fire-killed material. Alternative 4 would encompass 27,826 acres and 325 miles (15,692 acres) of SFMF. Treatments would lower fire intensities and provide advantageous similar to Alternative 3 and would reduce the CWD to be between 10 to 20 tons/acre, but on 494 fewer acres than Alternative 1 and 2,571 acres less than Alternative 3. Effects on treated acres would be similar to Alternative.

CUMULATIVE EFFECTS

Same as Alternative 3.

Summary of Effects Analysis across All Alternatives

Alternative 2 would result in increasingly hazardous travel as snags would decay and fall. Fire behavior would exceed firefighter capabilities within a few years and suppression efforts would have to use indirect tactics. Future fires would be expected to burn with high intensities, impacting resources and killing most vegetation. Therefore, Forest guidelines and direction for fire management would not be met after 5 years under Alternative 2. With implementation of alternatives 1, 3, or 4, fire intensities would be reduced and safety improved so that firefighters could enter the area and take appropriate action (Table 3.05-7). The three action alternatives would, therefore, meet Forest Plan direction for fire management.

Table 3.05-7 Fire behavior by alternative over the next 20 years

Alternative	Post Activity		5 years		10 years		20 years	
	Flame Length	Fireline Intensity	Flame Length	Fireline Intensity	Flame Length	Fireline Intensity	Flame Length	Fireline Intensity
Alternative 1	1	100	2	100	4	100	4	100
Alternative 2	2	100	4	500	10	≥1,000	13	≥1,000
Alternative 3	1	100	2	100	4	100	4	100
Alternative 4	1	100	2	100	4	100	4	100

Alternative 1 reduces CWD down to 10 tons per acre, which correlates to a reduction in fire effects. Alternative 1, because of the lower CWD, further increases the opportunities for suppression resources to contain fires spreading between the private and public interface. Compared to Alternatives 3 and 4 the fire effects are negligible as all three action alternatives can be contained by handline.

Under Alternative 2, surface fuels are projected to average 78 tons per acre within 10 years and 98 tons per acre within 30 years.

Alternative 3 reduces CWD to between 10 to 20 tons per acre outside SPLAT units and 10 tons per acre inside SPLAT and SFMF units. Alternative 3 also treats 2,077 more acres but 16 less miles (308 acres) than Alternative 1. Inside SPLAT and SFMF units the fire effects would be the same as Alternative 1, while fire effects would be slightly higher outside SPLAT units. Handlines could still contain fires.

Alternative 4 reduces coarse woody debris to 10 to 20 tons per acre outside SPLAT units and 10 tons per acre inside SPLAT and SFMF units. Alternative 4 treats 494 less acres and 11 less miles (158 acres) than Alternative 1. Alternative 4 treats 2,571 acres less, but 5 miles (150 acres) more than Alternative 3. Inside SPLAT and SFMF units the fire effects would be the same as Alternative 1, while fire effects would be slightly higher outside SPLAT units. Handlines could still contain fires.

3.06 INVASIVE SPECIES

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The following direction guides management of invasive plants on NFS lands:

- Executive Order 13112 Invasive Species 64 FR 6183 (Clinton 1999)
- Forest Service Manual 2900 (USDA 2011)
- Pacific Southwest Region Noxious Weed Management Strategy (USDA 2000)
- Noxious Weed Management S&Gs (USDA 2010a, p.52)

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Invasive Species

- Existing plant survey data covers less than 5 percent of the total project area, meaning that it is highly likely that undetected weed infestations exist within the project area.
- New and expanding infestations will result from habitat alterations caused by the fire (e.g. decreased canopy cover, increased nitrogen and water availability) and fire suppression activities.
- If an invasive weed infestation was determined to be within 15 feet of a road it was analyzed as a road maintenance, reconstruction or creation (whether temporary or permanent) impact. All other infestations within treatment units were analyzed as an impact from the proposed activities (e.g. skidding, heavy equipment piling, burning, long-lining, etc.).
- The risk of creating new or expanding invasive populations throughout the project area depends on a variety of factors (these factors are listed in the Summary of Effects Analysis across All Alternatives section).
- Without specific prevention and control measures, invasive non-native plants (weeds) will continue to spread along and within project areas and into adjacent areas.
- Weeds are likely to persist long-term once they are established in meadows.

Data Sources

- GIS layers of the following data: invasive plant infestations, units, roads, quarry sites, water sources and fire history. Information recorded in the GIS shapefiles was provided by the Mi-Wok and Groveland District botanists. All invasive plant data was collected from 2006 to 2011.
- Information on species status, distribution, and ecology was derived from general literature reviews, Forest Service documents, the Forest Service Fire Effects Information System, California Department of Fish and Wildlife, various field books, floras, and personal communications. Site surveys, in conjunction with literature and input from the District botanists were used to determine the potential occurrence of each species, and/or its habitat, as well as its priority for eradication/control.

Invasive Species Indicators

The primary indicator was acres within ground disturbing project locations (e.g. units, skid trails, road construction/ maintenance, quarry sites) that contain infestations of invasive plant species.

Invasive Species Methodology by Action

This analysis evaluates the factors influencing invasive plant introduction and spread by considering the risks of, and vulnerability to, invasive plant establishment.

Affected Environment

Existing Conditions

Twenty-six species of non-native and invasive plants are present or adjacent to (within 5 miles) the project area (Table 3.06-1).

Table 3.06-1 Invasive Species within Rim Fire perimeter and each alternative

Invasive Name	In Rim Fire (acres)	Alternative 1 (acres)	Alternative 3 (acres)	Alternative 4 (acres)	Project Priority[1]
Barbed Goatgrass	2.77	1.32	1.32	1.32	High
Bachelor Button	0.00	0.00	0.00	0.00	Moderate
Blackberry, cut-leaf	0.06	0.06	0.06	0.06	Low
Blackberry, Himalayan	2.32	0.74	0.74	0.74	Low
Black mustard /Shortpod mustard	0.02	0.00	0.00	0.00	Moderate
Blessed Milkthistle	0.02	0.03	0.03	0.03	Moderate
Bull thistle	35.31	13.52	13.52	13.56	High - dense infestations Low - scattered plants
Canada thistle	0.25	0.00	0.00	0.00	High
Cheatgrass	2.06	0.7	0.7	0.7	Low
Dyers Woad	0.74	0.00	0.00	0.00	High
Field bindweed	0.73	0.00	0.00	0.00	Moderate
French broom	.001	0.01	0.01	0.01	Moderate
Hedgeparsley	0.02	0.00	0.00	0.00	Low
Italian thistle	9.27	6.52	6.88	6.38	High
Klamathweed	0.84	0.20	0.22	0.22	Low
Medusahead Grass	112.20	80.97	81.32	81.32	High
Perennial Sweetpea	0.30	0.00	0.00	0.00	Moderate
Puncturevine	0.10	0.00	0.00	0.00	High
Scotch Broom	0.09	0.00	0.00	0.00	Moderate
Johnsongrass	0.00	0.00	0.00	0.00	Moderate
Spanish Broom	0.00	0.00	0.00	0.00	Moderate
Spotted Knapweed	0.72	0.26	0.26	0.26	High
Tocalote	76.38	21.03	20.36	20.36	High
Tumble mustard	No data	No data	No data	No data	Moderate
Woolly mullein	1.01	0.18	0.18	0.18	Moderate - dense infestations Low - scattered plants
Yellow star-thistle	112.43	18.1	17.4	17.4	High
Totals	**314.83**	**143.64**	**143.00**	**142.54**	

[1] Project priority determined by the invasive characteristics, habitat degradation potential, state rating, prevalence across the fire area, and control factors of the plant. In addition, the risk of potential seed and reproductive part spread from project activities was also considered in assigning priority.

Ten species, including barbed goatgrass (*Aegilops triuncialis*), Italian thistle (*Carduus pycnocephalus*), tocalote (*Centaurea melitensis*), yellowstar thistle (*Centaurea solstitialis*), spotted knapweed (*Centaurea stoebe ssp. micranthos*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), dyer's woad (*Isatis tinctoria*), medusahead grass (*Taeniatherum caput-medusae*) and puncturevine (*Tribulus terrestris*) are considered high risk species from project activities. Eleven other species, including, bachelor buttons (*Centaurea cyanus*), field bindweed (*Convolvulous arvensis*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monospessulana*), shortpod mustard (*Hirschfeldia incana*), perennial sweatpea (*Lathyrus latifolius*), milkthistle (*Silybum marianum*), tumblemustard (*Sisymbrium altissimum*), johnsongrass (*Sorghum halepense*), Spanish broom (*Spartium junceum*) and wooly mullein (*Verbascum thapsus*), are considered a moderate risk. The remaining five species are considered low risk. For a complete discussion of characteristics specific to each species, their known locations in the project, habitat impacts and recommended management tools (Noxious Weed Risk Assessment, project record).

Past actions involving ground disturbing activities such as timber removal, fuel reduction, road and trail creation/maintenance, grazing, unauthorized OHV use and other dispersed recreation have impacted invasive plant infestations across the project area. The invasive species known to occur within the project area before the Rim Fire were introduced and spread primarily through transport on vehicles, in straw and hay, on earthmoving and mowing/weed-eating equipment, and on animals and in their manure associated with these activities. Weed seeds also spread quickly down streams and upwind along lakes and reservoirs. Livestock grazing also contributed to weed spread, due to transportation on their fur, decreased native grass and forb cover from preferential grazing of un-palatability of many invasives, trampling, and other soil disturbances (Olson, 1999). Since the fire, it is highly likely that these existing infestations created by the disturbances listed above were spread by suppression and BAER efforts.

Given the current data it appears that Medusahead grass, tocalote, yellow starthistle bull thistle and Italian thistle are by far the most common species within the project area (Table 3.06-1). To a lesser extent, several other invasive weed species occur, primarily along roads. It should be noted however, that it is highly likely that many of the lower priority invasives are mapped at a fraction of their actual occurrence acreage given their commonality. Indeed, given that less than 5 percent of the project area has been surveyed for invasives, it is highly likely that actual acreage is exponentially higher than shown in Table 3.06-1.

The risk of creating new or expanding populations throughout the project area depends on a variety of factors:

- **Species-specific dispersal traits of weeds**: Weed species with seeds dispersed by wind (Italian thistle), by tumbleweed (shortpod mustard), water (tamarisk), or animals (Medusahead grass) can potentially spread weed propagules miles from their original sources. Most seeds are not moved far from the parent plant, but a small proportion of seeds can be found large distances away. Even propagules with low innate dispersal abilities, such as stem fragments of giant reed or castor bean seeds which fall close to the plant, can be carried far after initial dispersal by streams or surface runoff. However, species without wind, water, or animal-mediated dispersal are less likely to disperse propagules far from the original source.
- **Habitat disturbed**: While many weed species are generalists that can potentially colonize a fairly wide range of vegetation types, it is true that some habitats, particularly those with ample nutrients and soil moisture or those that have been recently disturbed, are more susceptible to invasion. Additionally, the suite of weed species one would expect to colonize a site is dependent to some degree on the habitat where the disturbance occurred.
- **Regional patterns in weed occurrence and propagule pressure**: The project occurs across a transitional area with regards to microclimate, elevation, and vegetation communities. The most commonly observed weeds differed within these areas, possibly due to species-specific habitat preferences.
- Type of ground disturbance. The type of disturbance creates conditions favoring release and establishment of different weed species. For example, tree removal is expected to favor the establishment of weed species that do best in full sun, such as yellow starthistle; burning is expected to favor the establishment of fire-adapted weed species such as French broom; and soil disturbance is expected to favor the establishment of early-colonizing weed species, such as mustards or tocalote, that respond favorably to disturbed, denuded soils.

These factors were used to consider the risks associated with the establishment of new weed infestations due to project activities. In addition to these four factors, the results of the Noxious Weed Risk Assessment (project record) were focused on risks associated with 1) the release of pre-existing but currently dormant weed seed banks at disturbed sites, 2) the rapid build-up of transient weed seed banks at disturbed sites, and/or 3) the creation of conditions favoring weed establishment at disturbed sites.

Environmental Consequences

Project-related activities under all action alternatives, could contribute to an increase in invasive plants in three major ways: (1) the creation of conditions that favor establishment of invasive plant (weed) species, such as soil disturbance, removal of native vegetation, or the breakup of cryptogamic crusts[5], (2) spread of new and pre-existing weed infestations into newly disturbed areas via project tools, equipment, and personnel; and 3) the subsequent release of pre-existing weed seedbanks from dormancy or the quick build-up of new weed seedbanks on disturbed soils.

Table 3.06-2 displays invasive plant acreages for the specific treatments in each alternative, indicating that the highest invasive infestation acreages are found within the salvage units and roadside hazard tree removal areas. This is not surprising given that these project areas cover the largest overall acreages and would therefore, be the most likely to harbor weed infestations. Road treatments (maintenance, reconstruction and new construction) also have higher invasive infestation acreages. Roads and roadsides consistently experience ground disturbance, creating areas of increased sunlight, decreased native competition and increased water runoff, attributes which create an ideal environment for weed colonization.

Table 3.06-2 Invasive Plant Locations by specific treatments in each alternative

Treatments	**Invasive Plant Locations** (acres)			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Salvage Units	42.0	0.0	71.5	70.5
Road Treatments	24.0	0.0	18.0	18.0
Roadside Hazard Tree	77.5	0.0	53.0	53.0
Quarry	0.5	0.0	0.5	0.5
Totals	**144.0**	**0.0**	**143.0**	**142.0**

The results of the Noxious Weed Risk Assessment (project record) focused on risks associated with 1) the release of pre-existing but currently dormant weed seed banks at disturbed sites, 2) the rapid build-up of transient weed seed banks at disturbed sites, and/or 3) the creation of conditions favoring weed establishment at disturbed sites. The risks are labeled "high, moderate and low," and are defined as follows:

- High: Chances of weed species infesting new areas range between 76 to 100 percent.
- Moderate: Chances of weed species infesting new areas range between 31 to 75 percent.
- Low: Chances of weed species infesting new areas range between 1 to 30 percent.

Each action alternative is expected in general to be high risk (a 76 to 100 percent chance) for the potential to establish new populations of invasive species, specifically those listed as high and moderate priority in Table 3.06-1. This high risk ranking was chosen after careful consideration of the four factors listed in the Affected Environment section (i.e. weed species dispersal traits, habitat disturbed, regional patterns in weed occurrence and types of disturbance), and the three avenues for weed proliferation: 1) release of seedbanks, 2) build-up of weed seed, and 3) the creation of weed-favorable conditions. For each of action alternative, the ranking was determined to be in the high category. Some individual project sites may have a less-high risk, but given that less than 5 percent of the project has been surveyed, the more conservative ranking was chosen. Those areas that are outside of the historic fire burn return interval (i.e., burning more or less frequently) are expected to have an

[5] Crypotogamic crusts are biological soil crust composed of living cyanobacteria, green algae, brown algae, fungi, lichens, and/or mosses.

even higher risk (yet still within the high risk category) of experiencing vegetation type conversion in the project areas.

Alternative 1 (Proposed Action)

Direct and Indirect Effects

Disturbance by heavy equipment can have long-term effects to soils and favor weed establishment if unmitigated. Heavy equipment can compact soils, reducing water infiltration and accelerating erosion. It can also displace soils and sheer off vegetative roots. If these effects are severe, a loss of soil productivity may occur. Numerous passes by equipment over vegetation often causes plant mortality or severe injury, exposing the soil organic layer and making it more susceptible to erosion. Loss of vegetative cover and the soil organic layer reduces the ability of the soil to hold moisture. Many weed species are more capable of utilizing less productive soils with less soil moisture. In addition, some weeds produce secondary chemical compounds that inhibit native plant germination and growth. These compounds also affect nutrient cycling rates by inhibiting soil microbial fauna activity (Sheley et al. 1999).

Maintenance, reconstruction and the creation of roads can also spread invasives. Grading disturbs soil and competing native vegetation in addition to dispersing weed seeds and plant parts. Cleaning ditches, grading, installing overside drains and road construction moves soil and creates ideal weed seedbeds. Seeds from equipment can be deposited in stream crossings and washed downstream. This movement of weed seed/parts can happen at any time of the year since the seeds and parts are present in the soil at infested sites at all times. Stockpiles of crushed aggregate can also be infested with weeds. Weeds are dispersed when that aggregate is moved to a new location. This translocation of weed seed is of particular concern when dispersal vectors (streamside, areas of high human use, fire staging and action areas, roads, etc.) are nearby.

Even those project sites in remote areas may be expected to contain an existing weed seedbank. Seedbanks are known to regularly contain a different suite of species than is represented by the standing vegetation due to succession, low reproduction rates of some perennials (by seed), and other factors (Thompson 2000). In most cases it is rare to find species in the seedbank that are not represented to any degree in the above-ground vegetation; the exception being seeds from invasive, aggressive, disturbance-adapted, and early colonizing weeds (Thompson 2000). For example, large cheatgrass seedbanks are commonly found throughout western North America, often regardless of such factors as remoteness of the site, grazing, or fire history. Within intact native communities these seeds are typically held in the above-ground vegetation or in crevices on cryptogamic crusts. Germination is therefore prevented until disturbance allows the cheatgrass seeds to come into contact with broken soil surfaces (Boudell et al. 2002).

Following establishment, new populations of weeds are often extremely difficult to eliminate, and even if controlled or eradicated, it may take several years or decades to re-establish native soil structure and biota. If allowed to expand, dense infestations can occur that not only displace native plants and animals, but also threaten natural ecosystems by fragmenting sensitive plant and animal habitat (Scott and Pratini 1995). For example, when equipment disturbance activities introduce or release weeds, the vegetative pattern is changed, often providing more flammable fuels into the system. As the weeds spread and increase in volume, an increase in ladder fuels occurs. Weeds such as Scotch broom, Medusahead/barbed goatgrass grass, yellow starthistle and others, change the arrangement of vegetation, the amount of soil moisture at specific times of the year, the amount of fuel available to burn, and how fire behaves (Keeley et al. 2011). These changes in fire behavior often mean that areas that would not ordinarily burn frequently or at high intensity are now doing so (DiTomaso and Healy 2007). This is especially a concern in dry lava cap areas where weed species compete with sensitive plants.

Under Alternative 1, management requirements will help reduce the risk of spreading weeds from known dense infestations and high priority invasive infestations; however, lowering the risk ranking from high to moderate is not warranted since pre-project surveys to detect unknown weed infestations are not required. Because only 5 percent of the project area was previously surveyed, it is highly likely that a large proportion of the existing weed infestations remain undetected, preventing the mitigation of this risk.

CUMULATIVE EFFECTS

Factors which are not planned and are difficult to control (e.g., wildfire, dispersed recreation use, climate change) will likely have the greatest cumulative impact to native plant communities from the expansion of invasive plants for Alternatives 1, 3 and 4. Fully implementing any of these alternatives will add to this cumulative effect. For the purpose of this analysis, cumulative effects of past activities or natural events are represented within the existing conditions.

Appendix B provides a list and description of present and reasonably foreseeable projects, including private lands within the Rim Fire perimeter. All of these activities will contribute to effects on invasive plant proliferation. Within the project area, hazardous fuels reduction and hazard tree removal are anticipated to occur within the next few years on approximately 16,107 acres of NFS, 816 acres on NPS and 18,407 acres on private lands (Appendix B). These projects are the primary activity that will alter forest vegetation and impact invasive plants; most of the weed risk assessments for these projects show the risk to be moderate if management requirements are followed. Recreation management, road and trail work and decommissioning of unauthorized routes account for approximately 96 miles of additional ground disturbing activities (anticipated to occur in the foreseeable future). Livestock grazing within the project area (13 allotments) may also proliferate weeds. All of these activities (in addition to other recreation activities such as dispersed camping) were ranked as low to moderate risk.

These present and future projects are cumulative in nature in that some of them overlap spatially with the project areas, but all of them impact the ability of the Forest Service to feasibly and adequately manage invasive plant proliferation. With all the different projects occurring across the forest (BAER treatments, hazard tree removal, fuel treatments, etc.), several of which are thousands of acres in size, in addition to the large size of the Rim Fire itself, it becomes very difficult to physically get to all the affected areas, let alone perform time consuming hand removal of invasives in an adequate manner.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, areas which currently have invasive plants will continue to support these species, providing seed sources for dispersal into adjacent areas. Current re-growing vegetation types will be maintained. This alternative will eliminate the likelihood of directly and indirectly spreading weeds from salvage, hazard tree removal and road construction activities. The No Action Alternative will potentially negatively affect invasive plant proliferation if fuel reduction activities are not completed. It is possible the next wildfire event will have high vegetation and high soil burn intensity and severity because of the amount of untreated fuels (dead trees). As discussed above, these more intense or severe fires may promote weed proliferation where native vegetation recovery is slower, releasing invasive species from greater competition. However, when comparing the potential effects of the different project activities, it does appear that impacts associated with the action alternatives are of greater scope and magnitude than the impacts of no action.

CUMULATIVE EFFECTS

All the activities and factors listed in Appendix B may cumulatively affect the proliferation of invasive plant species. Factors that are not planned and difficult to control (e.g., wildfire, dispersed recreation use, climate change) will likely pose the greatest risk of proliferating invasive plants. Alternative 2 will not add to these cumulative impacts.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1, except additional management requirements will help to reduce the risk of establishing new populations of (high and moderate priority) invasive species from a high to a moderate ranking (31 to 75 percent chance of new infestation). However, those requirements will more than likely not reduce the high risk ranking for the spread of common invasives, which are typically some of the biggest contributors to vegetation type conversion and habitat degradation because they are avoided or removed under Alternative 3.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 3.

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

All action alternatives have roughly the same affected environment and acreage of invasive plant species across similar treatments (Table 3.06-1 and Table 3.06-2). The direct, indirect and cumulative effects are also expected to be very similar. In terms of the risk of spreading invasive species, the main difference between the alternatives lays in the details of the management requirements. Alternatives 3 and 4 have a lower risk of invasive weed spread and proliferation than Alternative 1. While the difference between Alternative 3 and Alternative 4 for invasive plant impacts is very slight, Alternative 4 has a lower acreage of known weed infestations, salvage removal units and road work (especially new construction and reconstruction). Alternative 4 also has the highest amount of project acreage that is within the historic fire return interval, potentially making it slightly less susceptible to weed invasion.

3.07 RANGE

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Legislative authorities for administration of the National Forest System range program are shown in Forest Service Manual (FSM) 2201 and objectives, policies, and responsibilities are in the FSM 2202 through 2204 and FSM 2230 through FSM 2238. The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Range

- The authorization for livestock grazing and the administration of allotments will not change with any of the alternatives.
- The proposed activities and the amount of rangeland infrastructure in treatment areas reflects the relative degree of impact each alternative will have on permitted grazing in the project area.
- Monitoring will occur during project implementation to inform livestock managers about the effects on grazing use and rangeland resource conditions.

Data Sources

The following information was used to describe existing condition and analyze effects on rangeland resources.

- Post-fire field visits
- Local professional knowledge
- Project Treatment Information
- Vegetation and Soil Burn Severity, Soil Erosion Hazard Rating
- California Wildlife Habitat Relationships data
- Allotment and unit/pasture boundaries
- Land ownership data
- Capable Rangeland
- Rangeland infrastructure data
- Transportation data

Range Indicators

The following indicators were used to assess the effects of each alternative on rangeland resources.

- Proposed treatment area in each allotment (percent of allotment proposed for treatments)
- Proposed treatment area in capable rangelands within each allotment
- Road treatments (hazard tree removal and reconstruction/maintenance)
- Amount of range infrastructure encompassed by proposed treatments

Range Methodology by Action

Quantitative and qualitative comparisons of the anticipated impacts of each alternative on rangeland resources and the expected potential for moving existing conditions toward Forest Plan desired conditions were used for determining the effects on rangeland resources.

Affected Environment

Existing Conditions

The following information applies to grazing allotments affected by the Rim Fire.

Fire Extent and Burn Severity of Grazing Allotments

The Rim Fire effected thirteen grazing allotments. Some allotments were relatively less impacted due either to the proportion of the allotment burned and/or fire severity in the burned areas. Capable rangeland describes areas of land that can sustain domestic grazing and generally represent the portions of the landscape assumed to be most commonly used by cattle (USDA 2004). Capable rangeland was used to compare the relative effects of the fire on the allotments. Table 3.07-1 provides a summary of vegetation burn severity, soil burn severity, and erosion hazard rating for the affected allotments.

Table 3.07-1 Allotment burn severity and erosion hazard data

Allotment	Vegetation Burn Severity Mod and High (%)	Capable Range		Soil Erosion Hazard High (%)
		Vegetation Burn Severity Mod and High (%)	Soil Burn Severity High (%)	
Jawbone-Rosasco	64	72	61	15.1
Hunter Creek	54	52	49	3.5
Duckwall	14	6	8	2.2
Middle Fork, Meyer-Ferretti, Gravel Range, Curtin	65	68	56	18.1
Bonds, Bower Cave, Bull Creek, Little Crane	20	2	2	1.4
Westside, Lower Hull, Upper Hull	17	5	3	1.5

Grazing Management

Allotment Administration

Forest Plan Direction provides standards and guidelines designed to provide for resource conservation and sustainable use of rangelands. Range monitoring is conducted as needed to ensure that the grazing management strategies meet objectives for desired conditions. Administration of grazing allotments involves travel on roads by Forest Service staff and permittees. Post-fire administration of grazing allotments will require more frequent travel to and from key areas and range infrastructure. Dead trees pose a threat to human safety and make access more difficult for grazing permittees and Forest staff.

Rangeland Infrastructure

Rangeland infrastructure includes fences, water developments (troughs), cattleguards, gates and corrals designed to control livestock movements (timing, duration, and intensity of grazing). The Rim Fire and fire suppression activities damaged this rangeland infrastructure. Allotment management is difficult or impractical without this functioning critical infrastructure. Over time, standing dead and unhealthy trees will fall on range fences, as noted following the 1996 Ackerson Fire. Some improvements, particularly fences, are in need of repair. Dead trees adjacent to fences and troughs pose a safety risk for Forest staff and permittees responsible for repairing and maintaining improvements. Over time, dead trees are likely to fall and damage range infrastructure after it is repaired. Numerous water developments and cattleguards are not functioning because they were either damaged during the fire or have been affected by post-fire sediment and debris accumulation.

Livestock Movements

Livestock move through the allotments throughout the grazing season to find available forage and water. Dead or dying trees may reduce forage production to some extent due to shading and space availability. In many burned areas dead standing trees are abundant and have begun to fall. Fallen dead trees have the potential to “jackstraw” inhibiting livestock movements and reducing forage availability. Defective trees may also pose some risk to livestock, as cattle may be injured or killed by falling trees or by an excess of unburned fuel and debris. The presence of an abundance of dead timber also impedes the ability of permittees to herd livestock and achieve proper distribution.

The allotments are open range allotments. Livestock frequently travel across and along roads. When vehicles approach, the cattle generally move off of roads and out of the way of the oncoming vehicle. Fire killed trees along roadsides are expected to fall down hampering the ability of livestock to move off of roads when vehicles approach. To some extent, fallen dead trees along roadsides have the potential to cause an increase in vehicle-cattle interactions and/or collisions.

Rangeland Vegetation

Vegetation Types

Deerbrush (*Ceanothus integerrimus*) is the predominant local forage species used by livestock in the mid-elevation range of 3,500 to 6,000 feet. Riparian areas and meadows, which occur as patches within the forest mosaic, are also preferred by livestock due to the availability of water, shade and high quality forage. Livestock also feed in forested areas and forest openings where sufficient understory forage exists. Livestock may graze incidentally in any area of an allotment while moving between primary grazing areas.

California Wildlife Habitat Relationships (CWHR) vegetation types (Mayer and Laudenslayer 1988) and fire severity (Miller and Thode 2007) are used to describe the existing potential for landscape diversity. Pre-fire vegetation was examined using the CWHR vegetation types. Vegetation types were grouped into one of five broad categories of rangeland ecosystems. Table 3.07-2 displays pre-fire composition of rangeland vegetation types derived from CWHR data.

Table 3.07-2 General rangeland vegetation types and burn severity

Vegetation Type	Fire Area		Vegetation Burn Severity		
	acres	%	Mod	High	M+H
Annual Grasslands	7,928	5.2	22.4	48.3	70.7
Hardwood Forests	18,737	12.3	17.0	51.3	68.3
Chaparral	22,465	14.8	15.1	65.1	80.2
Conifer Forests	101,073	66.4	13.8	37.0	50.8
Riparian	2,004	1.3	16.7	49.2	65.9

Vegetation Condition

Current vegetation conditions are the combined result of pre-fire conditions and fire effects on the landscape. Table 3.07-2 shows vegetation burn severity for five broad rangeland vegetation types. Some vegetation types inherently burn more severely (chaparral), but species that dominate these plant communities are well adapted to recover from fire. Unburned areas and areas that burned at low severity are in a condition similar to that before the fire. Areas that burned at high severity are most likely to be in poor condition, with significantly reduced plant vigor and ground cover immediately following the fire. Because burned areas will naturally recover following fire, vegetation condition will improve over time, even in severely burned areas.

Forest and rangeland ecosystems recover naturally following fire, but each vegetation type responds differently to fire. Recovery sequence and timing varies based on environmental factors such as climate, soils and land management activities. Recognizing differences in vegetation types, identifying the stages of recovery and being responsive with changes in management are crucial to facilitating recovery of the burned landscape. Fire can cause a large scale vegetation type conversion to predominantly non-forest vegetation types, with many areas often dominated by brush within a few years following fire. The increase in transitory range helps to reduce overall utilization, due to the post-fire flush of palatable and nutritious forage.

Environmental Consequences

Direct effects on rangeland resources are directly caused by project implementation. Indirect effects on rangeland resources are in response to the direct effects of treatments or, as with Alternative 2 (No Action), a lack of treatment. Project management requirements are designed to mitigate the direct and indirect effects of the project on rangeland resources.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Table 3.07-3 provides a summary of the Alternative 1 treatment areas within allotments, capable range, roadside hazard trees, and fences.

Table 3.07-3 Alternative 1 treatments in affected grazing allotments

Allotment	Alternative 1 Treatment Areas				
	Acres	**Allotment** (%)	**Capable Range** (%)	**Roadside Hazard Tree** (miles)	**Fences** (%)
Jawbone-Rosasco	14,189	28	33	71.3	25
Hunter Creek	3,482	12	28	67.1	16
Duckwall	941	5	9	15.0	41
Middle Fork, Meyer-Ferretti, Gravel Range, Curtin	17,260	33	20	121.7	22
Bonds, Bower Cave, Bull Creek, Little Crane	1,487	3	2	24.5	50
Westside, Lower Hull, Upper Hull	5,087	9	5	56.4	90

Grazing Management

Allotment Administration

Alternative 1 improves safety and access conditions for allotment administration and grazing management. Alternative 1 removes hazard trees along a total of 356 miles of roads and improves (reconstruction and maintenance) 508 miles of roads inside allotment boundaries. Alternative 1 also removes hazards away from roadsides in salvage units, which improves safety conditions for grazing permittees and forest staff when working away from roads. Access within the allotments will be improved from existing conditions, facilitating allotment administration activities such as herding and monitoring. Project activities involving roads could affect livestock operations if temporary road closures are needed, although alternative access may be available for permittees. Non-use as a result of project activities is not expected to be necessary; however, if non-use is necessary, this change will result in inconvenience or economic loss to the permit holders.

Rangeland Infrastructure

Alternative 1 poses some risk that harvest activities will damage range infrastructure. The potential for damage to range improvements is mitigated by management requirements and timber sale administration. Timber sale contracts will require project activities to avoid damaging functioning range fences and to repair damage to fences that occur during implementation. Long-term maintenance needs will decrease to some extent, and the functioning condition of range infrastructure increases under Alternative 1 because dead trees will be removed along 13.8 fence miles within grazing allotments. Removing snags adjacent to range infrastructure will improve safety conditions for persons responsible for infrastructure maintenance and have a positive effect on grazing management. The cattleguards on roads proposed for reconstruction and maintenance will be maintained which will also improve grazing management on affected allotments.

Livestock Movements

Alternative 1 treats 4,193 acres within capable rangelands. Long-term availability of forage may be increased by salvage logging since removing dead or dying trees can increase sunlight. Livestock distribution could potentially change or expand if treatments reduce dead and downed woody material and if transitory range is created around these areas. An increase in transitory range could improve livestock distribution and use patterns. This alternative reduces the short and long-term potential for fallen dead trees which minimizes "jackstraw" and increases livestock movement and forage availability. Removal of roadside hazard trees will reduce the potential for vehicle-cattle interactions and livestock injury or death. Alternative 1 facilitates herding and increases livestock movements and distribution.

Rangeland Vegetation

Vegetation Types

Through natural recovery, ecosystems will tend to revert back to plant communities similar to what was seen with the pre-fire state, though there may be shifts in the proportions of vegetation types, floristic composition, and elevation range. The proposed activities may result in short term changes in species composition, but is not likely to result in long-term measurable changes to the proportions and distribution of vegetation types on a landscape scale.

Vegetation Condition

Alternative 1 has a beneficial effect on vegetation condition. Proposed activities will directly increase short-term forage availability, which results in a reduction of overall forage utilization. This alternative will indirectly improve long-term vegetation condition because fuel treatments reduce the potential for future catastrophic fires. Project activities may increase the likelihood of weed invasion and spread, a serious threat to rangelands; however, management requirements minimize the potential for weed invasion. Monitoring of grazing standards and guidelines will continue as described in the permit, Allotment Management Plan (AMP), and Annual Operating Instructions (AOI). Monitoring and adaptive management will ensure that vegetation condition meets standards and guidelines outlined in management direction.

CUMULATIVE EFFECTS

Alternative 1 when combined with the effects of other projects (Appendix B) may cause short-term negative cumulative effects on range due to the potential for soil compaction, ecological disturbance, and weed invasions. Long-term cumulative effects to range from those projects will be beneficial or neutral because they improve accessibility, curtail resource damage, or improve the ecological health of forest and rangelands. Monitoring will occur as needed to ensure that the combined effects of other projects and ongoing activities (Appendix B) meet Forest objectives for desired conditions. Since Alternative 1 implements the Forest Plan and includes management requirements that mitigate potential effects to acceptable levels, no adverse long-term cumulative effects are expected.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Grazing Management

Allotment Administration

Alternative 2 will not improve conditions for allotment administration and grazing management. The presence of hazard trees poses risks to the safety of rangeland managers and negatively affects accessibility for allotment administration. Access within the allotments will not be improved from existing conditions. Maintenance (clearing of fallen trees) of travel routes may become cumbersome in areas where roadside hazard trees are prevalent. Allotment administration activities such as herding and monitoring will be more challenging and time consuming, but will still occur.

Rangeland Infrastructure

Alternative 2 poses no risk of direct damage to range infrastructure by salvage operations; however, dead and unhealthy trees will not be removed and will fall on range fences over time, as noted following the 1996 Ackerson Fire. Allotment management will become much more difficult if critical range infrastructure is not functioning. Maintenance needs will be more significant under this alternative than for the action alternatives. Dead trees pose a safety risk for forest staff and permittees responsible for repairing and maintaining infrastructure. The long-term functioning condition of range infrastructure will be degraded as a result of this alternative.

Livestock Movements

Alternative 2 will not reduce the potential for "jackstraw", which can inhibit livestock movements and reduce forage availability. Alternative 2 will not improve livestock distribution and movements. This alternative does not reduce the risk of livestock death or injury by falling trees or by an excess of unburned fuel and debris. Permittee ability to herd and distribute livestock throughout key areas and capable range will not be improved under this alternative, which may increase the potential for localized overgrazing. This alternative may also increase the potential for vehicle-cattle interactions.

Rangeland Vegetation

Vegetation Types

Alternative 2 has no effects on rangeland vegetation types because no project activities will occur. The lack of project activities will not likely have measurable effects on post-fire recovery and vegetation dynamics. The landscape will recover naturally as early stages of forest succession take place immediately following the fire, favoring rapid revegetation of grasses, forbs, and sprouting woody plants. Forest succession in the burned area will continue over time.

Vegetation Condition

Alternative 2 may indirectly negatively affect vegetation condition. Because this alternative may increase the potential for localized overgrazing, it may also cause negative impacts on vegetation condition in some areas. Additionally, a lack of fuel treatments increases the potential for future catastrophic fire. Monitoring and adaptive management will be used to ensure that vegetation condition meets Forest standards and guidelines.

CUMULATIVE EFFECTS

Alternative 2 when combined with the effects of other projects (Appendix B) may pose some risk to rangeland health due to the potential for soil compaction, ecological disturbance and weed invasions. Long-term cumulative effects to range from those projects will be beneficial or neutral because they improve accessibility, curtail resource damage, or improve the ecological health of forest and rangelands. Other projects may to some extent alleviate the risk of high severity future fires; however, fuel loadings will be higher and the chances for a larger, hotter and more resource damaging fire will increase due to no salvage logging under Alternative 2. Combined with the increased potential for localized overgrazing, lack of road treatments, wildlife and watershed treatments, the cumulative effects of Alternative 2 are not likely to contribute to desired conditions for rangeland resources and would result in long-term negative cumulative effects to rangeland resources.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Table 3.07-4 provides a summary of the Alternative 3 treatment areas within allotments, capable range, roadside hazard trees, and fences.

Table 3.07-4 Alternative 3 treatments in affected grazing allotments

Allotment	Alternative 3 Treatment Areas				
	Acres	Allotment (%)	Capable Range (%)	Roadside Hazard Tree (miles)	Fences (%)
Jawbone-Rosasco	16,569	32	46	62.3	37
Hunter Creek	3,439	11	28	66.8	16
Duckwall	940	5	9	13.8	41
Middle Fork, Meyer-Ferretti, Gravel Range, Curtin	16,813	32	21	122.4	18
Bonds, Bower Cave, Bull Creek, Little Crane	1,488	3	2	24.9	50
Westside, Lower Hull, Upper Hull	4,471	8	5	54.3	9

Grazing Management

Allotment Administration

Alternative 3 has similar effects on allotment administration and grazing management as Alternative 1. Alternative 3 removes hazard trees along 345 miles of roads and improves (reconstruction and maintenance) 503 miles of roads inside allotment boundaries. Alternative 3 improves safety conditions and access for grazing permittees and forest staff, facilitating allotment administration activities.

Rangeland Infrastructure

Alternative 3 has beneficial effects to rangeland infrastructure, similar to Alternative 1. Dead trees will be removed along 12.9 fence miles within grazing allotments and several cattleguards will be maintained, thereby improving grazing management on affected allotments.

Livestock Movements

Alternative 3 proposes treatments on 4,887 acres of capable rangelands, almost 700 more acres than Alternative 1. The effects of this alternative are similar to Alternative 1.

Rangeland Vegetation

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Table 3.07-5 provides a summary of the Alternative 4 treatment areas within allotments, capable range, roadside hazard trees, and fences.

Table 3.07-5 Alternative 4 treatments in affected grazing allotments

Allotment	Alternative 4 Treatment Areas				
	Acres	Allotment (%)	Capable Range (%)	Roadside Hazard Tree (miles)	Fences (%)
Jawbone-Rosasco	15,487	30	46	65.2	37
Hunter Creek	3,439	11	28	66.8	16
Duckwall	941	5	9	13.8	17
Middle Fork, Meyer-Ferretti, Gravel Range, Curtin	16,710	32	21	123.3	4
Bonds, Bower Cave, Bull Creek, Little Crane	1,184	2	2	24.9	50
Westside, Lower Hull, Upper Hull	3,946	7	5	55.3	9

Grazing Management

Allotment Administration

Alternative 4, similar to Alternatives 1 and 3 improves conditions for safety and access for allotment administration and grazing management. Alternative 4 removes hazard trees 349 miles of roads and improves (reconstruction and maintenance) 503 miles of roads inside allotment boundaries.

Rangeland Infrastructure

Alternative 4 poses some risk that harvest activities will damage range infrastructure, but this is mitigated by management requirements and timber sale administration. Dead trees will be removed along 8 fence miles within grazing allotments. Cattleguard maintenance will also improve grazing management on affected allotments. The effects are similar to Alternatives 1 and 3.

Livestock Movements

The effects of Alternative 4 on livestock movements are similar to Alternatives 1 and 3, except that it treats 4,850 acres in capable rangelands, almost 700 more acres than Alternative 1 and only slightly less than Alternative 3.

Rangeland Vegetation

Vegetation Types

Same as Alternative 1.

Vegetation Condition

The effects of Alternative 4 on rangeland vegetation condition are similar to Alternatives 1 and 3, except that it treats less area. Alternative 4 will have a beneficial effect on vegetation condition.

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

The effects of each alternative are compared against the relative area proposed for treatment within grazing allotments, the amount of capable range in treatment areas, length of fence segments encompassed by treatments, and travel routes treated for hazard tree removal and road improvements. Table 3.07-6 displays a summary of this information for all alternatives.

Table 3.07-6 Allotment area and length of fences treated by each alternative

Treatment Areas	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Grazing Allotment (acres)	42,445	0	43,720	41,718
Capable Range (acres)	4,193	0	4,887	4,850
Fence (miles)	13.8	0	12.9	7.8
Roadside Hazard Tree (miles)	356	0	345	350
Road Improvements (miles)	508	0	503	503

All action alternatives propose a similar amount of roadside hazard tree removal and road improvement activities, and so will provide similar positive effects to allotment administration and livestock movements. Alternative 1 encompasses the most fence segments, and is the most desirable alternative for range infrastructure. Alternative 2 will not provide any improvements and would result in long-term negative cumulative effects. Alternative 3 provides the most benefits to rangeland resources. Alternatives 3 and 4 treat the largest amount of capable rangeland, and so have the potential to create the most improvements in forage availability and livestock distribution. Alternatives 1, 3 and 4 provide the most benefits for allotment administration (safety and travel).

3.08 Recreation

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan. In addition, the Forest Plan includes a specific goal applicable to recreation and the Rim Recovery project:

- **Forest Goal for Recreation**: Provide a wide range of recreation opportunities directed at various experience levels to meet current and projected demand, including campgrounds, hiking trails, picnic areas, off-highway vehicle (OHV) trails, etc. (USDA 2010a, p. 6).

Effects Analysis Methodology

The geographic extent of this analysis is the Rim Recovery project area and includes the Cherry Valley recreation area. This unit of spatial analysis is used for determining direct, indirect and cumulative effects. A short-term timeframe of three years allows the activities associated with this project to be mostly completed. A long-term temporal bound of 10 years allows completed activities associated with this project to be established.

Assumptions Specific to Recreation

- The National Visitor Use Monitoring (NVUM data) report accurately expresses recreation.
- Action alternatives will not cause long-term changes to recreation opportunities.
- Dust associated with the removal of logs from the Forest will be abated.
- Though the most updated dispersed camping and route data were used for this analysis, conditions change on the ground.

Data Sources

- Stanislaus GIS Library
- NVUM data (USDA 2008b)

Recreation Indicators

- Developed Recreation Opportunities
- Dispersed Recreation Opportunities

Recreation Methodology by Action

Use the recreation indicators to identify and compare the effects of the alternatives on developed recreation and dispersed recreation.

Affected Environment

Existing Conditions

Rim Fire Closure

Numerous recreation resources in the Rim Fire area have been damaged. Maintenance and rehabilitation is ongoing. Falling trees, rock falls, and debris flows will create an increased workload over the long-term to maintain these resources to Forest Service standards. Regulatory, information, directional, and interpretive signs have been damaged during the fire. Because roads and other developed facilities within the project area are faced with hazard trees that pose a threat to human health and safety, there is a need to remove those hazards to provide a safe environment for administration and public use of those facilities.

On November 18, 2013, after determining that conditions within the burn area present unsafe conditions for public travel, Forest Supervisor Susan Skalski issued a temporary Forest Order (STF 2014-01) that prohibited public use within the burn area until November 18, 2014. A total of 7 campgrounds, 5 semi-developed dispersed camping/concentrated use areas, 6 day use areas, 11 non-motorized trails, 5 OHV riding areas, 4 developed recreation sites under special use permits, and 475 inventoried dispersed campsites are located within the closure. Additionally, numerous outfitter/guides have special use permits (rafting, hiking, bicycling, fishing, etc.).

Recreation Visitor Use

Before the Rim Fire, Forest recreation use within the project area included OHV use, passenger car driving, rafting, boating, hunting, swimming, mining, wood cutting, camping (dispersed and developed), hiking, cycling (mountain and road), fishing, backpacking, horseback riding, and winter sports. These opportunities will once again be available after the hazard trees are abated and the area is re-opened for public access. Obviously, the fire has modified some of the experiences these activities provide in those locations where the severity changed the existing forest condition.

The Stanislaus National Forest ranks in the top five National Forests in California for overall annual recreation use (USDA 2008b). The Forest receives more visitation than any other National Forest on the Sierra Nevada western slope. The Recreation Facility Analysis (RFA) projected an increase in overall recreation use of 43 percent over the next 20 years (USDA 2007b). This is dramatically higher than the average forest nationally, but typical of adjacent Forests in the central Sierra. The expected increase in visitor use will create challenges as demand for all types of activities approach capacity.

Visitor use estimates for the Forest are based on the NVUM survey conducted from October 1, 2006 through September 30, 2007 (USDA 2008b), prior to the Rim Fire. Recreation use on the Stanislaus National Forest for this period was estimated at 1,817,200 National Forest visits and 2,100,300 site visits. The survey assessed existing recreation demand on the forest by asking visitors what they did during their visit. This assessment resulted in two categories of visitor use: all activities in which they participated in and the main activity (the primary purpose for their visit to the Forest). The survey highlighted the fact that the two uses may or may not be related. For example, 75 percent of the forest visitors reported participating in the viewing of natural features, but only 42 percent reported this as their main activity. The top five recreation activities visitors participated in were viewing scenery, hiking/walking, general relaxation, viewing wildlife, and picnicking. Each visitor also picked one of these activities as their primary activity for their current recreation visit to the forest. Table 3.08-1 identifies the primary activities as viewing scenery, downhill skiing, relaxing, OHV use (including motorized trails) and fishing (USDA 2008b).

Most visitors to the Forest participate in a variety of activities. Many activities, such as viewing natural features, can be either motorized or non-motorized. The overwhelming majority of forest visitors arrive in a motorized vehicle; the exception being immediately adjacent residents who hike or bicycle. This means that motorized and non-motorized activities are often combined as part of the total recreation experience.

Based on the 2012 NVUM data, an estimated 76,500 individual recreation site visits have been “lost” because of the fire and closure orders. An individual recreation site is defined as a single user visiting a single site. Because several users visit more than one individual recreation site on their visit, total individual visits to the National Forest “lost” due to the fire and closure orders is estimated to be 53,000. These figures are only valid under the assumption that none of the visits had a temporal or spatial substitute on the forest. That is, none of the visits either occurred at some other place on the forest or at some other time on the forest. If any such spatial or temporal substitution occurred, then these figures overstate the losses.

Table 3.08-1 National Visitor Use Monitoring Classified Activities

Activity[1]	Participation (percent)	Rank	Main Activity (percent)	Rank
Developed Camping	16.2	9	3.5	8
Primitive Camping	5.7	15	0.4	18
Backpacking	2.2	20	0.3	19
Resort Use	6.6	14	0.9	15
Picnicking	20.5	5	2.3	10
Viewing Natural Features	75.3	1	42.0	1
Visiting Historic Sites	2.5	18	0	-
Nature Center Activities	1.3	25	0	-
Nature Study	1.9	21	0	-
Relaxing	35.2	3	8.2	3
Fishing	18.7	8	8.0	5
Hunting	9.0	12	7.7	7
OHV Use	10.4	11	8.1	4
Driving for Pleasure	19.9	6	1.9	11
Snowmobiling	1.8	22	1.5	12
Motorized Water Activities	2.3	19	0.1	20
Other Motorized Activity	0.1	26	0.1	21
Hiking / Walking	36.2	2	7.7	6
Horseback Riding	1.8	23	0.9	14
Bicycling	3.2	17	0.6	17
Non-motorized Water	7.9	13	3.5	9
Downhill Skiing	11.4	10	10.9	2
Cross-country Skiing	1.8	24	1.1	13
Other Non-motorized	18.7	7	3.2	9
Gathering Forest Products	4.1	16	0	-
Viewing Wildlife	32.0	4	0.7	16

[1] Information based on 2007 monitoring and January 2009 update

Table 3.08-2 Recreation Opportunity Spectrum Classes within the Rim Recovery project area

ROS	General Direction	Standards and Guidelines
Semi-Primitive Non-Motorized **NMFPA**	Manage the area so that on-site controls are minimized and restrictions are subtle. Provide a range of semi-primitive non-motorized recreation opportunities and experiences.	Meet the ROS objective of Semi-primitive Non-motorized. Interaction between visitors is low but there is evidence of other users. Motorized use is normally prohibited, except for: 4N80Y, 5N02R (**NMFPA**). Resource improvements will normally be limited to minimum, unobtrusive facilities.
Roaded Natural	Manage the area so there is only moderate evidence of the sights and sounds of man. Provide a range of roaded natural recreation opportunities and experiences.	Meet the ROS objective of Roaded Natural. Interaction between users is usually low to moderate with evidence of other users prevalent. Resource modification practices are evident. Conventional motorized use is provided for in construction standards And facilities designs. A full range of other resource activities is permitted to the extent that the general practice description is met.

NMFPA=Non-motorized Forest Plan Amendment (USDA 2010a, p. 2)

Recreation Opportunity Spectrum

ROS identifies possible mixes or combinations of activities, settings, and probable experience opportunities are arranged along a spectrum, or continuum (USDA 1986). The Forest Plan integrates ROS into the management prescriptions and associated standards and guidelines. Table 3.08-2 displays the ROS classes that exist within the project area: Semi-Primitive Non-Motorized and Roaded Natural[6].

Recreation Access

Traditionally, high volumes of traffic occur during peak seasons on Forest Service Maintenance Level 3, 4, and 5 roads that are subject to the Federal Highway Safety Act. These higher maintenance level roads provide access to most developed recreation and some dispersed sites. Currently, most access to developed sites is closed. The Rim HT project is expected to remove the hazard trees, opening many of these roads to public use. Logging trucks and related timber removal equipment will be operating along main corridors seven days a week. Evergreen Road on the Groveland Ranger District, however, will have no harvest operations implemented during weekends from Memorial Day and to Labor Day to allow safe public access. Evergreen Road is a main artery that provides access to several popular recreation areas:

- Dimond O Campground (Forest Service);
- Middle Fork Day-Use (Forest Service);
- Carlon Day-Use and Trailhead (Forest Service), which provides trail access to Carlon Falls in Yosemite National Park;
- Peach Growers Recreation Residence Tract, which encompasses 20 Forest Service Special Use cabins, roads and water infrastructure;
- Evergreen Lodge (Privately owned Historic Yosemite Lodge); and,
- Camp Mather (City and County of San Francisco family camp).

Some access routes show resource damage due to rain on slopes with no ground cover or vegetation. Lumsden Road (1N10) with numerous debris slides since the Rim Fire accesses dispersed areas and developed sites including the Merals Pool put-in for whitewater boating.

Developed Recreation Opportunities

Developed recreation sites provide infrastructure which typically include running water, structures, vault toilets, signage, barrier posts, interior roads, campfire rings, grills and picnic tables. Developed campgrounds within the affected area are Dimond O, Lost Claim, Lumsden Bridge, Lumsden, South Fork, Sweetwater, and Cherry Valley. Upper and Lower Carlon, Middle Fork, and Rainbow Pool Day Use Areas, Rim of the World Vista, Cherry Creek and Merals Pool Boat Launches are also found within the Rim Fire perimeter. Developed recreation sites under special use permit within the Rim Fire perimeter include Berkeley-Tuolumne Camp, Peach Growers Recreational Residence Tract, and San Jose Camp. Berkeley-Tuolumne Camp was completely destroyed in the Rim Fire and may be rebuilt. San Jose Camp received some fire damage, and a vault toilet was burned at the South Fork Campground. Camp Tawonga is a privately owned camp that is accessed by Cherry Lake Road or Evergreen Road and Forest Route 1S02.

Dispersed Recreation Opportunities

Dispersed recreation opportunities include non-motorized system trails and motorized recreation opportunities. The project area provides a variety of dispersed recreation opportunities that include 475 inventoried dispersed campsites. Developed-dispersed camping and concentrated use areas within the Rim Fire perimeter include Camp Clavey, Cherry Borrow, Cherry Valley, Joe Walt Run, and Spinning Wheel. Many dispersed sites are accessed by Forest Service Maintenance Level 2 roads proposed for hazard tree removal in this project.

Non-motorized system trails include Andresen Mine, Carlon Falls, Hamby, Golden Stairs, Humbug/Duluke, Indian Creek, Kibbie Ridge/Huckleberry, North Mountain, Preston Falls, Tuolumne

[6] Not all ROS classes are present with the Rim Recovery project area (Table 3.08-2). The full range of ROS classes include: 1) Primitive; 2) Semi-Primitive Non-Motorized; 3) Semi-Primitive Motorized; 4) Roaded Natural; 5) Rural; and, 6) Urban.

River Canyon, West Side Trail, and Lake Eleanor. Some trails access various points of interest along the Tuolumne Wild and Scenic River corridor and serve as important emergency access points for river users. Wilderness trailheads within the project area provide access to trails in Yosemite and Emigrant Wildernesses.

Motorized recreation opportunities typically provide a variety of settings and a diversity of OHV trails varying in length, degree of difficulty, and access to other recreation opportunities. Motorized Recreation Areas include Jawbone Pass, Pilot Ridge, Tuolumne Rim, Two-mile/Middle Clavey/Reynolds Creek, and West Side Rail Tour.

A Burned Area Emergency Response (BAER) team began assessing the Rim Fire area for post-fire emergencies on September 9, 2013. BAER is a rapid assessment of burned watersheds to identify imminent post-wildfire threats to human life and safety, property and critical natural or cultural resources on NFS lands and takes immediate actions to implement emergency stabilization measures before the first major storms. The Forest invested $4,600,000 in BAER treatments including the following areas.

- **Roads**: out-sloped road surface, maintained and constructed drainage features (e.g., rolling dips, cleaned and replaced culverts), replaced guardrails and reflectors, installed and closed gates to close burned area to public use according to closure (STF 2014-01), fell hazard trees at intersections, cleared trees that fell across roads, replaced traffic control barriers, installed signs (e.g., warning, regulatory, and hazard signs), and continued storm patrolling.
- **Trails**: maintained and installed drainage dips, removed burned wooden retaining features and replaced with rock or rerouted trail, fell hazard trees at trailheads, cleared trees that fell across trails, replaced traffic control barriers on motorized trails, installed warning and hazard signs, closed public access to trails through winter, and continued storm patrolling.
- **Facilities**: sealed burned vault toilets, removed and replaced burned traffic barriers, installed warning and hazard signs, fell hazard trees, closed public access to trails through winter, and continued storm patrolling.

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Alternative 1 will improve administrative, visitor, and traffic safety and provide overall net benefits for recreation resources. Salvage of fire-killed trees within the project area would remove dead trees from the project area; thereby, recovering commercial value and reducing excessive fuel loads. Recreation resources may need to be temporarily closed during hazard tree removal efforts, which will displace users and may affect scenic quality.

A limited amount of noise from chainsaws, skidders, loaders, logging trucks and personnel associated with the abatement and removal of hazard trees is expected during project implementation. Hazard tree operations can treat from 0.5 to several miles of road per day, assuring limited impacts, which would not exceed more than a few days in any one location. Noise disturbances to users of facilities within this project are inevitable, but would be very limited in duration and amount.

Developed Recreation Opportunities

Lumsden Bridge, Lumsden Campground and South Fork Campground would not be affected from the proposed activities. Sweetwater, Lost Claim, and Dimond O Campgrounds and Peach Growers Recreation Residence Tract are immediately adjacent to proposed tractor logging units and would experience temporary negative effects from noise, dust, and increased traffic associated with the cutting and removal of trees. Loading for hazard tree operations along Highway 120, where Sweetwater and Lost Claim Campgrounds are located, will be avoided during the weekends (3:00 pm

Friday through Sunday). Because logging operations would not occur along or adjacent to Evergreen Road on weekends during the peak summer season (from July 3 through July 5, during Memorial Day and Labor Day weekends, and during the special event on Evergreen Road), negative effects are lessened for Dimond O Campground and Peach Growers Recreation Residence Tract, along with the private properties of Camp Mather and Evergreen Lodge. The reduced logging operations and hauling during peak travel time for visitors to the forest should reduce the potential for accidents related to industrial vehicles in use in the project area.

Activities are planned on NFS land adjacent to privately owned Camp Tawonga (Table 3.08-3). The camp will experience temporary negative effects from noise, dust, and increased traffic associated with the cutting and removal of trees. It should take 30 days or less to log and haul the dead timber on tractor units within 1 mile of the camp. In addition, appropriate safety procedures related to traffic management requirements will be included in all Timber Sale contracts. This may be accomplished by placing warning or closure signs in locations that ensure maximum visibility for forest visitors.

Table 3.08-3 Tractor Units within 1 Mile of Camp Tawonga

Units	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
tractor units	13	0	14	14
acres	1,321	0	1,263	1,263

Cherry Valley Campground is adjacent to proposed treatment units (helicopter and tractor) as well as hazard tree removal activities occurring along the roads accessing this area. Due to heavy logging traffic on travel routes that access Cherry Lake Road, Cherry Valley campground will be closed for at least the 2014 season. Under the Forest Order discussed earlier in this section (STF 2014-02), the Forest is currently closed until hazard trees along roads are abated either under the Rim HT project or this EIS. Closure of Cherry Valley Campground will have a temporary negative financial effect to the campground concessionaire and temporary negative effects to forest visitors who prefer camping in Cherry Valley.

Dispersed Recreation Opportunities

Considering the volume of dispersed recreation on the Stanislaus National Forest and the size and scale of the Rim Recovery project, many dispersed areas would be impacted by either through project activities directly (e.g., landings placed on top of dispersed camping sites) or indirectly through log hauling and continued closed access routes to the sites. However, these sites are currently closed under Forest Order STF 2014-02. The positive effects of this alternative are to provide safe dispersed recreation areas and safe access. As access routes are cleared of hazard trees the Forest would open to public use including the 99 miles of motorized and non-motorized trails currently closed due to hazard trees. Finally, although gravel will be used on some roads that currently have a native surface; these roads are expected to return back to their native state at the conclusion of the logging period due to the significant wear and tear imposed by the industrial traffic.

CUMULATIVE EFFECTS

Appendix B identifies other actions within the Rim Fire area including ecological restoration, soil improvement, transportation and motorized trail improvement projects. Those projects will add to the overall health of the forest and enhance recreation opportunities within the Rim Fire area. Cumulative effects would include the temporary negative effects of noise, dust and increased traffic on the recreation experiences of Forest users; however, the Rim HT project and the Rim Recovery provide safe access and safe travel to developed recreation sites and dispersed recreation areas.

Hazard tree and other projects are expected to occur in the foreseeable future. Some proposed activities may temporarily limit access for recreation opportunities, displacing recreation use to other areas in the vicinity during project implementation. Since all projects on NFS lands are designed to meet Forest Plan direction for recreation and ROS, Alternative 1 will not result in cumulative, long-term effects on recreation.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, current management plans would continue to guide management of the project area. No hazard tree removal or road maintenance would be implemented to accomplish project goals, and thousands of currently hazardous trees would be left to fall on their own as a result of the forces of wind, snow and gravity. These trees will not be removed, will contribute to accumulation woody debris, and may pose a risk for more intense wildfire behavior. Hazard trees and other trees previously felled during fire suppression or BAER activities would not be removed from areas adjacent to Level 2 roads, motorized or non-motorized trails, dispersed campsites, and other recreational activities.

Developed Recreation Opportunities

In a 2004 study of more than 200 BAER reports, many direct and indirect impacts and potential risks to recreation due to resource damage caused by fire were identified following fires on National Forests across the nation (Chavez 2004). Table 3.08-4 lists some potential impacts and risks to developed recreation sites. Some impacts, such as falling snags, will be long-term issues resulting from the Rim Fire.

Table 3.08-4 Alternative 2: Potential Impacts and Risks to Developed Recreation

Developed Recreation Impacts	Direct	Risks
Closure, blocked, or restricted access	X	X
Drinking water source damage	X	X
Falling snags/hazard trees		X
Facilities and improvements damaged	X	
Tree stands severely damaged	X	
Plugged culverts	X	X
Degraded water quality for recreation purposes		X

Dispersed Recreation Opportunities

Continued closure of portions of the burn area will limit access to dispersed recreation opportunities and displace users. Alternative 2 indirectly will contribute to the proliferation of unplanned, unauthorized, non-sustainable roads, trails and areas created by unauthorized cross-country travel. Impacts include compacted soil, soil and vegetation loss, and habitat disturbance. Table 3.08-5 lists some potential impacts and potential risks to dispersed recreation areas (Chavez 2004). Many of these will be long-term impacts resulting from Alternative 2.

CUMULATIVE EFFECTS

A total of 475 inventoried dispersed campsites exist within the project area. Continued closure of portions of the burn area under Alternative 2 will displace users to other available areas within the Rim Fire. Displaced users may impact sensitive meadows and riparian areas. Intense heat from campfires can damage vegetation and soil. Repeated use of a dispersed campsite can result in soil compaction, soil and vegetation loss, habitat disturbance, and heritage resource degradation. As such, Alternative 2 will contribute towards adverse cumulative effects on recreation and possibly other resources in the Rim Fire perimeter.

Table 3.08-5 Alternative 2: Potential Impacts and Risks to Dispersed Recreation

Dispersed Recreation Impacts	Direct	Risks
Closure, blocked, or restricted access	X	X
Drinking water source damage	X	X
Falling snags/hazard trees		X
Flooding, water erosion		X
Landslides and debris flows		X
Loss of soil productivity		X
Noxious weed infestation		X
Tree stands severely damaged	X	
Unstable hillsides	X	
Falling rock		X
Increased unauthorized motorized use		X
Plugged culverts	X	X
Sign, guardrail and cattleguard damage	X	X
Stranding people		X
Stump burnout	X	
Unstable trail conditions	X	
Degraded water quality for recreation purposes		X
Vandalism/theft of cultural resource sites		X

Alternative 3

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

Although the proposed acreages and treatments change across the alternatives, the effects of Alternatives 1, 3 and 4 are the same. These include temporary negative effects of noise, dust and increased traffic on the recreation experiences of Forest users; however, the positive effect of improved forest health will benefit recreation. Alternative 2 will have long-term negative indirect and cumulative effects to developed and dispersed recreation opportunities due to limited or no access.

3.09 SENSITIVE PLANTS

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

No federally listed plants occur on the Stanislaus National Forest. Forest Service Manual (FSM 2670) and the Forest Plan provide direction for management of sensitive plants.

It is the Secretary of Agriculture's direction to "…manage 'habitats for all existing native and desired nonnative plants, … in order to maintain at least viable populations of such species'" and "avoid actions 'which may cause a species to become threatened or endangered'" (FSM 2670.12). Further, it is a Forest Service objective to "maintain viable populations of all native ... plant species in habitats distributed throughout their geographic range on National Forest System lands" (FSM 2670.22). Forest Service policy set out in FSM 2670.32 is to "avoid or minimize impacts to [Sensitive] species whose viability has been identified as a concern." Where it is determined that impacts cannot be avoided, "the line officer with project approval authority, [may make] the decision to allow or disallow impact, but the decision must not result in loss of species viability or create significant trends toward federal listing." Sensitive Plants are defined as "those plant … species identified by a regional forester for which population viability is a concern, as evidenced by: a) significant current or predicted downward trends in population numbers or density and b) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" (FSM 2670.5).

Forest Plan direction for Sensitive Plants is to "provide for protection and habitat needs of sensitive plants, so that Forest activities will not jeopardize their continued existence." Forest Plan S&Gs advise to "modify planned projects to avoid or minimize adverse impacts to sensitive plants" (USDA 2010a, p. 60). The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Sensitive Plants

- Unknown occurrences of Sensitive Plants exist within the project area and treatment units.
- Surveys conducted during the spring and summer 2014 will locate and document additional occurrences; management requirements would be applied to the newly discovered populations.

Data Sources

- Rare plant occurrences, survey locations and habitats (GIS).
- RareFind 3 Database from the California Natural Diversity Data Base (CNDDB), California Department of Fish and Wildlife (CNDDB 2014).
- Soil Survey, Stanislaus National Forest Area, California (USDA 1981).
- Tuolumne County Lithography.
- 2009 GIS Ortho Photo layers.
- Google Earth satellite aerial photos.
- Specimen herbarium records (CCH 2014).
- The paper-based Groveland Ranger District surveys completed atlas.

Sensitive Plant Indicators

- Sensitive Plant occurrences.
- Suitable habitat for sensitive plants and the condition of those habitats.
- Number of sensitive plants impacted by the project, the intensity of the impacts and the duration of the impacts.

Sensitive Plants Methodology by Action

A list of all federally listed Threatened, Endangered or Proposed plant species which might occur in the Stanislaus National Forest was acquired from the U.S. Fish and Wildlife Service (USFWS 2014).

A prefield review was conducted to determine which sensitive plant species might occur or are known to occur within the project area (project record). Habitat attributes such as geology and soil types, elevation range, aspect and presence of closed canopy and forest openings were used to determine availability of suitable habitat for each species.

The effects of the Rim Recovery project were analyzed using data from sensitive plant inventories, local observations of effects to the various plant species, anecdotal information for specific species documented in Regional Sensitive List revision forms and, where available, published research papers or research papers acquired prior to publication.

The project area will serve as the geographic bounds for effects analysis of sensitive plants. The project area is an appropriate size to assess the effects of the proposed activities because all potential disturbances and effects to sensitive plants would occur within this boundary. Any predictable effects to vegetation would remain within this area. For sensitive plants, the project area also serves as the area of analysis for cumulative effects because effects of other past, present, and foreseeable activities would interact with effects of the proposed project only within the project area.

The time frame considered for future effects is 10 to 20 years after implementation. By the end of this time period, the predicted effects to sensitive plant occurrences and habitats would be in progress and observable.

Affected Environment

As described in the Sensitive Plant BE (project record) and Botany Report (project record), rarity in plants can be the result of a number of things. Loss of habitat is a key factor for some species. Reproductive isolation through loss of populations is another factor. In many cases, the scarcity of the habitat in which the species evolved is the limiting factor which makes the species rare. Many of the sensitive plants considered in the Rim Recovery project are limited to specialized or scarce habitats such as cliffs, vernal pools, fens (spring-fed seep or meadow areas containing 16 inches or more of peat), or "lava caps" (prehistoric volcanic ash mud flows also known as lahars and composed of andesitic tuff).

Sensitive Plant surveys have been conducted within the project area for the past 24 years. However, changes to the Regional Forester's Sensitive Plant List, increased understanding of species range, the lack of floristic surveys in the past and the lack of any type of survey within some proposed treatment areas indicate the need to survey the proposed project for sensitive species. Within the Rim Recovery project, there are few treatment units which have been surveyed for all sensitive species based on the unit's habitat attributes and the current Sensitive Plant List.

The following Sensitive Plant species are known to occur within the project area: *Allium yosemitense, Balsamorhiza macrolepis, Botrychium crenulatum, Botrychium minganense, Botrychium pedunculosum, Clarkia australis, Clarkia biloba ssp. australis, Cypripedium montanum, Eriophyllum nubigenum, Erythronium taylori, Erythronium tuolumnense, Lewisia kelloggii ssp. hutchisonii, Lomatium stebbinsii, Mielichhoferia elongata, Mimulus filicaulis, Mimulus pulchellus,* and *Peltigera gowardii.*

In addition, suitable habitat within the appropriate geographic and elevational ranges exists within the project area for the following species: *Allium tribracteatum, Arctostaphylos nissenana, Botrychium ascendens, Botrychium lineare, Botrychium lunaria, Botrychium montanum, Botrychium pinnatum, Bruchia bolanderi, Cinna bolanderi, Dendrocollybia racemosa, Eriastrum tracyi, Eriogonum luteolum var. saltuarium, Eriophyllum congdonii, Fissidens aphelotaxifolius, Helodium blandowii,* *Horkelia parryi, Hulsea brevifolia, Lewisia kelloggii ssp. kelloggii, Meesia uliginosa, Mielichhoferia shevockii* and *Tauschia howellii.*

The following plant profiles are for species which might be impacted by project activities.

Allium tribracteatum (three-bracted onion) is a perennial herb which grows in “lava cap” soils. Lava caps are volcanically derived formations formed by ancient ash mud flows. The occurrence sites are usually open with no overstory. *Allium tribracteatum* usually grows on the thin soils near the tops of ridges where there is little competition. Thirty-three known occurrences of *Allium tribracteatum* exist in the Stanislaus National Forest. Most are in the Mi-Wok Ranger District, none within the Rim Fire perimeter; however there is unsurveyed suitable habitat.

Clarkia australis (Small's southern clarkia) is an annual herb which grows in openings in ponderosa pine and mixed-conifer stands often in association with bear clover. *Clarkia australis* prefers sites with little or no competition from aggressive weedy species. When not associated with bear clover, the species is usually observed growing in bare mineral soil or with a very light layer of leaf litter. *Clarkia australis* has a very narrow range in Tuolumne and northern Mariposa Counties. The Rim Fire burned through a large portion of the known occurrences of this species.

Clarkia biloba ssp. *australis* is an annual herb which usually grows under light shade in oak woodland, chaparral and conifer forests. Like *Clarkia australis*, it prefers to grow where there is little competition from weedy species.

Lewisia kelloggii ssp. *hutchisonii* (Hutchison’s bitterroot) and *Lewisia kelloggii ssp. kelloggii* (Kellogg’s bitterroot) are recently described perennial herbs which grow on rocky ridges in shallow soils over bedrock or relatively flat open areas with widely spaced trees in partial to full sun. Soils are typically either sandy granitic or erosive volcanic soils. *Lewisia kelloggii* ssp. *hutchisonii* is known from 56 occurrences in five National Forests in California. This species occurs in Siskiyou, Butte, Plumas, Sierra and Tuolumne Counties. There are 17 known occurrences in the Stanislaus National Forest, two inside the Rim Fire, one within a treatment unit. *Lewisia kelloggii ssp. kelloggii* is known from 25 occurrences and is found from Humboldt County in the coast Range and from Plumas, Nevada, Sierra, El Dorado, Placer, Calaveras, Mariposa and Madera Counties in the Sierra Nevada. There is one occurrence of *Lewisia kelloggii ssp. kelloggii* in the Stanislaus National Forest in the Calaveras Ranger District, well outside the Rim Fire area. There is suitable habitat which has not been surveyed for these species in Rim Fire Recovery units.

Lomatium stebbinsii (Stebbins’ lomatium) is a perennial herb which grows in shallow soils on ridge tops and slopes of lava caps. This species is limited to Calaveras and Tuolumne Counties. There are about 90 occurrences in the Stanislaus National Forest, three in Calaveras Big Trees State Park and five on private property. The majority of the occurrences are found in the watersheds of the South Fork Stanislaus and North Fork Tuolumne Rivers on either side of Highway 108. Eight occurrences are found within the Rim Fire, made up of 34 colonies. Four colonies occur in three salvage units. There are five colonies in four roadside hazard tree units.

Mimulus filicaulis (the slender-stemmed or Hetch-Hetchy monkey flower) and *Mimulus pulchellus* (the pansy monkey flower) are annual herbs which occur in seasonally damp soils, seeps, springs, meadows and drainages in openings in forests or chaparral. *Mimulus pulchellus* is often found growing in “lava cap” soils. *Mimulus filicaulis* has a very narrow range from the Tuolumne River south to Mariposa County. Most of the occurrences are centered on the area east of Cherry Lake Road and north of Highway 120 and west of the boundary with Yosemite National Park. The range of *Mimulus pulchellus* is Calaveras, Tuolumne and Mariposa Counties. Both *Mimulus filicaulis* and *Mimulus pulchellus* prefer to grow in areas with little competition. Both tolerate low levels of soil disturbance, such as caused by gophers after the plants have gone to seed.

Peltigera gowardii (Goward's waterfan) is a lichen which grows submerged or within spray zones of perennial streams. The streams are shallow and often fed by cold water springs. The water is very clear and peak flows are not of the intensity that would lead to scouring. The range of this species is from southern Alaska to Fresno County in California. There are 19 occurrences in the Stanislaus National Forest. Six occurrences are within the Rim Fire burned area. There is unsurveyed suitable habitat within the burned area.

In addition to Sensitive Plants, the Botany Report (project record) analyzed Forest Watchlist and Botanical Interest species. Forest Watchlist species include those which are locally rare (as opposed to declining throughout their range), are of public concern, occur as disjunct populations, are newly described taxa, or lack sufficient information on population size, threats, trend, or distribution. Botanical interest species are those which are protected or enhanced for the purpose of conserving botanical richness or diversity within the National Forest. These are typically species which are uncommon in the Forest but not necessarily uncommon at a regional or global scale. They are sometimes species at the extent of their geographic ranges, disjunct from areas where they are common, or are limited by habitats which are uncommon in the Forest but more numerous elsewhere.

Existing Conditions

The geology of the project area, as it relates to sensitive plant habitat, is quite varied. Bedrock and soil parent material are composed of granite, especially on the eastern half of the project, metasedimentary rock primarily on the western half of the project, or volcanically derived andesitic tuff (Mehrten Formation) which is isolated on some of the ridge tops and surrounding slopes. Soils in the project area are diverse, running the full range from deep sandy or loamy granitics to rocky clays of metasedimentary origin. The andesitic tuff breccia tends to be shallow, coarse and fast draining. This variety of soils and parent material allows for the establishment of rare plants, many of which have affinities for very specific types of soils or parent material. Lava caps were disturbed by the Rim Fire and some were also impacted during suppression activities. Before the fire, some of the lava caps were impacted by off-trail OHV driving causing localized disturbance.

Before the Rim Fire, plant communities within the project boundaries included Westside Ponderosa Pine Forest, Sierran Mixed Conifer Forest, several different chaparral communities such as Montane Manzanita Chaparral and Northern Mixed Chaparral, Montane Meadow, White Alder Riparian Forest, Aspen Riparian Forest, Blue Oak Woodland, and other oak woodland communities (Holland 1986). Among these were mixed conifer stands which had not burned in wildfires in more than 100 years and provided excellent habitat for occurrences of *Cypripedium montanum*, and small, low gradient perennial streams which provided excellent habitat for *Peltigera gowardii*. These high functioning ecosystems were relatively free of noxious weeds. Many of them burned with a moderate to high intensity in the Rim Fire where the conifer overstory was completely killed.

Wildfire has been an important component driving plant community composition within the analysis area during the past 100 years. Dating back as far as 1908, 124 wildfires occurred within the Rim Fire boundary (USDA 2010d). Some of the past fires overlapped with each other, burning some areas three, four or even five times prior to the Rim Fire. Other drivers of the pre-Rim Fire mix of plant communities include past logging, reforestation activities, cattle grazing and effective fire suppression.

Many of the Westside Ponderosa Pine Forest areas were conifer plantations 10 to 40 years of age. Some of the plantations were isolated and the result of old clear-cut timber harvests. However, most of the plantations were planted as part of the recovery from the1973 Granite Fire, the 1987 Stanislaus Complex fires and the 1996 Ackerson Complex or Rogge Complex fires. The Wrights Creek plantations dated from the 1950s and the Sawmill plantations dated from the 1960s and were also the result of post-fire recovery. The past wildfires and subsequent salvage logging and reforestation activities created thousands of acres of disturbed habitat. These plantations were in various phases of growth and many had been thinned in the past fifteen years. Due to their mostly early seral nature, the understories had low native plant diversity and were primarily composed of disturbance followers such as non-native annual grasses and native shrubs like deer brush (*Ceanothus integerrimus*), manzanita (*Arctostaphylos* sp.), bear clover (*Chamaebatia foliolosa*) and Sierra gooseberry (*Ribes roezlii*).

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Sensitive Plant occurrences will be flagged and avoided prior to implementation. Sensitive plants may occur within roadside hazard tree removal areas where trees will be felled. Management requirements will minimize the amount of effects to these occurrences by ensuring the smallest possible portion is impacted with the tree falling and removal or fuel abatement. No occurrences are expected to be eliminated as a result of these situations.

With avoidance of most sensitive plant occurrences, only *Clarkia australis*, *Clarkia biloba* ssp. *australis*, *Mimulus filicaulis* and *Mimulus pulchellus* would possibly be directly affected by the proposed activities. In some of these occurrences, manual fuel reduction would be allowed during the dry non-growing period when the species are present as seed, not living plants. Because they are annual plants, timing this work for the dry, non-growing period is critical for ensuring that the activity does not cause loss of entire occurrences. These occurrences would be less vulnerable to loss as seed than as living plants. Mastication and legacy skid trail subsoiling to alleviate compaction would also be allowed within occurrences of *Clarkia australis* during the dry, non-growing period.

Effects to *Clarkia australis* are reduced by not allowing equipment to track through occurrences smaller than 0.25 acre and to minimize tracking through occurrences larger than 0.25 acre. Rather than impacting growing plants, activities in *Clarkia australis* occurrences would be restricted to the dry, non-growing period, when they would have less impact by allowing annual seed set and conserving seed in the soil. These mitigations greatly reduce the risk that occurrences of *Clarkia australis* would be eliminated. The benefit of conducting mastication within occurrences of *Clarkia australis* is reduction of fuels from the small dead trees which would eventually fall or the dead brush which would contribute to fuel loading and thereby lowering the risk of losing occurrences during the next wildfire. Additionally, mastication might help prevent or reduce the establishment of dense brush which might otherwise dramatically reduce the quality of the habitat for the *Clarkia* which prefers to grow in forest openings with little or no competition from other plants. The benefit of subsoiling legacy skid trails in *Clarkia australis* occurrences is the enhancement of habitat.

Conducting manual fuel reduction within occurrences of *Clarkia australis*, *Clarkia biloba* ssp. *australis*, *Mimulus filicaulis* or *Mimulus pulchellus* poses a low to moderate risk of damage or death of some of the seeds even when implemented during the dry, non-growing period. The risk would come from trampling by workers. The amount of seed damaged or lost is expected to be minimal.

Indirect adverse effects to the two occurrences of *Lomatium stebbinsii* on the western edge of Unit A01B may occur. Mastication is proposed for this unit. The *Lomatium* occurrences would be flagged and equipment would avoid tracking or masticating within the occurrences. However, there is a risk that debris from the mastication activity could be thrown by the equipment into the occurrences, building up organic matter. This species grows in a habitat with very little soil surface organic matter. A buildup of woody debris could block sunlight to the plants or cause drift soil to accumulate and act as an anchor point for weedy species such as cheat grass (*Bromus tectorum*) which tend to be highly competitive. Additionally, the woody debris and accumulation of weedy species could concentrate heat at the soil surface during a fire in a habitat which normally has little or no burnable matter present where this perennial species grows. Excessive heating of the soil surface during a wildfire could cause loss of *Lomatium* plants which grow from a tuber in the shallow soils.

The Sensitive aquatic lichen *Peltigera gowardii* may be affected. It is expected that activities which change these habitat characteristics – increase sedimentation, scour or sun exposure – would likely lead to a reduction or loss of individuals, and depending on the degree of impact, perhaps loss of the occurrence. Sedimentation or scouring could damage the thin, gelatinous thallus of *Peltigera gowardii* by abrading it, leading to death of the organisms (USDA 2010c). Sedimentation could also cover the organisms, blocking their ability to photosynthesize (USDA 2010c).

There are six *Peltigera gowardii* occurrences within the project area. Three of these areas, Corral Creek, an unnamed tributary to Skunk Creek and an unnamed tributary to the Clavey River, are in a portion of the project area which burned at moderate to high severity. The risk of erosion and sedimentation affecting the *Peltigera gowardii* sites in these streams is high as a result of the fire effects. The soil and watershed BMPs would prevent direct impacts to the species, and would reduce the amount of activity-created sediment in these occurrences, but might not fully alleviate additional scouring effects due to loss of soil cover combined with the logging activities.

Mastication and logging activities adjacent to “lava cap” habitats could unintentionally create motorized access to these fragile open habitats which can be home to sensitive species such as *Allium tribracteatum, Lomatium stebbinsii, Lewisia kelloggii ssp. hutchisonii, Lewisia kelloggii ssp. kelloggii and Mimulus pulchellus.* Impacts from unauthorized off road use can cause substantial damage to these habitats by compacting soil, causing erosion, killing plants, and introducing weedy species.

Some of the quarries, from which crushed rock or boulders would be obtained for use on road surface stabilization or closures, contain the invasive plant cheatgrass (*Bromus tectorum*). While this species is fairly common in disturbed places in the lower elevations of the Forest, it is not particularly common on the lava cap habitats. There is a possibility that cheatgrass seed could be carried to some of the lava caps with the crushed rock and boulders for road work, thereby introducing the weeds to rare plant habitat. The lava caps are particularly vulnerable to weed infestation. With the added disturbance of road work on some lava caps, currently suitable rare plant habitat could be degraded with the introduction of the very competitive cheatgrass, adversely effecting *Allium tribracteatum, Lomatium stebbinsii, Lewisia kelloggii ssp. hutchisonii, Lewisia kelloggii* ssp. *kelloggii* and *Mimulus pulchellus.*

CUMULATIVE EFFECTS

Forest Service projects recently planned within the Rim Fire Recovery (Appendix B) incorporate management requirements which reduced the risk of loss of occurrences. The combined effects of the proposed activities in Alternative 1 with past, present or foreseeable future actions are not expected to result in adverse cumulative effects to sensitive plants, mainly due to flagging and avoiding known sites. Individuals of certain sensitive plant occurrences may be adversely affected by proposed project activities. However, these impacts are not expected to be so great in intensity or duration that any of these occurrences would be eliminated, even when combined with other Forest activities.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Alternative 2 has no direct effects to Sensitive Plants. Indirect effects might occur in the form of dead trees falling into occurrences. The dead trees could directly kill rare plants when they fall. The downed trees could block germinating seeds, cause ground level shading for sun-loving plants, and create a high fuel accumulation which would burn at a high intensity, thereby killing plants which survive the falling trees.

Cumulative Effects

The cumulative effects for Alternative 2 are the same as the indirect effects of Alternative 2. The cumulative effect of Alternative 2 is not expected to reduce the amount of dead material effecting plant germination and growth or reduce the fuel accumulation and risk of high intensity impacts during future fires. With no soil and watershed enhancement activities reducing or preventing sedimentation of *Peltigera gowardii* occurrences, three occurrences are at a high risk of loss to sedimentation in this alternative.

Alternative 3

Direct and Indirect Effects

Same as Alternative 1, except that additional management requirements would prevent some of the impacts identified in Alternative 1:

- No impacts from mastication debris landing in *Lomatium stebbinsii* occurrences in Unit A01B.
- Project created access to lava cap habitats would be blocked.
- Lower risk of project-created sediment causing habitat degradation or mortality to *Peltigera gowardii*.

Cumulative Effects

Same as Alternative 1.

Alternative 4

Direct and Indirect Effects

Same as Alternative 3.

Cumulative Effects

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

For all alternatives, the Rim Recovery project **will not impact** *Allium tribracteatum, Allium yosemitense, Arctostaphylos nissenana, Eriastrum tracyi, Helodium blandowii, Meesia uliginosa, Mielichhoferia elongata, and Mielichhoferia shevockii* because activities are not proposed in their habitats and they would remain unaffected with no action.

Because their occurrences would be protected from disturbances, all action alternatives **will not impact** any sensitive plant species, except *Clarkia australis*, *Clarkia biloba* ssp. *australis*, *Mimulus filicaulis,* and *Mimulus pulchellus.*

For *Clarkia australis*, *Clarkia biloba* ssp. *australis*, *Mimulus filicaulis,* and *Mimulus pulchellus,* all action alternatives of the Rim Fire Recovery project **may affect individuals, but are not likely to result in a trend toward federal listing or loss of species viability** because portions of their occurrences would likely receive adverse effects.

The No Action Alternative will have no impacts on 11 species as shown in Table 3.09-1. Falling dead trees would likely impact individuals of the remaining 26 Sensitive Plant species as dead trees fall and accumulate as fuel, creating a higher risk of mortality in a future fire event. The No Action Alternative **may affect individuals, but is not likely to result in a trend toward Federal listing or loss of species viability for** the other 26 species as shown in Table 3.09-1.

Table 3.09-1 provides a summary of the effects to each species by alternative.

Table 3.09-1 Sensitive Plants Summary of Effects

Sensitive Plant Species	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Allium tribracteatum	No impact	No impact	No impact	No impact
Allium yosemitense	No impact	No impact	No impact	No impact
Arctostaphylos nissenana	No impact	No impact	No impact	No impact
Balsamorhiza macrolepis	No impact	Some impact	No impact	No impact
Botrychium ascendens	No impact	Some impact	No impact	No impact
Botrychium crenulatum	No impact	Some impact	No impact	No impact
Botrychium lineare	No impact	Some impact	No impact	No impact
Botrychium lunaria	No impact	Some impact	No impact	No impact
Botrychium minganense	No impact	Some impact	No impact	No impact
Botrychium montanum	No impact	Some impact	No impact	No impact
Botrychium pedunculosum	No impact	Some impact	No impact	No impact
Botrychium pinnatum	No impact	Some impact	No impact	No impact
Bruchia bolanderi	No impact	Moderate impact	No impact	No impact
Cinna bolanderi	No impact	Some impact	No impact	No impact
Clarkia australis	Mixed[1]	Greatest Impact	Mixed[1]	Mixed[1]
Clarkia biloba ssp. *australis*	Mixed[1]	Greatest Impact	Mixed[1]	Mixed[1]
Cypripedium montanum	No impact	Moderate impact	No impact	No impact
Dendrocollybia racemosa	No impact	Some impact	No impact	No impact
Eriastrum tracyi	No impact	No impact	No impact	No impact
Eriogonum luteolum var. *saltuarium*	No impact	Some impact	No impact	No impact
Eriophyllum congdonii	No impact	Some impact	No impact	No impact
Eriophyllum nubigenum	No impact	Some impact	No impact	No impact
Erythronium taylori	No impact	Some impact	No impact	No impact
Erythronium tuolumnense	No impact	Some impact	No impact	No impact
Fissidens aphelotaxifolius	No impact	Moderate impact	No impact	No impact
Helodium blandowii	No impact	No impact	No impact	No impact
Horkelia parryi	No impact	Some impact	No impact	No impact
Hulsea brevifolia	No impact	Moderate impact	No impact	No impact
Lewisia kelloggii ssp. *hutchisonii*	Some impact	No impact	No impact	No impact
Lewisia kelloggii ssp. *kelloggii*	Some impact	No impact	No impact	No impact
Lomatium stebbinsii	Some impact	No impact	No impact	No impact
Meesia uliginosa	No impact	No impact	No impact	No impact
Mielichhoferia elongata	No impact	No impact	No impact	No impact
Mielichhoferia shevockii	No impact	No impact	No impact	No impact
Mimulus filicaulis	No impact	Some impact	No impact	No impact
Mimulus pulchellus	No impact	Some impact	No impact	No impact
Peltigera gowardii	Some impact	Moderate impact	No impact	No impact
Tauschia howellii	No impact	Some impact	No impact	No impact

[1] Mixed=positive and negative impacts

3.10 Society, Culture and Economy

This section presents information regarding the social and economic effects the recovery efforts may have in the surrounding area. Included in the review of possible socio-economic impacts is an assessment of environmental justice concerns that could impact specific subgroups within the larger community.

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Multiple statutes, regulations and executive orders identify the general requirement for the application of economic and social evaluation in support of Forest Service planning and decision making. These include, but are not limited to, the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215: 16 USC 528-531), National Environmental Policy Act of 1969 (83 Stat. 852; 42 USC 4321, 4331-4335, 4341-4347), and the Planning Act of 1974. In addition, the following guidance also applies.

Executive Order 12898 issued in 1994 orders federal agencies to identify and address any adverse human health and environmental effects of agency programs that disproportionately impact minority and low-income populations. The Order also directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

The Civil Rights Act of 1964 provides for nondiscrimination in voting, public accommodations, public facilities, public education, federally assisted programs, and equal employment opportunity. Title VI of the Act, Nondiscrimination in Federally Assisted Programs, as amended (42 U.S.C. 2000d through 2000d-6) prohibits discrimination based on race, color, or national origin.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Society, Culture and Economy

The majority of the Rim Fire burned within Tuolumne County, but the southern portion of the fire also burned into Mariposa County. The primary socioeconomic impacts would occur within a geographic region of impact defined by these two counties. Some secondary impacts would be felt in other counties as noted in the analysis below.

The Environmental Justice analysis will report what effects might occur to minority and low-income populations. Of particular concern is whether job or income discrimination might occur to these groups in the area during, or resulting from, the proposed project.

Data Sources

- Bureau of Economic Analysis, U.S. Department of Commerce
- California Department of Finance
- California Employment Development Department
- Minnesota IMPLAN Group
- United States Census Bureau
- University of California, Division of Agriculture and Natural Resources

Society, Culture and Economy Indicators

Indicators used in the analysis of economic effects include jobs and incomes generated in the two-county region of impact. Non-market values, such as the value of recreation experiences and ecological services, by their nature are difficult to quantify. Direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15, (7/6/04) and 22.35 (01/14/05) provides for the use of qualitative analysis to evaluate the effects of these non-market values. The non-market aspects of each proposed activity will be described in other resource sections and specialist reports. Key indicators include:

- Employment and income information at the county level;
- Jobs supported by Rim Recovery project activities;
- Local population trends and community demographic statistics; and,
- Recreation patterns within the region of impact.

Society, Culture and Economy Methodology by Action

Actions, or the lack thereof, would have an effect on the society, culture and economy of Tuolumne and Mariposa Counties. Although not all of the socio-economic effects can be quantified, the methodology will be to at least describe the mechanisms through which effects may be felt and to characterize their relative magnitude and direction (i.e., beneficial or adverse). Actions through which socio-economic effects may be generated include:

- **Commercial Salvage**: Activities required to reduce fuel loads through timber salvage and biomass removal and to process it into lumber, electrical energy, and other forest products with commercial value.
- **Wildlife/Fuels Biomass Removal**: Activities directed by the Forest Service to gather and remove additional biomass for the benefit of wildlife and further fuel reduction.
- **Post-Contract Forest Service Activities**: Additional treatment of units after the commercial salvage operations are complete that use tractors to pile and burn excess fuels, drop and lop activities, and mastication of biomass in watershed areas.
- **Restoration of Access for Recreation**: Reopening the burn area for public access and recreational activities.
- **Grazing Allotments**: Reopening and clearing biomass from portions of the burn area subject to grazing permits.

COMMERCIAL SALVAGE

The Rim Recovery project and the speed with which it is proposed to be implemented are designed to take advantage of the diminishing economic value that is embodied in the standing dead trees in the burn area. The commercial value of the trees is highest now, and, although diminished by 20 percent or so, will still be valuable during the coming 2014 harvest season. During the following year's harvest season sufficient value should still remain to salvage dead trees in the burn area, but after about two years it will not be economically feasible for private industry to conduct the operations commercially because the dead timber will have deteriorated so badly (Bowyer et al. 2007). So long as salvage timber sales can be organized fast enough, and the dead trees salvaged within two years, a major economic benefit would be gained in all the action alternatives in that a meaningful portion of the public cost of Rim Recovery project can be offset by the proceeds of the sales to private industry.

The most important economic effect within the two-county region of impact would be the support for jobs resulting from a chain of industrial activities. Direct support for jobs would come from:

- Improving roads to provide access for logging crews and equipment to the treatment units;
- Logging of dead trees through such means as tractor, skyline, and helicopter operations;
- Collection, chipping and hauling of biomass that can be done profitably for commercial purposes;
- Hauling of saw logs and biomass chips to sawmills and energy plants; and,
- Processing the raw materials into commercial commodities such as milled lumber and electrical power.

The methodology for estimating direct job support builds on work conducted by the University of California, Division of Agriculture and Natural Resources, which has tracked and analyzed the forest products industry over the years in California. An analysis by William McKillop, professor emeritus of Forest Economics at the University of California, Berkeley, found that the entire chain of activities described above directly generates the equivalent of 6.4 annual jobs per million board feet (MMBF) of timber harvest. By applying this job generation factor to the estimated MMBF in each action alternative, an estimate may be made for the total jobs directly supported over the 2-year time period involved.

Additional jobs would be indirectly supported in the region of economic impact as a result of the activities described above. Economic models based on input-output analysis are used to generate "multipliers" which estimate the "indirect" and "induced" economic effects associated with "direct" impacts. For example, if the driver of a logging truck is the direct job supported, an indirect job would be held by the mechanic in Tuolumne County that services the truck. Part of an induced job is supported in the local grocery store where both of the previous employees shop after work. In the methodology used for alternatives analysis, multipliers are derived from the IMPLAN system, developed and vended by the Minnesota IMPLAN Group, Inc. (MIG). Multipliers are lower for small economic areas than they are for the state as a whole, and the relevant multipliers for the direct industries affected average 1.5, indicating that for every job directly generated by the commercial salvage operations, another half a job would be supported in Tuolumne or Mariposa Counties through indirect or induced mechanisms.

Wildlife/Fuels Biomass Removal

In some of the treatment units, some biomass would not routinely be gathered and hauled by commercial contractors because it cannot be done profitably, but which is still desirable to have removed for aiding wildlife and further reducing fuel loads. Biomass treatments would entail the mechanical removal of unmerchantable trees for use as firewood, shavings logs, pulpwood, chipped for biomass fuel for electric cogeneration plants, or decked and left on site for public firewood cutting. This additional treatment would be directed by the Forest Service, and whether it is conducted by the woods contractor doing the logging for additional compensation or by a different contractor, it would generate a bit more employment. This additional treatment could cost the Forest Service from $500 per acre to over $2,000 per acre.

The economic impact methodology will assume a typical budget will be $1,250 per acre, but will apply this budget to only half the wildlife/fuels biomass acreage to be treated in each action alternative, which assumes half of the effort will be covered by commercial operations. The methodology will then assume that half of the budget ultimately goes to support employment, which is typical of most industries. The other half of gross revenue typically goes to costs of equipment, fuel, supplies, insurance, and other operating costs. Jobs are likely to be seasonal, but one annual direct job will be assumed to be supported in the local economy for every $40,000 of income. An additional 0.5 jobs will be supported through indirect and induced multiplier mechanisms due to the direct job. Support for these jobs would likely be spread over a period of 2 years, but it could be longer. The biomass treatments would likely be conducted at the same time as the thinning treatments, but depending on availability of equipment and operators, this activity may occur as a second entry after the timber is removed.

Post-Contract Forest Service Activities

After the activities that are routinely included in the commercial harvesting process are completed, the Forest Service would still need to treat the majority of the acreage in the units further. The three treatments that will be estimated for the action alternatives are:

- Tractor piling of downed wood and biomass;
- Drop and lop for watershed enhancement; and,
- Mastication for watershed enhancement.

An average budget estimate for any of these treatments is $500 per acre. The economic impact methodology will apply this budget to the acreage to be treated in each action alternative, and will assume that half of the budget ultimately goes to support employment, as opposed to costs of equipment, fuel, supplies, insurance, and other operating costs. Jobs are likely to be seasonal, but one annual direct job will be assumed to be supported for every $40,000 of income. An additional 0.5 jobs would be supported through indirect and induced multiplier mechanisms due to the direct job. Support for these jobs would likely be spread over a period of 2 to 3 years, after the salvage harvesting is complete.

RESTORATION OF ACCESS FOR RECREATION AND RESOURCES

Recreation, and especially the tourism that is associated with it in Tuolumne and Mariposa Counties, has an economic impact. While the economic impacts cannot be quantified with any credible precision in terms of jobs or incomes, the direction of impacts will be described when analyzing each alternative. Recreation in the National Forests, and in the Rim Fire burn area specifically, has been an important part of the society and culture of Tuolumne and Mariposa Counties. Access to forest resources has also been a part of the society and culture for some specific communities: examples include native plants and other resources for American Indians, and firewood for residents who rely on wood burning to heat their homes. The methodology will be to describe the impacts that continued closure or restoration of public access would have on the social and cultural experience of living in the region.

GRAZING ALLOTMENTS

The methodology will not estimate any quantitative impacts associated with grazing, because the existing allotments will continue to operate in very similar ways under all alternatives, including the No Action Alternative. Social and cultural effects, however, will be noted.

Thirteen grazing allotments either wholly or partially within the cumulative analysis area, currently affecting 7 ranching families in Tuolumne County. Historically, ranching has been an important part of the culture and society of Tuolumne County, and has contributed to the economic health of the community. Although the existing grazing allotments will continue under all alternatives, some alternatives would ease access for range animals and their managers more than others.

Affected Environment

For socio-economic analysis, the primary environment impacted by the Rim Recovery project actions is defined by the two counties that contained the fire: Tuolumne and Mariposa. The resident populations have lived in a culture that has a long history of forest products industries, ranching and grazing, and other resource-based economic activities, such as mining. Residents also value the recreational opportunities provided by the National Forest System lands close to home.

The affected environment counties also have a long history of serving a tourism industry that has Yosemite National Park as the largest attraction in the vicinity. The industry also relies on recreational opportunities in the National Forests, including many within the Rim Fire burn area. The area has also included a special type of tourism associated with a collection of summer camps and private resorts that were impacted by the Rim Fire.

Existing Conditions

POPULATION

Table 3.10-1 shows rapid growth in the affected environment during the 1970s and 1980s. The population of Tuolumne and Mariposa Counties grew much faster than the state as a whole during those decades. The relative growth rate slowed during the 1990s, however, and since 2000 the counties have grown much slower than the state.

Table 3.10-2 shows growth is expected to occur at a slower rate than the state average in coming decades as well. Today Tuolumne is by far the larger of the two counties, and coupled with the location of the majority of the Rim Fire area, the majority of the primary socio-economic impacts would be felt in Tuolumne County.

Table 3.10-1 Historical Population by County 1970 – 2010

County/Region	1970	1980	1990	2000	2010
Mariposa	6,015	11,108	14,302	17,130	18,251
Tuolumne	22,169	33,928	48,456	54,504	55,368
Total 2-Co. Region	28,184	45,036	62,758	71,634	73,619
10-Year Growth		60%	39%	14%	3%
California	19,953,134	23,667,902	29,760,021	33,873,086	37,253,956
10-Year Growth		19%	26%	14%	10%

Source: U.S. Bureau of the Census

Table 3.10-2 Projected Population by County 2000 – 2050

County	2000	2010	2020	2030	2040	2050
Mariposa	17,150	19,108	21,743	23,981	26,169	28,091
Tuolumne	54,863	58,721	64,161	67,510	70,325	73,291
Total 2-Co. Region	72,013	77,829	85,904	91,491	96,494	101,382
10-Year Growth		8%	10%	7%	5%	5%
California	34,105,437	39,135,676	44,135,923	49,240,891	54,226,115	59,507,876
10-Year Growth		15%	13%	12%	10%	10%

Source: California State Department of Finance

ENVIRONMENTAL JUSTICE CONCERNS

Some demographic data for the affected environment describe the context for evaluating environmental justice concerns. Executive order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," signed February 11, 1994 by President Clinton states (Section 1-101), "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States."

Table 3.10-3 Ethnic Minority Populations in the Region of Impact

Ethnic Identity	Tuolumne County	Mariposa County	California
White alone, percent, 2012 (a)	91.1%	90.6%	73.7%
Black or African American alone, percent, 2012 (a)	2.2%	1.0%	6.6%
American Indian and Alaska Native alone, percent, 2012 (a)	2.2%	3.2%	1.7%
Asian alone, percent, 2012 (a)	1.2%	1.3%	13.9%
Native Hawaiian and Other Pacific Islander alone, percent, 2012 (a)	0.2%	0.2%	0.5%
Two or More Races, percent, 2012	3.2%	3.7%	3.6%
Hispanic or Latino, percent, 2012 (b)	11.1%	9.5%	38.2%
White alone, not Hispanic or Latino, percent, 2012	81.7%	82.5%	39.4%

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Source: US Census Bureau

For environmental justice analysis, Table 3.10-3 presents the ethnic distribution of the two-county population that defines the region of socioeconomic impact. The ethnic distribution of the California state population is also presented for comparison purposes. Tuolumne and Mariposa counties have very similar ethnic profiles, and both contain distinctly fewer minorities than the state as a whole, with the one exception that Native Americans are more heavily represented locally than statewide.

Environmental justice concerns can also focus on low-income populations. Similarly, age discrimination can be an issue for the Civil Rights Act. Table 3.10-4 presents the Key age and income characteristics. The two-county region has fewer families with young children than the state average, and has dramatically more people of retirement age than the state average. Incomes by all measures are lower in Tuolumne and Mariposa Counties than for similar measures statewide. In spite of that, proportionately fewer people are living below the poverty line in the two-county region than those statewide.

Table 3.10-4 Age, Income and Poverty Characteristics in the Region of Impact

Key Age and Income Characteristics	Tuolumne County	Mariposa County	California
Population, 2012 estimate	54,008	17,905	37,999,878
Persons under 5 years, percent, 2012	4.0%	4.4%	6.7%
Persons under 18 years, percent, 2012	16.9%	17.3%	24.3%
Persons 65 years and over, percent, 2012	22.0%	23.0%	12.1%
Per capita money income in past 12 months (2012 dollars), 2008-2012	$26,043	$27,670	$29,551
Median household income, 2008-2012	$48,169	$52,584	$61,400
Persons below poverty level, percent, 2008-2012	13.1%	14.7%	15.3%

Source: US Census Bureau

INDUSTRIAL PROFILE OF THE REGIONAL ECONOMY

Table 3.10-5 (Tuolumne County) and Table 3.10-6 (Mariposa County) present the historical perspective, and the most recent available profile, of the structure of the regional economy. The industry sector for "Mining and Logging" is much larger in Tuolumne County, and almost non-existent in Mariposa County. The dramatic decline in employment in the Mining and Logging sector from 1990 through 2010 can also be seen in Tuolumne. In recent years, however, it appears the industry has stabilized. Employment in sawmills is included in the "Manufacturing" sector of the economy.

Table 3.10-5 Tuolumne County Industry Employment and Labor Force by Annual Average

Industry Title	1990	2000	2010	2012	2013
Civilian Labor Force	19,880	22,890	25,800	25,920	24,550
Civilian Employment	18,540	21,540	22,240	22,900	22,160
Civilian Unemployment	1,340	1,350	3,570	3,020	2,400
Civilian Unemployment Rate	6.7%	5.9%	13.8%	11.6%	9.8%
Total, All Industries	14,190	15,950	15,840	16,280	16,220
Total Farm	90	180	60	50	50
Total Nonfarm	14,100	15,760	15,780	16,230	16,170
Total Private	10,200	11,230	10,470	11,010	10,980
Goods Producing	2,320	2,250	1,340	1,470	1,460
Mining and Logging	400	200	130	120	120
Construction	1,080	920	540	530	500
Manufacturing	850	1,130	680	820	850
Durable Goods	730	890	490	660	680
Nondurable Goods	110	240	190	170	170
Service Providing	11,780	13,510	14,440	14,760	14,710
Private Service Providing	7,870	8,970	9,120	9,540	9,520
Trade, Transportation and Utilities	2,380	2,840	2,330	2,490	2,500

Industry Title	1990	2000	2010	2012	2013
Wholesale Trade	190	150	190	130	140
Retail Trade	2,020	2,490	1,970	2,150	2,150
Transportation, Warehousing and Utilities	170	200	180	210	210
Information	200	230	240	210	210
Financial Activities	790	550	520	510	550
Professional and Business Services	880	890	930	930	930
Educational and Health Services	1,120	1,700	2,680	2,930	2,760
Leisure and Hospitality	1,960	2,130	2,040	1,990	2,110
Other Services	550	630	380	480	480
Government	3,910	4,540	5,310	5,220	5,190
Federal Government	560	370	440	470	480
State and Local Government	3,350	4,170	4,870	4,750	4,710
State Government	1,160	1,110	1,260	1,130	1,080
Local Government	2,190	3,060	3,610	3,620	3,630

Source: California Employment Development Department, Labor Market Information Division

The relative health of the regional economy can also be inferred from comparisons with the state average for unemployment rate. Using the same data sources and methods as shown in Table 3.10-5 and Table 3.10-6, the State of California had an unemployment rate of 8.9 percent last year in 2013. With unemployment rates of 9.8 and 9.2 percent respectively, somewhat more distress exists in the economies of both counties in 2013.

Table 3.10-6 Mariposa County Industry Employment and Labor Force by Annual Average

Industry Title	1990	2000	2010	2012	2013
Civilian Labor Force	6,780	7,980	9,610	9,450	9,260
Civilian Employment	6,390	7,490	8,470	8,410	8,400
Civilian Unemployment	380	490	1,140	1,040	860
Civilian Unemployment Rate	5.7%	6.2%	11.9%	11.0%	9.2%
Total, All Industries	4,780	4,890	5,330	5,240	5,410
Total Farm	30	10	20	10	10
Total Nonfarm	4,750	4,880	5,310	5,230	5,400
Total Private	3,320	3,150	3,120	3,160	3,430
Goods Producing	430	300	240	250	260
Private Service Providing	2,900	2,850	2,880	2,910	3,180
Mining and Logging	10	20	10	20	20
Construction	250	160	110	110	140
Manufacturing	160	120	120	120	110
Service Providing	4,330	4,580	5,070	4,980	5,140
Trade, Transportation and Utilities	370	340	330	330	340
Wholesale Trade	20	10	10	10	20
Retail Trade	340	320	270	270	270
Transportation, Warehousing and Utilities	10	10	50	40	40
Professional and Business Services	100	250	170	160	140
Educational and Health Services	220	150	150	180	320
Leisure and Hospitality	1,920	1,930	2,130	2,040	2,160
Private Service Providing - Residual	290	180	120	210	230
Government	1,430	1,730	2,190	2,070	1,960
Federal Government	570	620	850	810	730
State and Local Government	860	1,110	1,340	1,260	1,230
State Government	150	170	180	160	160
Local Government	710	940	1,160	1,090	1,070

Source: California Employment Development Department, Labor Market Information Division

FOREST PRODUCTS INDUSTRY IN THE REGION OF IMPACT

California's timber harvest peaked in 1955 at 6 billion board feet. The trend in total industry volume statewide has been down ever since, although it was still almost 5 billion board feet in the late 1980s, 25 years ago. The number of sawmills in the state was over 100 at that time, but has declined dramatically to between 30 and 40 today. This has reduced the number of mills, within practical haul range of the Rim Fire burn area, that are available today to process salvaged logs. On the other hand, the reduction in milling capacity in California has not declined as rapidly as the number of mills, because it has been the smaller, less efficient mills that have ceased operations. Even so, the bottleneck in the industrial process for turning standing trees into lumber remains due to the combined capacities of the sawmills within reach. Other steps in the industrial process are more scalable and flexible. For example, more logging and trucking contractors can be brought into the region from further away if needed.

Two sawmills in Tuolumne County are within the region of impact:

1. The Sierra Pacific Industries Standard Mill just east of Sonora, and
2. The smaller Sierra Pacific Industries mill near Chinese Camp.

Two other sawmills are potentially able to haul logs from the Rim Fire to their facilities economically:

3. The Sierra Pacific Industries mill in Lincoln, Placer County, 104 miles north of Sonora, and
4. The Sierra Forest Products mill in Terra Bella, Tulare County, 188 miles south of Sonora.

In addition two other mills in Tuolumne County are within the region of impact that can process smaller trees and/or byproducts:

5. The Sierra Pacific Industries Bark Plant in Keystone, and
6. The American Wood Fibers plant (formerly California Wood Shavings) just south of Jamestown off Highway 108.

During the process of cutting, loading, and hauling merchantable salvaged logs out of the forest, biomass, composed of branches and tops of trees that are too small to be of use for milled lumber, is generated. After the saw logs are salvaged, many units will still contain a dangerously high concentration of fuels remaining in small dead standing trees and other biomass. In both cases, these sources of biomass can be collected into piles at the landings along access roads into the forest. Options at that point can be to reduce the fuel load by burning the piles in place, or hauling the biomass to a plant that can burn the material to generate electrical power. The latter option generally involves chipping or grinding the biomass on site, and hauling the material as chips to an energy plant. Under some economic conditions where the price of power is high enough, and the costs of collection, chipping, and hauling are low enough, the entire process can be self-funding as a profitable business. Under other circumstances, at least a portion of the costs of reducing fuel loads in the forest can be recovered by hauling the biomass and selling it for generating power. Although harder to quantify, there are also clearly ecosystem value benefits to be gained by burning biomass in power plants that can contain a majority of the particulates and greenhouse gases, rather than burning the material in open piles.

The biomass power generation industry is newer than the lumber industry, and at this time has a significant infrastructure of existing plants within 90 to 120 miles of the Rim Fire burn area. In approximate order of proximity, the larger sized facilities in terms of megawatt capacities (MW) include:

1. Pacific Ultrapower Chinese Station, Jamestown, 22 MW
2. SPI Sonora Standard Biomass Power, Sonora, 8 MW
3. Buena Vista Biomass Power, Ione, 18.5 MW

4. DTE Stockton, Stockton, 25 MW
5. Greenleaf Tracy Biomass Plant, Tracy, 19.4 MW

Other power facilities that are further away, but under some circumstances might be able to take some Rim Fire biomass include:

6. Woodland Biomass Power Ltd., Woodland, 25 MW
7. Rio Bravo, Fresno, 25 MW
8. Rio Bravo, Rocklin, 25 MW
9. SPI Lincoln, Lincoln, 18 MW
10. Sierra Power Corp., Terra Bella, 9.5 MW

The revenue ultimately available to biomass energy generators is limited by the market for electrical power, and is generally set in advance by fixed price energy contracts. This means there are limits to the costs that can be borne profitably to cut, collect, chip, and haul the biomass material. For treatment units that have a very high value of trees that can be used for sawlogs, it is possible for the Forest Service to require the removal of biomass at the same time as the salvage logging because the value of the trees can subsidize the costs of collecting and hauling biomass. At the other end of the spectrum, there will be units where biomass cannot be removed profitably and the Forest Service will have to use service contracts to have the material taken out of the forest. Selling the material to an energy plant can then recover some, but not all, of the costs. There are other business models between a timber salvage sale and a service contract as well, which will accomplish the same physical outcomes.

While there are a number of options for power generating plants as end users of biomass, there are other potential bottlenecks in the industry infrastructure currently in place. Some of the chipping equipment currently available in Tuolumne and Mariposa counties is old, and may need to be replaced to handle the volumes of biomass that could come out of the Rim Fire burn area in coming years. Similarly, recent California Air Resources Board rules regarding diesel truck emissions may render some of the existing chip hauling trucks obsolete, also reducing the capacity of the available fleet.

RECREATION/TOURISM INDUSTRY IN THE REGION OF IMPACT

The portion of the Stanislaus National Forest affected by the Rim Fire, has a long history of recreational use. One of the social and cultural attractions for living in Tuolumne and Mariposa Counties has been the presence of recreational opportunities on the National Forest close to home.

The Rim Fire area has also historically been used extensively by non-locals. One of the reasons for this is that Highway 120, passing through the burn area, is one of the major gateways to Yosemite National Park, which has generated recreation related tourism and economic impacts in multiple ways. Some people have spent a portion of their money in the area as they passed through to their primary destination in Yosemite. Others were not able to secure overnight accommodations in the park, and instead stayed in other accommodations within the burn area, such as camping on the National Forest, and made day trips into Yosemite. Yet others found that Tuolumne river rafting or other recreational offerings in the burn area were sufficiently attractive to warrant extending their visit to Yosemite by one or more days in the Stanislaus. The Stanislaus has also been the primary destination for many non-locals who were motivated by the recreational activities to be had there, without visiting Yosemite at all during the same trip.

Examples of the activities historically available within the Rim Fire burn area that have drawn both locals and non-locals, in roughly descending order of participation in each activity, include:

- Viewing natural features
- Hiking / walking
- Viewing wildlife

- Picnicking
- Driving for pleasure
- Fishing
- Developed camping
- Motorized trail activity
- OHV use
- Hunting
- River rafting (non-motorized water sports)
- Resort use
- Primitive camping

The burn area is currently closed to the public, and the recreational opportunities that have traditionally drawn thousands of people per year to Tuolumne and Mariposa Counties are not available. Developed campgrounds, dispersed camping sites, and other overnight accommodations in the burn area are currently not available, which reduces the capacity of the Highway 120 gateway region to house overnight guests. Given that the typical recreation party spends an average of $261 per day, according to the most recent data available from the National Visitor Use Monitoring (NVUM) Program (USDA 2102), the region of impact has suffered a loss of tourism spending over traditional amounts.

The Rim Fire also affected a variety of summer camps, private resorts, and other recreational facilities operated by other public agencies, private non-profit groups, and private for-profit entities including:

- City of Berkeley Tuolumne Camp,
- San Francisco's Camp Mather,
- The City of San Jose's camp,
- Camp Tawonga,
- Evergreen Lodge, and
- Other facilities.

In the case of the Berkeley Tuolumne Camp, the entire facility was destroyed by the Rim Fire and is currently not available. In other cases, damage to facilities or their access may or may not be repaired and cleared in time for the coming summer use season. To the extent the combined capacity of these facilities has been diminished, there has been a proportionate decrease in the size of the visitor-serving economy in Tuolumne County.

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

The action proposed under Alternative 1 would remove hazard trees from lower level roads sufficiently to reopen the burn area for dispersed recreation. If the actions proposed in the Rim Fire Hazard Tree Environmental Assessment are implemented, developed campgrounds and developed trailheads on class 3, 4, and 5 level roads will already have been opened. Biomass and other fuels would be removed from treated areas in order to create conditions to foster a healthier forest in the future, and to enhance wildlife movement and habitat. Some of the public cost of the action could be offset by the sale of salvage timber to private industry. Social, cultural, and economic impacts would be generated.

Social and Cultural Impacts

Compared with the current situation where the majority of the burn area is closed to the public, Alternative 1 would restore some of the access, recreation, and other uses of the area that have been part of the life and culture of Tuolumne and Mariposa Counties. Access for American Indians to gather native plants and other forest resources would be enhanced, and the ability of local residents to gather firewood would be restored. The ranching lifestyle for families, that have grazing allotments within the burn area, would be enhanced somewhat by clearing out some of the impediments to movement of their range stock, and making access to their allotment areas easier. Residents of the region who own businesses or work in the tourism industry would see some restoration of lifestyles that have been diminished by the reduced volumes of visitors. Specific communities of interest that participated in the various summer camps and resorts would find some of their previous activities returning.

Compared with Alternative 2 (No Action), the social and cultural character of Tuolumne and Mariposa Counties that has been appreciated historically would return much faster.

Economic Impacts

Without taking action (i.e., Alternative 2), the current situation of closure would continue for as much as 10 years, or until the hazard trees fall on their own. Compared with the No Action scenario, Alternative 1 would have many noticeable economic impacts.

Support for direct jobs in the region of impact would be created by the activities required to improve roads, bring in logging crews and equipment, load and chip logs and biomass, haul materials out of the burn area, and process the raw materials into merchantable lumber, electrical power, and other forest products. If the entire 661 million board feet (MMBF) contemplated by the Forest Service under Alternative 1 can be sold and harvested, then 4,230 annual jobs could be supported in the two county area over a period of two to three years (at 6.4 direct jobs / MMBF). With a surge of activity as large as the Rim Fire salvage, some entirely new jobs would likely be created in the region through new hiring, and additional contracting. On the other hand, the majority of the jobs estimated above are in positions that are already filled in the region. For example, many of the people employed at the Standard Mill near Sonora would have the same jobs that they had before, but the source of their income would shift from processing green trees to Rim Fire salvage trees for a couple years (leaving more green trees to support future economic activity). Support of employment in the logging, biomass, and wood products industries would be seen as a beneficial economic impact in the region.

Compared with the No Action Alternative, Alternative 1 would be beneficial for the public sector in that a portion of the public costs of recovery can be recaptured from the proceeds of the salvage timber sale to private industry.

Some of the Forest Service's expenditures can then go to additional contractors to provide further treatment of some units to clear out biomass for wildlife enhancement and to remove more fuel from the Forest. These activities would also generate support for more direct jobs. Alternative 1 estimates 7,626 acres would have biomass removal for these purposes, generating support for 60 direct jobs over a period of years. Over a similar time period, another 151 direct jobs would be supported by post-contract treatments applied to an estimated 24,143 acres (at a typical cost of $500 / acre, as described above in the methodology section).

Total direct job support from all three categories of activities would be 4,439 annual jobs over a period of several years. For example, this could represent 1,500 to 2,000 jobs each in 2014 and 2015 as the bulk of the salvage work is taking place, and tailing off to a few hundred jobs per year in the following few years. Associated with direct employment, another 2,220 annual jobs would be supported over the same time period through indirect and induced multiplier effects in Tuolumne and Mariposa Counties (at a multiplier of 1.5).

Total support for jobs in the region of impact would be 6,659 annual jobs over the next five years or so with the bulk of the economic support coming in the next two years. Given that Tuolumne and Mariposa Counties have higher unemployment rates than the average for the State of California, the impact on jobs would be seen as beneficial to the economy. Given that the civilian labor force in the two-county region of impact is 34,000, the Rim Fire related job support would be between 5 and 10 percent of all employment, which most likely would be seen as a significant beneficial economic impact by the Tuolumne and Mariposa County communities.

Reopening of the burn area to the public would also occur faster in Alternative 1 than it would in the No Action Alternative. This would allow more overnight camping visitors to be accommodated in dispersed locations throughout the area. Reopening recreation areas within the burn area would also give visitors more reasons to stay in the region of impact, or to extend their stays. Restoring some of the volume of tourism that was lost due to the Rim Fire would allow businesses in Tuolumne and Mariposa Counties to capture more tourism spending. While not as conducive to quantification as the forest products industries, the expansion of recreation and tourism would also support more employment, thereby expanding the beneficial economic impacts associated with Alternative 1. Reopening of the burn area for firewood gathering would also be seen as economically beneficial by low-income residents who rely on wood burning to supplement the heating of their homes.

CUMULATIVE EFFECTS

Past actions in the region of impact, and throughout California, have led to a reduction in the number of sawmills available to process logs into lumber. The mills that remain today tend to be the larger and more efficient ones. Even so, the capacity of the existing private industry infrastructure to mill lumber is below historical highs. As described in the Affected Environment section above, there are other potential capacity constraints in the existing industrial infrastructure as well, such as the number of chippers, the number of trucks, and the number of mills and bioenergy plants within an economical haul range.

The Rim Fire burned over a quarter million acres including private forest lands and forest inside Yosemite National Park. Present actions contributing to cumulative effects include the emergency salvage logging of over 18,000 acres of private timber land, and over 28 miles of roadside hazard tree removal in Yosemite (over 800 acres). In addition, three National Forest timber sales in progress on over 2,000 acres when the fire broke out, must be honored with replacement timber resources.

Foreseeable future actions include the proposal to salvage hazard trees on over 10,000 acres within the National Forest portion of the Rim Fire burn area. Decisions have also been recorded to harvest 4,000 acres of green trees to reduce fuel loads and protect from future fires. Planning has also been done to improve over 90 miles of roads and trails in the National Forest.

All of these contribute demand on private industry infrastructure available to conduct road work, log forests, haul raw materials, and produce lumber, energy and other forest products. There are several cumulative economic effects that would likely be produced by this situation:

- In the short term, capacity is limited. Given the surge in raw materials available from salvage logging, downward pressure would be placed on the prices for raw materials. This can be seen as a beneficial economic impact by buyers, such as sawmills and power plants, and an adverse economic impact by sellers, such as the Forest Service.
- Given the limited ability to expand capacity in the short term over the next two years, it is possible that the Forest Service would not be able to sell as much salvage timber as they are planning for. Although the overall impact of Alternative 1 would be beneficial to the local economy, sale of less than 100 percent of the timber would partially represent a lost opportunity from not being able to realize the full benefit.
- In the short term, capacities can be expanded for some portions of the industrial processes. Existing woods contractors can hire more workers. Additional operators and their crews can be brought in temporarily from more distant locations. Existing mills can operate a few more hours or days per week. Raw materials can be hauled further distances to other processing plants. Some of these adaptations would expand incomes in counties beyond the region of impact, but virtually

all of them would also expand direct economic activity and its ripple effects locally as well. This would be seen as a beneficial economic impact on Tuolumne and Mariposa Counties.

- In the long run, implementing Alternative 1 in conjunction with other present and foreseeable actions would serve as a stimulus to expand the capacity of the industry infrastructure through capital investment. Buying new trucks, equipment, and processing capacity would be seen as a beneficial impact on the local economy. For significant capital investment to take place, however, the perception would have to be that there is some assurance that new equipment will be needed for its usable life, and not for just a one-time surge lasting a couple years.

Combined with the foreseeable future actions proposed in the Rim Fire Hazard Trees project, Alternative 1 would further expand the capacity of the tourism industry based along Highway 120, and incomes and jobs in visitor serving businesses in Tuolumne County would increase as a result. Because the Highway 120 corridor also serves as one of the major gateways to Yosemite National Park, Alternative 1 could also expand visitation to Yosemite somewhat, for example by allowing people to stay overnight in dispersed campsites in the Rim Fire area and become day visitors to Yosemite Valley. From a cumulative perspective, this could have a magnified impact on direct tourism employment gains in Tuolumne and Mariposa Counties, as well as additional beneficial indirect economic impacts through multiplier mechanisms.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, hazard tree removal would not occur and the area would remain closed for dispersed recreation. Biomass and other fuels would not be removed. No income from the sale of salvage timber to private industry would be available to offset the public costs of protecting wildlife and the forest environment from future catastrophic fires. Social, cultural, and economic conditions would remain much as they are today.

Social and Cultural Impacts

Alternative 2 would perpetuate the current situation where the majority of the burn area is closed to the public for the foreseeable future. After hazard trees fall through natural processes, in a decade or so, parts of the burn area might again be opened to the public. Historically, access, recreation, and other uses of the area have been an important part of the life and culture of Tuolumne and Mariposa Counties, and the fire and subsequent closure are perceived as having had an adverse impact already. Residents of the region who own businesses or work in the tourism industry have experienced some diminishment of their incomes and lifestyles due to the reduced volumes of visitors from elsewhere. Alternative 2 would do nothing to remedy these adverse social and cultural impacts.

Economic Impacts

Without taking action (i.e., Alternative 2), no salvage timber sale would take place and the government would not realize any proceeds from such a sale. Private woods contractors and sawmill operators are currently busy processing salvage timber from private lands. Forest products industry employment would continue at current levels for the near term in the two-county region of impact. Compared with the current situation, no noticeable economic impacts, beneficial or adverse, would be created.

On the other hand, the perception in the tourism industry is already that it has been adversely impacted by the fire and subsequent closure. To the extent that incomes and support for jobs has been diminished, those lower employment levels would continue.

CUMULATIVE EFFECTS

Present actions contributing to cumulative effects include the emergency salvage logging of over 18,000 acres of private timber land and over 28 miles of roadside hazard tree removal in Yosemite (over 800 acres). In addition, three National Forest timber sales in progress on over 2,000 acres when the fire broke out, must be honored with replacement timber resources. Foreseeable future actions include harvesting 4,000 acres of green trees to reduce fuel loads and protect the environment from future fires, and improving over 90 miles of roads and trails in the National Forest.

All of these contribute demand on private industry infrastructure available to conduct road work, log forests, haul raw materials, and produce lumber, energy and other forest products. Without material from the Rim Fire area, these sources would run out sooner leading the industry to switch back to green tree harvesting sooner. Rim Fire actions would not add to cumulative economic effects under Alternative 2.

Under Alternative 2, the current visitor accommodating capacity of the Highway 120 corridor would remain below what it was before the Rim Fire. This could have a cumulative effect of keeping Yosemite visitation levels lower than they would have been with the visitor serving infrastructure in place.

Alternative 3

DIRECT AND INDIRECT EFFECTS

The action proposed under Alternative 3 would be essentially the same as under Alternative 1, but would cover slightly more acreage and produce slightly less salvage timber for sale. As with Alternative 1, it would remove hazard trees from lower level roads sufficiently to reopen the burn area for dispersed recreation. Biomass and other fuels would be removed from treated areas in order to create conditions to foster a healthier forest in the future, and to enhance wildlife movement and habitat. Some of the public cost of the action could be offset by the sale of salvage timber to private industry. Social, cultural, and economic impacts would be generated.

Social and Cultural Impacts

Compared with the current situation where the majority of the burn area is closed to the public, Alternative 3 would restore some of the access, recreation, and other uses of the area that have been part of the life and culture of Tuolumne and Mariposa Counties. Access for American Indians to gather native plants and other forest resources would be enhanced, and the ability of local residents to gather firewood would be restored. The ranching lifestyle for families that have grazing allotments within the burn area would be enhanced somewhat by clearing out some of the impediments to movement of their range stock, and making access to their allotment areas easier. Residents of the region who own businesses or work in the tourism industry would see some restoration of lifestyles that have been diminished by the reduced volumes of visitors. Specific communities of interest that participated in the various summer camps and resorts would find some of their previous activities returning.

Compared with Alternative 2 (No Action), the social and cultural character of Tuolumne and Mariposa Counties that has been appreciated historically would return much faster.

Economic Impacts

Without taking action (i.e., Alternative 2), the current situation of closure would continue for as much as 10 years, or until the hazard trees fall on their own. Compared with the No Action scenario, Alternative 3 would have many noticeable economic impacts.

Support for direct jobs in the region of impact would be created by the activities required to improve roads, bring in logging crews and equipment, load and chip logs and biomass, haul materials out of the burn area, and process the raw materials into merchantable lumber, electrical power, and other forest products. If the entire 623 million board feet (MMBF) contemplated by the Forest Service under Alternative 3 can be sold and harvested, then 3,987 annual jobs could be supported in the two county area over a period of two to three years (at 6.4 direct jobs / MMBF). With a surge of activity as large as the Rim Fire salvage, some entirely new jobs would likely be created in the region through new hiring, and additional contracting. On the other hand, the majority of the jobs estimated above are in positions that are already filled in the region. For example, many of the people employed at the Standard Mill near Sonora would have the same jobs that they had before, but the source of their income would shift from processing green trees to Rim Fire salvage trees for a couple years (leaving more green trees to support future economic activity). Support of employment in the logging, biomass, and wood products industries would be seen as a beneficial economic impact in the region.

Compared with the No Action Alternative, Alternative 3 would be beneficial for the public sector in that a portion of the public costs of recovery can be recaptured from the proceeds of the salvage timber sale to private industry.

Some of the Forest Service's expenditures can then go to additional contractors to provide further treatment of some units to clear out biomass for wildlife enhancement and to remove more fuel from the forest. These activities would also generate support for more direct jobs. Alternative 3 estimates 8,379 acres would have biomass removal for these purposes, generating support for 65 direct jobs over a period of years. Over a similar time period, another 160 direct jobs would be supported by post-contract treatments applied to an estimated 25,573 acres (at a typical cost of $500 / acre, as described above in the methodology section).

Total direct job support from all three categories of activities would be 4,212 annual jobs over a period of several years. For example, this could represent 1,500 to 2,000 jobs each in 2014 and 2015 as the bulk of the salvage work is taking place, and tailing off to a few hundred jobs per year in the following few years. Associated with direct employment, another 2,106 annual jobs would be supported over the same time period through indirect and induced multiplier effects in Tuolumne and Mariposa Counties (at a multiplier of 1.5).

Total support for jobs in the region of impact would be 6,318 annual jobs over the next five years or so with the bulk of the economic support coming in the next two years. Given that Tuolumne and Mariposa Counties have higher unemployment rates than the average for the State of California, the impact on job support would be seen as beneficial to the economy. Given that the civilian labor force in the two-county region of impact is 34,000, the Rim Fire related job support would be between 5 and 10 percent of all employment, which most likely would be seen as a significant beneficial economic impact by the Tuolumne and Mariposa County communities.

Reopening of the burn area to the public would also occur faster in Alternative 3 than it would in the No Action Alternative. This would allow more overnight camping visitors to be accommodated in dispersed locations throughout the area. Reopening recreation areas within the burn area would also give visitors more reasons to stay in the region of impact, or to extend their stays. Restoring some of the volume of tourism that was lost due to the Rim Fire would allow businesses in Tuolumne and Mariposa Counties to capture more tourism spending. While not as conducive to quantification as the forest products industries, the expansion of recreation and tourism would also support more employment, thereby expanding the beneficial economic impacts associated with Alternative 3. Reopening of the burn area for firewood gathering would also be seen as economically beneficial by low-income residents who rely on wood burning to supplement the heating of their homes.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

The action proposed under Alternative 4 would be essentially the same as under Alternative 1, but would cover slightly less acreage and produce 18 percent less salvage timber for sale. As with

Alternative 1, it would remove hazard trees along lower level roads sufficiently to reopen the burn area for dispersed recreation. Biomass and other fuels would be removed from treated areas in order to create conditions to foster a healthier forest in the future, and to enhance wildlife movement and habitat. Some of the public cost of the action could be offset by the sale of salvage timber to private industry. Social, cultural, and economic impacts would be generated.

Social and Cultural Impacts

Compared with the current situation where the majority of the burn area is closed to the public, Alternative 4 would restore some of the access, recreation, and other uses of the area that have been part of the life and culture of Tuolumne and Mariposa Counties. Access for American Indians to gather native plants and other forest resources would be enhanced, and the ability of local residents to gather firewood would be restored. The ranching lifestyle for families that have grazing allotments within the burn area would be enhanced somewhat by clearing out some of the impediments to movement of their range stock, and making access to their allotment areas easier. Residents of the region who own businesses or work in the tourism industry would see some restoration of lifestyles that have been diminished by the reduced volumes of visitors. Specific communities of interest that participated in the various summer camps and resorts would find some of their previous activities returning.

Compared with Alternative 2 (No Action), the social and cultural character of Tuolumne and Mariposa Counties that has been appreciated historically would return much faster.

Economic Impacts

Without taking action (i.e., Alternative 2), the current situation of closure would continue for as much as 10 years, or until the hazard trees fall on their own. Compared with the No Action scenario, Alternative 4 would have many noticeable economic impacts.

Support for direct jobs in the region of impact would be created by the activities required to improve roads, bring in logging crews and equipment, load and chip logs and biomass, haul materials out of the burn area, and process the raw materials into merchantable lumber, electrical power, and other forest products. If the entire 541 million board feet (MMBF) contemplated by the Forest Service under Alternative 4 can be sold and harvested, then 3,465 annual jobs could be supported in the two county area over a period of two to three years (at 6.4 direct jobs / MMBF). With a surge of activity as large as the Rim Fire salvage, some entirely new jobs would likely be created in the region through new hiring, and additional contracting. On the other hand, the majority of the jobs estimated above are in positions that are already filled in the region. For example, many of the people employed at the Standard Mill near Sonora would have the same jobs that they had before, but the source of their income would shift from processing green trees to Rim Fire salvage trees for a couple years (leaving more green trees to support future economic activity). Support of employment in the logging, biomass, and wood products industries would be seen as a beneficial economic impact in the region.

Compared with the No Action Alternative, Alternative 4 would be beneficial for the public sector in that a portion of the public costs of recovery can be recaptured from the proceeds of the salvage timber sale to private industry.

Some of the Forest Service's expenditures can then go to additional contractors to provide further treatment of some units to clear out biomass for wildlife enhancement and to remove more fuel from the forest. These activities would also generate support for more direct jobs. Alternative 4 estimates 7,975 acres would have biomass removal for these purposes, generating support for 62 direct jobs over a period of years. Over a similar time period, another 146 direct jobs would be supported by post-contract treatments applied to an estimated 23,427 acres (at a typical cost of $500 / acre, as described above in the methodology section).

Total direct job support from all three categories of activities would be 3,674 annual jobs over a period of several years. For example, this could represent 1,500 to 2,000 jobs each in 2014 and 2015 as the bulk of the salvage work is taking place, and tailing off to a few hundred jobs per year in the following few years. Associated with direct employment, another 1,837 annual jobs would be supported over the same time period through indirect and induced multiplier effects in Tuolumne and Mariposa Counties (at a multiplier of 1.5).

Total support for jobs in the region of impact would be 5,511 annual jobs over the next five years or so with the bulk of the economic support coming in the next two years. Given that Tuolumne and Mariposa Counties have higher unemployment rates than the average for the State of California, the impact on job support would be seen as beneficial to the economy. Given that the civilian labor force in the two-county region of impact is 34,000, the Rim Fire related job support would be between 5 and 10 percent of all employment, which most likely would be seen as a significant beneficial economic impact by the Tuolumne and Mariposa County communities.

Reopening of the burn area to the public would also occur faster in Alternative 4 than it would in the No Action Alternative. This would allow more overnight camping visitors to be accommodated in dispersed locations throughout the area. Reopening recreation areas within the burn area would also give visitors more reasons to stay in the region of impact, or to extend their stays. Restoring some of the volume of tourism that was lost due to the Rim Fire would allow businesses in Tuolumne and Mariposa Counties to capture more tourism spending. While not as conducive to quantification as the forest products industries, the expansion of recreation and tourism would also support more employment, thereby expanding the beneficial economic impacts associated with Alternative 4. Reopening of the burn area for firewood gathering would also be seen as economically beneficial by low-income residents who rely on wood burning to supplement the heating of their homes.

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

As was described in the methodology section and for each individual alternative above, a set of key measures of the actions proposed under each alternative were used to calculate economic impacts on job support. Table 3.10-7 presents the key measures for all alternatives, including:

- Estimated Salvage Timber (in MBF);
- Additional Treatment for Wildlife/Fuels/Biomass (in acres); and,
- Post-Contract Treatment (in acres).

Table 3.10-7 Key Measures Used as Inputs to Calculate Economic Impacts

Key Measures of Economic Activities to be Undertaken	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Fuel Reduction Economics				
Total Acreage in Units Treated	28,326	0	30,399	27,826
Est. Salvage Timber (MBF)	**660,781**	**0**	**622,899**	**541,399**
Additional Treatments				
Wildlife/Fuels/Biomass Acres	**7,626**	**0**	**8,379**	**7,975**
Post-Contract FS Activities				
Fuels Tractor Pile Acres	20,606	0	22,036	20,320
Watershed Drop and Lop Acres	2,228	0	2,228	1,798
Watershed Mastication Acres	1,309	0	1,309	1,309
Total Post-Contract Acres	**24,143**	**0**	**25,573**	**23,427**

Source: Rim Recovery project

Table 3.10-8 presents the numbers of jobs supported by these activities for each alternative. The No Action Alternative contributes no job support to Tuolumne and Mariposa Counties, but each of the action alternatives support between 5,500 and 6,700 jobs. Again, these are annual jobs and would be spread over multiple years, with the largest portions occurring in the first two years during the bulk of the salvage harvesting, and could amount to 1,500 to 2,000 jobs supported in each of those two years.

To the extent that capacity constraints in the forest products industry limits the amount of timber that can be salvaged and processed within the usable life of the damaged trees, the higher job numbers in Alternatives 1 and 3 might not be completely achieved. In such a capacity constrained scenario, the differences between the action alternatives could be reduced. In all cases, the most dramatic difference in social, cultural, and economic impacts is between the No Action alternative and any of the action alternatives.

Table 3.10-8 Annual Jobs Supported by Each Alternative

Economic Activities and Effects on Employment Generation	Alternative 1 (Proposed Action)	Alternative 2 (No Action)	Alternative 3	Alternative 4
Fuel Reduction Economics				
Direct Jobs Supported [1]	4,229	0	3,987	3,465
Additional Treatments/Biomass				
Direct Jobs Supported [2]	60	0	65	62
Post-Contract FS Activities				
Direct Jobs Supported [3]	151	0	160	146
Total Direct Job Support	**4,439**	**0**	**4,212**	**3,674**
Multiplier "Ripple" Effects				
Indirect and Induced Job Support [4]	2,220	0	2,106	1,837
Total Jobs Supported (Multiple Years)	**6,659**	**0**	**6,318**	**5,511**

[1] at 6.4 direct annual jobs / MMBF harvested.
[2] at $1,250/acre cost, 50% in addition to sawlog harvesting activities, 50% to labor at $40,000/job supported.
[3] at $500/acre treated, 50% to labor costs, and $40,000/ annual job supported.
[4] using an IMPLAN multiplier of 1.5 for Tuolumne and Mariposa Counties combined.
Source: Land Economics Consultants analysis

Environmental Justice

Environmental Justice (EJ) is an executive order (EO 12898) which requires, in brief, that each Federal Agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low income populations.

USDA Civil Rights policy requires each agency to analyze the civil rights impact(s) of policies, actions, or decisions that will affect federally conducted and federally assisted programs and activities. A civil rights impact analysis (CRIA) facilitates the identification of the effects of eligibility criteria, methods of administration, or other agency-imposed requirements that may adversely and disproportionately impact employees or program beneficiaries based on their membership in a protected group. Protected groups include multiples of similarly situated persons who may be distinguished by their common race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetics, political beliefs, or receipt of income from any public assistance program.

Actions including temporary closure of the Rim Fire area to the public and its eventual reopening, and actions that are applied consistently to everyone are not discriminatory. Economically beneficial support for additional employment, generated by action alternatives, is not specific to any ethnic group or income segment of the population. No evidence suggests that considered actions (in their entirety) have disproportionately high and adverse impact on minority and low-income populations.

3.11 SOILS

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

National Forest Management Act (NFMA) of 1976 as amended and the Forest and Rangeland Renewable Resources Planning Act of 1974) require the maintenance of productivity and protection of the land and, where appropriate, the improvement of the quality of soil and water resources. NFMA specifies that substantial and permanent impairment of productivity must be avoided.

Forest Service Manual (FSM) 2550 (USDA 2010) establishes the management framework for sustaining soil quality and hydrologic function while providing goods and services outlined in the Forest Plan. Primary objectives of this framework are to inform managers of the effects of land management activities on soil quality and to determine if adjustments to activities and practices are necessary to sustain and restore soil quality. Soil quality analysis and monitoring processes are used to determine if soil quality conditions and objectives have been achieved.

Pacific Southwest Region (Region 5) FSM 2500 Chapter 2550 Supplement (USDA 2012a) establishes soil functions (support for plant growth (productivity) function, soil hydrologic function, and filtering and buffering function) that the Region uses to assess soil conditions. The analysis standards are used for areas dedicated to growing vegetation. They are not applied to lands with other dedicated uses, such as system roads and trails or developed campgrounds.

Forest Service Handbook (FSH) 2509.22, Chapter 10 (Water Quality Management Handbook) (USDA 2011**)** improves and replaces the BMPs presented in Water Quality Management for NFS lands in California. The Forest Service water quality protection program relies on implementation of prescribed BMPs. These BMPs are procedures and techniques that are incorporated in project actions and determined by the State of California to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. Improvements to Forest Service BMPs, as presented in the 2011 Handbook amendment, include more detailed descriptions of individual BMPs (section 12), a requirement that site-specific BMPs be included in timber sale contracts (section 13), and direction that legacy sites (sites disturbed by previous land use that is causing or has potential to cause adverse effects to water quality) within timber project boundaries will be restored or improved. Additionally, the 2011 Handbook amendment establishes an expanded water quality management monitoring program (section 16). Chapter 2 includes detailed BMPs developed by watershed specialists.

National Best Management Practices for Water Quality Management on National Forest System Lands (USDA 2012b) apply to the proposed activities and are included in Chapter 2.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

The scope of the analysis for direct and indirect effects to the soil resource is limited to the proposed treatment units and connected actions situated outside of those units. Table 3.11-1 lists activities expected to affect the soil resources.

The current soil conditions reflect the cumulative effects of past activities, regardless of when they took place. If multiple activities have occurred in a given treatment unit over the past 50 years, it is not necessary to separate the effects of older treatments from more recent ones and therefore not practical to set a time constraint on those effects. The future timeframe for the soils analysis must extend until the resource has recovered from the impact of the proposed activities. The persistence of soil effects into the future can vary widely. For example, soil cover may recover within one to three years following a treatment. Soil compaction effects, however, may last for decades (Poff 1996).

Table 3.11-1 Activities expected to affect soil resources with each action alternative

Activity	Alternative 1	Alternative 3	Alternative 4
Tractor Harvesting (acres)	24,127	26,252	24,176
Skyline Harvesting (acres)	1,253	1,096	1,066
Helicopter Harvesting (acres)	2,930	3,035	2,568
Tractor/Skyline (acres)	16	16	16
Roadside Hazard Tree Removal (acres)	16,315	15,253	15,692
Watershed Treatment, mastication (acres)	0	1,215	1,215
Watershed Treatment, mastication pre-activity (acres)	0	93	93
Watershed Treatment, drop and lop (acres)	0	2,228	1,798
Total (acres)	**44,641**	**49,188**	**46,624**
Temporary Roads, new (miles)	3.9	9.5	8.4
Temporary Roads, existing (miles)	9.3	22.7	22.1
Temporary Roads, revert to existing (miles)	8.4	3.3	3.3
Total (miles)	**21.6**	**35.5**	**33.8**

Assumptions Specific to Soils

- Effective application of Best Management Practices for the action alternatives: In a burned soil environment, the natural filtering ability of the soil is greatly reduced and accelerated hillslope flow and erosion is expected. With the application of BMPs included in the project management requirements this will be greatly reduced (Watershed Report).
- Modeling parameters: Because of the size of the fire, it is assumed that the parameter development used in erosion modeling and EHR analysis reflects site specific parameters. Based on the resolution of the tools used, this assumption holds for most of the parameters. However, the parameters based on topography add uncertainty to the models used in this analysis. For this reason, the erosion analysis in this report should only be used as a comparative tool rather than an absolute value prediction. Site monitoring during activities will verify EHR assumptions for specific areas. Assumptions for modeling of erosion and EHR analysis and include:
  - All slopes are uniform. Generally, slopes are more complex than any modeling can account for. Linear mid slopes and variable bottom and top slopes based on the gradient of the slopes were generalized based on the slope gradient. Also soil cover values are assumed to be uniform over a modeled hillslope.
  - The timing, intensity, quantity, and distribution of precipitation are significant factors in erosion and sedimentation and can be highly variable based on the type of precipitation event, topography and elevation. This analysis assumes a uniform climate over the fire area based on a weather station situated at 4,600 feet near the most intensely burned portion of the fire around Corral Creek.
  - Hazard tree removal was modeled for each alternative. However, it is difficult to assign parameters to the intensity of this activity since the frequency and distribution of hazard trees is highly variable along roadways. Thus, even though this activity is likely to be less intense than it is in salvage logging units, it is conservatively assumed to be the same for this analysis.
  - Pre-fire soil cover values were based on field surveys and remotely sensed data analysis and generalized over the fire area. It is not possible to know what the post-fire implementation will be. For assigning post-implementation cover values, soil cover was increased in high fire intensity areas due to the expected activity fuels that would be left behind after treatment. Cover values were decreased in low to moderate fire intensity areas. Although activity fuels in the moderate and low fire intensity areas would also increase, machine piling and

prescribed fire proposed to achieve fuels objectives will likely decrease soil cover compared with pre-salvage values.

- In Alternatives 3 and 4, management requirements prescribe a cover value of 50 percent or greater in the areas identified as sensitive for soils and hydrology, termed Watershed Sensitive Areas (WSAs). The Water Erosion Prediction Program (WEPP) and EHR are modeled with a minimum of 50 percent cover in those alternatives. However, some of the areas may not have enough standing material to achieve 50 percent. For fuel objectives to be met, ground fuels cannot exceed 20 tons per acre. Depending on the average diameter of the downed material, it may not be possible to achieve 50 percent soil cover and less than 20 tons per acre. In Alternative 1, increases in soil cover are anticipated to be slight due to activity fuels; however, cover is not expected to approach 50 percent.

- About 4,300 acres of aerial mulch treatments were applied as part of the BAER implementation at a rate of up to 1.5 tons per acre and 100 percent soil cover. Most of these treatments were applied to areas designated in Alternatives 3 and 4 as WSAs and will require effort to maintain 50 percent cover during implementation of salvage activities. For the analysis, the conservative assumption was made that no mulch would remain at the time of implementation or after. This will not likely be the case, but decomposition and incorporation of the mulch into the soil could occur and will depend on soil moisture and intensity of equipment use.

Data Sources

- Soil spatial data and soil property tables acquired from the Natural Resources Conservation Services (USDA 2008) and derived from the Stanislaus National Forest Soil Survey.
- Soil interpretations provided by the Region 5 Soil Interpretation Guide (USDA 1999).
- The Soil Burn Severity (Figure 1.04-3) and information regarding post-fire soil conditions provided by Rust et al. (2012).
- Vegetation Burn Severity Map (Figure 1.04-2) produced by the Remote Sensing Application Center based in Salt Lake City, Utah.
- LiDAR high resolution digital elevation model acquired and processed by the Forest Service Remote Sensing Lab based in McClellan, California.
- Multi-Spectral Imagery high resolution satellite data acquired and processed by the Forest Service Remote Sensing Lab based in McClellan, California.
- All map base layers, 10 meter Digital Elevation Model, and Vegetation GIS information.

Soils Indicators

For this soils analysis, Forest Service staff developed soil quality functions and indicators that are appropriate for the proposed activities, site conditions, and soil characteristics of the project area. Soil quality functions support plant growth (soil productivity) and soil hydrologic function. Soil filtering and buffering is the function of immobilizing, degrading, or detoxifying chemical compounds or excess nutrients. Because no proposed activity will affect the soil filtering or buffering capacity of the soil, they are not analyzed in detail for this project.

Soil quality indicators have been developed to support analysis of these functions. While qualitative estimates of the effects of management activities on soils are generally considered sufficient to meet project analysis objectives, quantitative field survey results and remotely sensed information were used to describe the existing condition and to support the analysis of effects of management activities.

Soil indicators analyzed in this project support the soil quality functions of soil productivity and soil hydrologic function. Soil hydrologic function is measured by Erosion Hazard Rating which also is an indicator for soil productivity. For this analysis, all indicators are addressed in soil productivity.

SOIL PRODUCTIVITY

Soil productivity is the inherent capacity of a soil to support appropriate site-specific biological resource management objectives, which include the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses (USDA 2010b). The soil stores water and nutrients, and provides favorable habitat for soil organisms which cycle nutrients. Chemical, physical, and biological soil processes sustain plant growth which provide forage, fiber, wildlife habitat, and cover for watershed protection (USDA 2012a). Important measures of soil productivity include: soil cover, soil porosity and surface organic matter.

Indicator 1: Soil Stability and Effective Soil Cover

An adequate level of soil cover is needed to maintain soil stability and prevent accelerated erosion. Effective soil cover consists of low-growing vegetation (grasses, forbs and prostrate shrubs), plant and tree litter (fine organic matter), surface rock fragments, and may also include applied mulches (straw or chips). Effective soil cover is the most important soil property in maintaining soil stability and reducing erosion. Surface cover mitigates erosion primarily by intercepting and reducing the detachment energy of raindrops, improving soil porosity, preventing soil sealing, and increasing surface roughness (Larsen et al. 2009).

Ground cover protects soil from rain splash erosion, slows surface runoff, and filters runoff. The percent of bare soil is an important factor in controlling sediment production following timber salvage (Chase 2006). The presence of even a thin litter layer can substantially reduce soil erosion (Peterson 2009). Soil cover is the dominant control on post-fire sediment yields and generally does not begin providing protection to soil stability until a level of 50 percent is reached (Larsen et al. 2009). Figure 3.11-1 from Pannkuk and Robichaud (2003) illustrates the coverage of 50 percent ponderosa pine needles.

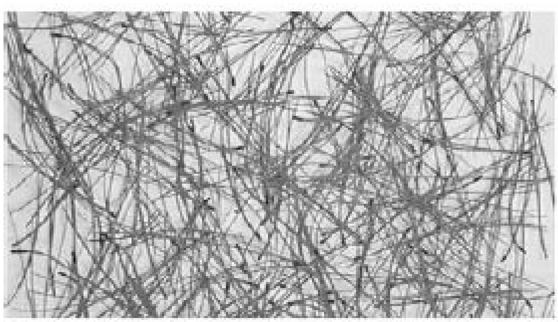

Figure 3.11-1 Fifty Percent Soil Cover from Ponderosa Pine Needles

Desired conditions for soils as stated in FSH 2550 are: "an adequate level of soil cover is maintained to prevent accelerated erosion and erosion prevention measures are effectively implemented following soil disturbing activities." Generally on slopes less than 35 percent, a minimum of 50 percent soil cover in a well distributed pattern is needed to maintain soil stability. Greater amounts of soil cover are generally needed for steeper slopes and in riparian zones.

Effective soil cover was estimated in field surveys and was used to correlate existing and potential soil cover with high resolution satellite imagery. The EHR (USDA 1990) system and the WEPP (Elliot 2010) were used to identify areas where accelerated erosion is likely to occur and to estimate the effects of management activities on erosion.

Metrics for Indicator 1 are erosion rates as modeled by WEPP, erosion hazard as measured by EHR, and Effective Soil Cover. Table 3.11-6 provides a summary by indicators for the existing condition and post-implementation values for each alternative. A soil will be considered stable if EHR ratings are moderate or below, and soil cover values are greater than 50 percent. Although threshold values for erosion rates are not established in Management Direction, this analysis uses the assumption that a soil is stable if erosion rates do not exceed rates of formation. The T-factor rating is an interpretation of acceptable soil loss tons per acre per year) which is related to the soil rate of formation. This interpretation is provided by the Natural Resources Conservation Services (NRCS). Values for the soils within the fire area range from 1 to 5 tons per acre per year with 1 ton per acre equivalent to the thickness of 2 sheets of paper.

Indicator 2: Surface Organic Matter

The concept of surface organic matter is related to effective soil cover, but includes the quality of the material. The amount of organic material on top of the mineral soil is maintained at levels to sustain soil microorganisms and provide for nutrient cycling. The size, amount, and distribution of organic matter maintained on the mineral soil on a long-term basis is consistent with the amounts that occur given the local ecological type, climate, and normal fire return interval for the area. Surface organic matter is characterized by its level of decomposition; **Oi** is fresh material with no decomposition, **Oe** is organic material with intermediate decomposition, and **Oa** is highly decomposed organic material with the original structure (needles and leaves) no longer discernible. The importance of the surface organic matter is comprehensively reviewed by Neary et al. (2005). Generally surface organic matter is important for moisture retention, nutrient cycling and storage, soil stability, infiltration, thermal cover, soil fauna and flora habitat, and gas exchange. Effective cover analyzed as Indicator 1 can be any material that provides for soil stability and does not factor in the quality of the cover to soil function. For example, although the organic layers are consumed by fire, needle cast additions can improve effective cover while taking years to incorporate into the soil as organic matter

Greater amounts of soil cover are generally needed for steeper slopes and in riparian zones (USDA, 2012a). Field crews collected data on the quantity and quality of soil cover and logs on the ground. Although the quantity and quality of surface organic material is unknown prior to the fire, field observations related to the Vegetation Burn Severity Map (Figure 1.04-2) allows for a good correlation of existing and potential cover as related to the canopy change caused by the fire. To estimate surface organic material, it is assumed that the amount of heat in both the moderate and high soil burn severity areas incinerate enough surface organic material to affect the soil productivity of these areas.

Indicator 3: Soil Organic Matter

Soil organic matter, also known as soil humus, is the highly decomposed organic material that is incorporated into the mineral portions of the soil. Soil organic matter is important for holding soil water, cycling nutrients, and reducing soil strength. The amount of organic matter within the mineral soil, indicated by the color and thickness of the upper soil horizon, is within the normal range of characteristics for the site, and is distributed normally across the area. The upper soil horizon is not displaced or eroded to the degree or extent that soil productivity is decreased for the desired vegetation.

Impacts to soil organic matter generally come from both excessive soil heating and soil displacement from mechanical disturbances. Soil heating volatizes both the complex organic compounds and plant nutrients. Changes in the soil organic matter can affect soil nutrient cycling, water holding capacity and aggregate stability.

Metrics for soil organic matter (SOM) is the extent of soil depleted either by volatilization from fire or displaced by project activities. Soil burn severity ratings of high were used to determine where SOM was volatized during the fire. High soil burn severity usually indicates penetration of heat into the soil and the consumption of fine roots and soil organic matter. This indicator was not directly measured by field crews, but was evaluated by the soil assessment team during BAER operations to develop the soil burn severity map. An analysis of existing and potential skid trail locations was used to identify areas where mechanical displacement of the SOM was likely. To estimate the amount of existing disturbance within units, the Forest Service Remote Sensing Lab in McClellan, CA is conducting advanced analysis on the LiDAR data set. As of this DEIS, that work is not complete and this indicator is discussed qualitatively.

For the purpose of this analysis, detrimental soil displacement is defined as occurring when either 2 inches or ½ the total thickness (whichever is less) of the humus-enriched topsoil (A horizon) is removed from an area of 3 square feet or larger.

Indicator 4: Soil Porosity

Soil porosity is the volume of pores in a soil that can be occupied by air, gas, or water and varies depending on the size and distribution of the particles and their arrangement with respect to each other. The two primary mechanisms for reducing soil porosity are compaction and soil sealing. The use of heavy forestry equipment and frequent stand entries increases bulk density and decreases the porosity of soils, which increases the potential for detrimental compaction (Powers et al 1998). Soil sealing is the process after a fire where fine soil particles fill the soil pores and reduce the flow of water through the voids.

The degree and extent of susceptibility to compaction is primarily influenced by soil texture, soil moisture, coarse fragments, depth of surface organic matter, ground pressure weight of the equipment, and whether the load is applied in a static or dynamic fashion. Soil compaction and increased soil strength can cause slowed plant growth, impeded root development, poor water infiltration, restricted percolation, increased overland flow during high precipitation events, and can cause plant nutrients to be relatively immobile or inaccessible (Poff, 1996). Recent research suggests that the effect of severe compaction on biomass productivity is highly dependent upon soil texture (Powers et al 2005). Within the Rim Recovery project area, soil textures of loam and clay loam produce widespread severe compaction ratings (Table 3.11-2).

The extent of detrimental soil compaction should not be of a size or pattern that will result in a significant change in production potential and should not result in common occurrences of overland flow and erosion within treated units (indicating that the infiltration and permeability capacity of the soil has been exceeded for the local climate).

Soil sealing and water repellency (hydrophobicity) resulting from a fire also affects area soil hydrologic function. As summarized by Larsen et al. 2009, soil seals are a thin layer of dense soil at the mineral soil surface. Metrics for soil porosity is the amount of ground that was impacted by logging equipment and high soil burn severity with the assumption that primary and secondary skid trails will be decompacted with subsoilers or ripping shanks. Compaction was identified by field crews using an evaluation of soil structure, particularly platey structure. Field observations were then used to correlate disturbances identified using the same methodology by the Remote Sensing Lab to identify displacement. Soil sealing, evaluated using soil burn severity, is likely to occur where ratings are high. The amount of existing disturbance within units is estimated using the LiDAR data set; however, this indicator is discussed qualitatively.

Soils Methodology by Action

SOIL DESCRIPTION AND INTERPRETATION

Soils information for this analysis was derived from the Stanislaus National Forest Soil Survey and obtained from the NRCS Web Soil Survey (WSS). The WSS provided both spatial and soil property information which was used for both field survey and analysis. Specific interpretations and soil data properties from the WSS were analyzed from the NRCS Soil Data Viewer (SDV) which is a GIS extension that helps the user analyze soils in a digital environment. Properties derived from the SDV include soil texture, depth, rock fragments, soil taxonomy, soil composition within a unit, and acceptable soil loss. The Soils Report (project record) includes a soil map.

Soil Erosion Hazard Rating

The Region 5 Soil EHR System (USDA 1990) was used to rate the risk of soil erosion for all soils in the project area post-fire, post-implementation with the incorporation of watershed treatments. This system uses various physical soil properties along with climate and site-specific conditions to rate sheet and rill erosion soil hazards.

Erosion Modeling

The disturbed WEPP batch program (Elliot 2010) was used to model predicted sedimentation resulting from the Rim Fire, salvage activities, and watershed treatments. Disturbed WEPP estimates erosion on an annual basis in contrast to the WEPP module ERMiT (Erosion Risk Management Tool) which predicts erosion for individual storm events used during BAER assessment. WEPP is a physically based erosion model which incorporates topography, soils, climate, vegetation and management activities. Because of the size and complexity of the fire, modeled erosion outputs should not be used as absolute values. The purpose of using modeled values is to illustrate relative risk from existing conditions and management activities and to evaluate the relative change in sedimentation associated with proposed activities.

Site Observations

The goals of field observations were to identify soil properties useful in confirming the accuracy of the soil survey, to identify existing soil conditions, to understand soil response to proposed activities management and to correlate the site conditions to remotely sensed data. Ninety seven plots were recorded. Site observation methods were developed for rapid assessment by field crews. Plot selection was stratified based on burn severity, soil type, topography, and visual satellite imagery expression. Soil cover is the most important soil characteristic estimate following a wildfire and any subsequent activities post fire. Observations were made to qualify the existing condition and to help watershed personnel correlate multi-spectral imagery with site characteristics.

Remotely Sensed Data Analysis

Analysis for this project utilized several remotely sensed sources of information to identify areas of both soil and vegetation burn severity, tree mortality, disturbances, and potential and existing cover. Unit-by-unit ocular analysis was completed using sensed data sets.

Watershed Sensitive Areas (WSAs)

Watershed staff examined each unit and identified Watershed Sensitive Areas (WSAs). WSAs are portions of the watershed that are at high risk of soil erosion and sedimentation due to the combined effects of the Rim Fire and potential recovery activities. Criteria for evaluating the existence of WSAs included: proposed recovery activities, burn severity, percent slope and slope shape, slope length, existing and potential soil cover, proximity to intermittent and perennial drainages, and proximity to high runoff response soils.

Affected Environment

Existing Conditions

Soils within the project area are primarily derived from metamorphic rock in the lower elevations and granitic rock at mid and higher elevations. A soil map (Soils Report, Appendix A) and Table 3.11-2 display the proportion of general soil groups per alternative and the corresponding soil properties used in the analysis. Field work during the BAER assessment and for this project verified the existing soil survey information, investigated current soil conditions and effects of the fire, and management capabilities. The dominant soils within the analysis area are mostly loams, sandy loams, and loamy sands with gravelly to extremely gravelly texture modifiers, indicating high natural infiltration rates and high rock content in many areas. These soils range from shallow to deep, reflecting a wide range of soil productivity and soil hydrologic groups. Specific dominant soils include the Holland, Josephine, Wintoner and Fiddletown. Rock outcrop is also common, even dominant, in several map units. Although rock outcrop does not produce sediment, it commonly produces runoff which accelerates erosion on soils downslope; a condition considered in the identification of WSAs.

Table 3.11-2 Soil families and associated properties used in analysis

Family	Max Extent of Activities (% total acres)	Soil Properties used in Analysis				
		T-Factor	Surface Texture	Subsurface Texture	Soil Depth (inches)	Compaction Hazard
Dystric Lithic Xerochrepts	2.1	1	Cobbly loam	Cobbly loam	20-40	Moderate
Dystric Xerochrepts	0.28	1	Cobbly loam	Coarse sandy loam	20-40	Moderate
Dystric Xerorthents	0.6	1	Coarse sandy loam	Coarse sandy loam	20-40	Slight
Entic Cyrumbrepts	0.06	3	Coarse sandy loam	Coarse sandy loam	20-60	Moderate
Fiddletown	7.5	2	Gravelly to Bouldery sandy loam	Gravelly sandy loam	20-60	Slight
Gerle	5.4	4	Gravelly sandy loam	Sandy loam	40-60+	Slight
Half Dome	0.17	3	Very Bouldery sandy loam	Cobbly sandy loam	40-60+	Slight
Holland	35.6	4	Loam	Clay loam	40-80+	Severe
Humic Dystroxerepts	0.1					
Josephine	27.8	4	Gravelly loam	Clay loam	20-60+	Severe
Lithic Xerumbrepts	3.7	1	Loamy sand	Sandy loam	0-20	Slight
McCarthy	4.1	3	Gravelly sandy loam	Sandy loam	20-60	Slight
Pinole	0.5	4	Gravelly loam	Clay loam	60-80+	Severe
Rock Outcrop	0.8	1	Unweathered bedrock	NA	0-10	Slight
Typic Dystroxerepts	0.4					
Ultic Haploxeralfs	1.7	1	Sandy loam	Loam		Severe
Wintoner	9.1	4	Gravelly loam	Clay loam	40-60+	Severe
Xerolls	0.1	5	Loam	Loam	40-60+	Severe

The majority of soils (about 75 percent) within the proposed action have a severe compaction rating (high probability to be compacted by activities when moist). These tend to be the most productive soils in the project area, particularly the Holland and Josephine soils. Both compaction ratings and productivity are strongly correlated with soil texture. During surveys, field crews noted severe compaction rating on nearly all sampled legacy skid trails confirming compaction potential in the project area. Fire history (Table 3.11-3) and past mechanical activities (3.14 Watershed) are the greatest influence on the existing soil condition.

Fire Disturbance

Although many activities occurred and affected the analysis area (3.14 Watershed) the existing soil condition is most dominated by recent fire history. Table 3.11-3 displays the six largest fires occurring within the Rim Fire perimeter (Figure 1.02-5). Fire can have both beneficial and negative effects on the soil resources. Fires that burn with low severity can maintain soil cover, mineralize important nutrients from plant matter stored on the soil surface, reduce fuel loads leading to possible future high burn severity, and stimulate herbaceous vegetation helping to facilitate nutrient cycling.

Moderate to high severity fires can cause a loss of soil hydrologic function by sealing pores and degrading soil structure, it can cause a loss of soil productivity by processes of erosion, mass-wasting, and nutrient volatization, and it can allow exotic plants to establish which can affect soil productivity. Similar to soil cover, the Rim Fire resulted in a deficiency of surface organic matter. It is estimated that 60 percent of the area has surface organic material coverage of less than 50 percent.

Table 3.11-3 Soil Burn Severity for selected fires in relation to the Rim Fire

Fire Name	Year	Size (NFS acres)	Soil Burn Severity (%)		
			High	Mod	Low/Unburned
Rim	2013	154,530	7	37	56
Stanislaus Complex	1987	147,100	36	20	44
Rogge1	1996	19,400	0	41	59
Granite	1973	17,100	55	30	15
Ackerson2	1996	11,300	19	14	67
Pilot	1999	4,000	46	25	29

[1] No high soil burn severity due to low fuel loading over much of the area because of new tree plantations after the Stanislaus Complex fire.
[2] This 59,000 acre fire burned mostly in Yosemite National Park.

Although the Rim Fire was the largest fire in Sierra Nevada recorded history, the Soil Burn Severity (SBS) was relatively low. The Granite, Ackerson, and Stanislaus Complex fires and post-fire fuel reduction activities removed significant build-up of surface fuels so the heat intensity and residence time was not favorable to high SBS. Table 3.11-4 indicates that the SBS as a proportion of the action alternatives is much higher than the fire as a whole simply because very little tree mortality occurred in the unburned and low SBS portion of the fire. There is very little difference in proportion of burn severity between alternatives.

Table 3.11-4 Soil Burn Severity of the maximum extent of activity

Burn Severity	Maximum Extent of Activities	
	acres	percent
Unburned	3,409	7.2
Low	15,038	31.8
Moderate	23,012	48.6
High	5,858	12.4
Total	**47,317**	**100.0**

SBS measures the direct effect of fires on soils. Whereas fire intensity measures the changes to the vegetation community, SBS indicates both changes to the above ground material, providing both existing and future soil cover, and the effects to the soil properties caused by heat penetration below ground. SBS categories are summarized as follows (Parsons et al. 2010):

- Low: Surface organic layers are not completely consumed and are still recognizable. Soil structure and roots are unchanged, and vegetation will appear green.
- Moderate: Up to 80 percent of the pre-fire ground cover may be consumed. Fine roots may be scorched but not consumed. Soil structure is not changed and there is usually potential for some immediate cover recruitment.
- High: All, or nearly all, of the pre-fire cover and organic matter has been consumed. Soil structure may be completely obliterated or strongly impaired. Fine surface roots have been consumed and coarse roots extending from stump holes may be consumed. There is little to no chance for short-term cover recruitment; cover will not return until vegetation regeneration occurs and snags begin to fall.

Figure 1.04-3 show the SBS for the entire fire area. The Vegetation Burn Severity Map (Figure 1.04-2) shows greater vegetation effects than soil effects primarily because this was a fast moving, wind-driven fire with little time for soil heat penetration. The Rim Fire BAER Soil Report (Rust et al. 2013) details the effects of the fire on soils.

Mechanical Disturbance

Mechanical equipment used in forest management activities compresses the soil by reducing pore size. This reduction in the pore space and the resulting increase in bulk density reduces the water holding capacity and gas exchange of soils. Compaction also increases the strength of soils restricting the ability of roots to penetrate the soil matrix. Post-fire field surveys revealed the most severe compaction in the Josephine and Holland soils on benched skid trails and legacy temporary roads and on displaced surface loam soils exposing the greater clay subsoil. In most units, the extensive skidding network resulted from past timber sales. Most skid trails sampled revealed high levels of compaction with little recovery. Within these skid trail prisms, soil cover generally is similar to the surrounding areas. Vegetation growing on these skid trails is either very stunted or non-existent reflecting a reduction of soil porosity and displacement of the soil organic material. Table 3.11-5 displays a summary of existing conditions within the maximum extent of activities, which includes all alternatives. The existing conditions include the effects from past fire and mechanical disturbance.

Table 3.11-5 Summary of existing condition of indicators

Indicator			Total	Percent
#	Indicator	Metric		
1	Soil Stability, Erosion	Average Erosion Rate (tons/acre)[1]	3.11	
1	Soil Stability, Erosion Hazard Rating	Greater than Moderate Rating (acres)	10,725	23
1	Soil Cover	Area with less than 50 percent cover (acres)	25,322	60
2	Surface Organic Material	Area with less than 50 percent cover (acres)	28,870	61
3	Soil Organic Matter[2]			
4	Soil Porosity[2]			

[1] Erosion rates for unburned areas tend to be 0.5 tons/acre or less.
[2] Currently being evaluated.

Environmental Consequences

All mechanical harvest operations will adhere to S&Gs set forth in the timber sale administration handbook (FSH 2409.15) and the BMPs as delineated in the Region 5 Amendment to the Forest Service Water Quality Management Handbook (USDA 2011a) and the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA 2012). Timber sale contracts contain many standard provisions that help ensure protection of soil and water resources. These include provisions for an erosion control plan, road maintenance, skid trail spacing, and restrictions for wet weather operation.

The analysis of effects is limited to the proposed activities that are expected to change the values of the indicators as compared to the existing condition. Although many unknowns exist both in existing conditions and the intensity of the activities on a site specific area, conservative estimates were made which will likely overestimate the effects of the activities. By comparing the effects to threshold values, this analysis informs the decision maker of the relative risk each alternative has to the threshold values established in management direction. Road construction and rock quarry work will permanently remove those areas from soil productivity. Management direction is to analyze for impacts to soils for areas of soil function. Due to implementation of BMPs those activities are expected to result in effects that are limited in extent to those specific locations and are therefore not expected to significantly impact soil productivity in the project area. Activities analyzed include tractor logging, skyline logging, helicopter logging, road work, prescribed fire, watershed treatments, hazard tree removal along roads and Best Management Practices.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1: Soil Stability and Effective Soil Cover

The effects of soil stability and effective soil cover are directly related and analyzed together. Erosional processes, which are the direct measures of soil stability, are primarily changed by management activities when those activities affect soil cover and porosity. While it is not feasible to predict the soil cover following treatments for every location, general assumptions can be made in regards to the departure of soil cover from pre-existing levels based on proposed activities. Activities expected to affect soil stability and cover include harvest activities and fuels treatments.

The existing condition of soil stability and soil cover are above threshold values. The proposed activities of Alternative 1 will do little to change this indicator. There will be slight increases in soil cover due to activity fuels, but not enough of an increase in cover values (less than 50 percent) is expected where the Rim Fire resulted in deficiencies due to high vegetation severity. Erosion rates and Erosion Hazard Ratings will also remain little changed.

Shakesby et al. (1996) found that logging residue can decrease erosion and retain sediment in postfire logged sites. In general, harvest activities are expected to generate ground cover from both slash and breakage. However, there is conflicting research, indicating some areas may not have sufficient soil cover post treatment. Studies directly measuring the change in soil cover following salvage activities are limited; studies of fuel increases however can serve as a reasonable proxy. McIver and Ottmar (2007) found that post-fire logging in an Oregon Ponderosa pine forest increased the amount of material less than 3 inches diameter to 2.8 tons/acre compared to 0.6 tons/acre in burned but unsalvaged stands. Donato et al. (2006) found that fine woody material increased above pre-fire levels following salvage logging of the 2002 Biscuit Fire. Although these studies reported material in weight as opposed to percentage ground cover, they support the idea that logging activities generate fine material that translates into soil cover. However, Chase (2006) found that both tractor logging and cable logging increased the amount of bare soil compared to burned and unlogged control plots. The amount of bare soil decreased with helicopter logging. Chapter 3.05 (Fire and Fuels) also discusses the material expected to be left after salvage operations.

Fuel treatments are also expected to affect the amount of soil cover. Machine-piling with a rake- fitted dozer followed by burning is expected to reduce soil cover to less than 20 tons per acre, creating areas where soil cover may go below threshold values. Machine-piling is not intended to reduce the fine fuels in contact with the ground, but because of “sweeping” of the surface by the larger targeted material, some surface cover will likely be displaced to piles. Monitoring by project administrators is expected to keep this displacement to a minimum. Pile-burning will have an impact on soil cover at the location of the pile. Fuel staff target 80 percent consumption of material in a pile, which will likely leave less than 50 percent ground cover in that location. Burn piles will be dispersed throughout a unit and typically burn in a mosaic. The area extent of the piles is unknown; however it is expected that pile burning along with other soil disturbing activities will occupy less than 15 percent of a unit to conform to Forest Plan Standard and Guidelines.

A WEPP analysis was used to predict hillslope erosion. Skid trails and cable corridors are compacted surfaces with reduced ground cover that concentrate water and increase rill and gully erosion at water outlets or along the compacted surfaces. Proper installation of BMPs on skid trails will help minimize the increased sediment production due to salvage logging (Chase 2006). Decompacting of primary and secondary skid trails to increase infiltration and surface roughness along with implementation of

BMPs is expected to minimize the erosion and sedimentation related to the concentration of hillslope water flow caused by skidding.

Soil cover and erosion were evaluated both at the area extent of the proposed salvage treatments and on a per unit basis. About 59 percent of the proposed action area currently has soil cover of less than 50 percent and 304 units are currently identified as likely to have less than 50 percent cover in more than 15 percent of the area. It is not expected that these values will change significantly as a result of proposed activities. Although effective soil cover is expected to increase in areas of high vegetation burn severity, it is unlikely that activity fuels will add enough soil cover to increase values above the 50 percent threshold in these areas. In the low and moderate vegetation burn severity, harvest and fuels activity are not likely to drop soil cover values below the 50 percent threshold since only activity generated material is treated during timber sale implementation

Table 3.11-6 shows modeling of the proposed activities which result in erosion rates dropping slightly for the project area from 3.1 tons per acre to 3.0 tons per acre, while the number of units where erosion rates exceeded acceptable soil loss increased slightly from 178 to 181. This increase is likely due to the decrease in cover values on steep slopes that are proposed for helicopter or skyline logging. EHR rates also will change little as a result of proposed activities. The number of units where the EHR exceeds ‘Moderate’ in over 15 percent of the unit stayed unchanged at 188 units. The small differences in erosion rates and the lack of change in EHR ratings are considered insignificant, but it is likely that erosion will increase as a result of the proposed action.

The use and development of temporary roads is part of the connected action to timber harvest that is expected to affect both soil cover and soil stability. The temporary roads were not considered in the unit-by-unit analysis and are addressed separately. About 4 miles of temporary roads will be constructed and 18 miles of existing temporary roads will be used. Ten of those 18 miles of existing temporary roads will be obliterated. It is expected that temporary roads will be deficient in ground cover, however, subsoiling, recontouring, installation of waterbars, and application of ground cover will reduce the risk of erosion.

In summary, there is much uncertainty regarding the effects proposed activities will have on soil cover and erosion. Research on post-fire logging resulting in erosion is limited (McIver and Starr, 2001) and is not consistent. The lack of change from current conditions based on proposed activities did not show a substantial decrease or increase in EHR or erosion in the models used for this analysis. Although erosion may increase as a result of salvage activities, the magnitude, as Chou (1994) suggests is likely overwhelmed by the erosion and sedimentation resulting from the fire itself. What is clear from both research and modeling is that most of the analysis area will remain below minimum threshold values for effective soil cover and will continue to exceed soil stability thresholds.

Skid trails and cable rows provide a conduit for rill erosion formation thereby increasing the amount of erosion and sediment (Chase 2006). Management requirements are incorporated into the proposed action to mitigate the effects of logging effects on erosion and soil cover. Also, most temporary roads will be obliterated (only those currently operating under other special uses will remain). Madej (2001) found that the activities proposed for restoration of skid trails, landings and temporary roads reduced sediment and runoff significantly when applied to closing forest roads.

Indicator 2: Surface Organic Matter

Proposed activities expected to affect surface organic matter include hauling, temporary road construction and prescribed burning. Harvest activities including the use of tracked feller-buncher type equipment will affect the surface organic matter with localized surface displacement, but will not have a detrimental soil effect on the stands where those activities occur. Long-term surface organic matter is more likely to occur as a result of skidding material to landings and cable yarding material along cable corridors. Removal of the material will be highest closer to landings and on portions of the cable corridors that do not support a fully suspended load. Fresh deposits of broken branches and needle cast will occur, but this accumulation is expected to be thin with surface coverage below threshold standards.

Long-term recovery of the soil organic material in high soil burn severity areas may be affected by the removal of the overstory. With the fine organic material and needles consumed in high severity vegetation burn areas, surface organic matter recovery depends on snag recruitment and needle fall to the soil surface. During field surveys, those portions of the analysis area with the highest depletion of surface organic material correlate with thick stands of burned trees smaller than the 16 inch diameter at breast height that will not be removed. Therefore, material is likely to remain to decompose and rebuild soil organic layers over time.

Piling of fuels is not expected to significantly affect surface soil organic matter; however, piling will reduce the amount of material that could contribute to future surface organic matter. Tractor-piling with a rake is likely to cause limited disturbance and displacement of the organic soil layers as target material sweeps the soil surface. The burning of piles is expected to generate enough heat to consume all soil organic layers although the extent is expected to be much lower than the threshold of disturbance of 15 percent extent.

Indicator 3: Soil Organic Matter

Displacement is the removal of surface layers of the mineral soil generally by mechanical means. All salvage activities have the potential to substantially displace the SOM. Feller-buncher activity will cause limited displacement. Displacement from harvesters is generally not considered detrimental displacement because the effects are localized. In ground based mechanical harvest units higher levels of displacement are likely to occur with skidding operations. Skidder tracks along with dragging of trees digs into the mineral soil surface and wedges the surface to the side. This creates berms and piles along the edges of skid trails. Skyline units are expected to have displacement along portions of the corridors, with higher displacement levels occurring closer to the landings. The most severe displacement is expected to occur on steeper temporary roads and skid trails. The steeper the slope on both temporary roads and skid trails, the more severe the displacement is likely to be due to cut-banking. Displacement results in the removal of nutrient rich loamy material exposing the high clay content subsurface. This subsurface is deficient in soil nutrients, reduces infiltration, and has higher natural soil strength impeding root penetration. Fox et al. (1989) found displacement caused by windrowing decreased forest productivity dramatically. Displacement can also lead to channelized flow from entrainment between berms, reduced infiltration, reduced surface roughness, and in the case of roads, high levels of compaction. While local displacement damages soil function, the activities resulting in negative effects will not exceed 15 percent of the area and impacts are not expected to be significant.

The other mechanism of displacement involves heat penetration into the mineral soil sufficient enough to char or volatize the organic compounds that form SOM. The diminishment of SOM caused by the Rim Fire dominates the existing condition; however, pile and jackpot burning is expected to produce enough heat where fuel loads exceed 20 tons/acre to consume SOM within the footprint of the piles. The extent and burn severity is unknown and is dependent on the size of the piles and distribution of fuels. The impact will be limited to the pile locations and small areas of high concentrations and therefore is not expected to be significant.

The development of skid trails will have the largest impact on SOM, but management requirements will mitigate the effects. It is clear from ocular review of LiDAR, there are units with little to no displacement and some units where the existing condition exceeds the 15 percent threshold for disturbance. Existing skid trails will be reused where practical. For many of the tractor units, existing skid trails are expected to be adequate for salvage harvest and new skid trail development will be unnecessary or minimal. Displacement caused by new skid trails and temporary road construction will be considered a long-term disturbance as no mitigations to replace displaced SOM are planned.

SOM will recover regardless of management activities in the long-term. SOM is expected to recover more rapidly in areas where SOM was displaced by fire, because nutrient cycling of ash and rapid vegetation regrowth of root dense, nitrogen-fixing shrubs will facilitate deposition of organic matter by decomposing roots and mineralization of decaying material in the soil. On soils where SOM will be impacted by mechanical activities, the recovery is expected to be slower because residual nutrients of the fire will be displaced and SOM replenishing vegetation will be stunted where compaction occurs.

Indicator 4: Soil Porosity

Changes in porosity occur both by the reduction of soil pore space by force applied to the soil surface (compaction) and the filling of pores by soil and ash material (soil sealing). Heavy equipment use is expected to increase compaction within treated areas. For this project, the dominant soil is rated as high compaction hazard primarily because of the increasing clay at depth. Within tractor units, compaction is expected to increase depending on the number of passes and the weight of the machine. Feller-buncher harvesting equipment is considered low ground-pressure equipment and typically does not travel the same location more than twice. Compaction is therefore expected to be slight where mechanical harvesting occurs.

Skidding operations, however, will detrimentally compact the soil. Williamson and Neilson (2000) found that most maximum compaction occurs after 3 passes of log-laden equipment. Landings are areas of high compaction because they support skidding equipment, processors, and log trucks but all landings will be deep tilled after use on this project. Management requirements confine the extent of detrimental disturbance from skid trail patterns to less than 15 percent of a unit. However, it is likely that many units will exceed 15 percent disturbance because of this existing condition. Management requirements, such as subsoiling, substantially decrease the negative effects of compaction. Powers (2002) observed that subsoiling significantly improved the porosity of soils. Subsoiling temporary roads, landings and skid trails will limit the extent and duration of effects in these areas. Detrimental disturbance is expected to be minimal in helicopter units. The risk of compaction will be increased in those sky line and helicopter units where feller-buncher type harvesters assist handfallers in removing trees. In these units where no skid trails will be used, detrimental compaction is not expected outside cable corridors.

Although the effects of soil sealing resulting from the fire may be reduced before implementation starts, it is likely that soil surface disturbance through mechanical harvest activities will further reduce the effects of soil sealing by exposing more developed soil structure. Compacted road surfaces reduce infiltration to near zero. Forest roads are the largest source of erosion. This is exacerbated in a burned environment because the capacity of the landscape to moderate flow and trap sediment is greatly reduced (Peterson et al. 2009). The extent of new and temporary road construction is limited, and while compaction of these surfaces is severe, the limited extent of activities is not expected to result in significant impacts to forest productivity.

CUMULATIVE EFFECTS

The Rim Fire resulted in significant impacts to soils within the analysis area including increases in erosion potential, loss of soil cover, loss of soil organic matter and reduction in soil porosity from soil sealing. With no other actions planned (Appendix B) within the Rim Recovery soil analysis area, the cumulative effects for Alternative 1 are the same as the direct and indirect effects of Alternative 1. The cumulative effect of Alternative 1 is expected to slightly improve soil cover from activity fuels and will increase the porosity in existing skid trails, landings, and abandoned roads identified for use as temporary roads in the project; however in general the activities are not expected to substantially improve the soil indicators within the analysis area.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1: Soil Stability and Effective Soil Cover

Under Alternative 2, only indirect effects to soils occur. Soil cover for erosion protection will be limited to natural rates of accumulation. In areas of lower burn severity, needlecast from dead tree canopies will continue to accumulate as ground cover at natural rates. Soil stability will remain reduced and erosion risk will remain elevated in the short term, for 1 to 3 years, until ground cover and vegetation are reestablished. Higher burn severity areas currently lacking effective soil cover will recover more slowly because woody material will be deposited naturally at a slower rate. Where the potential for soil cover to be added through needlecast is low, soil cover in the short term will mainly be added as dead trees shed branches and fall. Effective soil cover will only be fully reestablished after surface vegetation recovers. This will expose the soil to higher erosion potential over the next 3 to 5 years. Under this alternative, WSAs will not receive additional ground cover as proposed in Alternatives 3 and 4 and therefore the analysis area will not realize a reduction in erosion and sediment in areas identified as higher risk for sedimentation and erosion. Areas will have continued accelerated erosion for 3 to 5 years until soils stabilize and vegetation cover returns.

Indicator 2: Surface Organic Matter

The Fuels Report (project record) states that smaller diameter class snags will fall within the fire perimeter at the highest rate in the first ten years. Larger snags will persist for relatively longer time periods, but most snags will be expected to fall within 20 years post-fire (Hood, Chuck and Smith 2007). Within 10 years, surface fuels are projected to be 78 tons per acre. Within 30 years, surface fuels are projected to average 98 tons per acre due to dead trees falling over (Fuels Report). Richie (2013) showed that 10 years after the Black Mountain Fire, 80 percent of the basal area was on the ground. These predicted fuel loading levels pose a risk to soil productivity if reburned in a subsequent wildfire. The fuel loadings predicted exceed the levels that cause severe soil heating in a fire (Brown et al. 2003). While it is not possible to accurately predict when a fire will reburn, predicted fuel loadings in Alternative 2 will create an elevated fire hazard leading to excessive soil heating damage. One study, in adjacent Yosemite National Park, examined the effects of multiple fires on vegetation in unlogged areas. Areas of high severity were more likely to burn with an increased area of high severity again in future fires, partly because of a post-fire vegetation shift from forest to brush or chaparral (Wagtendonk 2012). Areas that burned at low or moderate burn severity initially and maintained forest conditions were more likely to burn at low or moderate burn severity in later fires.

Other studies show that if salvaged logged areas reburn, they may have higher overall vegetation burn severity and fire effects than areas that were unlogged (Fraver et al. 2011; Thompson 2007). Most studies on this topic analyze the vegetation effects of reburn. There are fewer studies that directly compare soil effects and associated fire risk or hazard in unlogged and salvage logged areas, therefore impacts to soils in this scenario are less clear. It is expected that fuel loading in contact with the soil surface is likely to be the most important variable in determining risk of fire damage to the soil during a reburn and this Alternative will provide far more down woody material than treated stands.

Indicator 3: Soil Organic Matter

Without the proposed management requirements associated with soil ground cover in WSAs and other areas with elevated erosion rates, soil organic matter could be lost through surface erosion until soils stabilize. In lower burn severity areas, less soil organic matter will be lost due to erosion without alteration by active management, and in the long-term it will develop at natural rates. With increased fuel loadings described under indicator 2, it is possible that soil heating effects could increase in future fires. High surface temperatures, especially from burning downed logs, raise soil temperatures, resulting in increased volatilization of soil organic matter. Prolonged heating under burning logs will lead to lethal temperatures of greater than 122°F for fungi and 212°F (Boyer and Dell, 1980) for nitrifying bacteria at greater soil depths. The loss of SOM is probably the most serious concern in terms of long-term soil effects. SOM dynamics and nutrient cycling will continue to recover naturally, once vegetation becomes re-established.

Indicator 4: Soil Porosity

Existing levels of compaction will not be improved or changed. Existing compaction on abandoned roads and skid trails will remain until natural processes restore soil porosity. Additional compaction will not occur; however, areas with compacted, benched-in skid trails will not be subsoiled and are likely to remain compacted for decades.

CUMULATIVE EFFECTS

With no other actions planned (Appendix B) within the Rim Recovery soil analysis area, the cumulative effects for Alternative 2 are the same as the indirect effects of Alternative 2. The cumulative effect of Alternative 2 is not expected to improve soil cover or soil porosity.

Alternative 3

While Alternative 3 include less salvage acres, the area of impact is increased through proposed biomass removal. Impacts of biomass removal will result in similar soil effects, as machinery used to do the activities are the same. The proposed temporary road use increases by 18.3 miles while new road construction drops from 5.4 miles to 1 mile. The most substantial change to Alternative 3 affecting the soil resource is the 3,536 acres of watershed treatments providing for additional cover if post-activity soil cover is not greater than 50 percent in WSAs.

DIRECT AND INDIRECT EFFECTS

Indicator 1: Soil Stability and Effective Soil Cover

The effects of activities to soil stability and effective soil cover from salvage activities and road work activities would be similar to Alternative 1. The addition of soil cover in the WSAs improves the soil stability and the amount of effective soil cover substantially due to the targeted application of soil cover in areas identified as most erodible and lacking in soil cover. Table 3.11-6 displays the modeled erosion rate decreases from the existing 3.1 tons per acre per year down to 2.2 tons per acre per year for Alternative 3. The number of units where the average unit erosion rates exceeded T-Factor similarly will decrease when compared to the existing condition from 194 to 136 units.

Improvement in effective soil cover is also expected to increase, but will not be as considerable as the erosion rate reduction. This is due to cover being added only in the highest potential erosion rate areas. Areas deficient in soil cover on gentle slopes are expected to remain deficient in soil cover until it recovers naturally over time. The area of Alternative 3 that is expected to have less than 50 percent soil cover will decrease as a result of proposed activities from nearly 60 percent to 53 percent. The number of units where the amount of soil cover is less than 50 percent in at least 15 percent of the unit is expected to decrease from 335 to 329 units.

The amount of area and number of units that are a ‘Moderate’ EHR rating or less improved with the modeled additions of soil cover, but not as dramatically as improvements in modeled erosion rates using WEPP. The area of EHR ratings above ‘Moderate’ decreased by 1 percent from 22 percent to 21 percent and the number of units that have more than 15 percent of the unit area with a rating of ‘High’ or ‘Very High’ decreased from 209 units to 203 units. Where EHR rating is improved from ‘Very High’ to ‘High’ it is still considered above thresholds set by management direction. Although assumptions are factored into all modeling, the improvement of erosion rates, EHR, and soil cover is substantial enough to conclude the proposed activities in Alternative 3 will decrease erosion and increase cover sufficiently that they will have a net benefit to the analysis area.

Indicator 2: Surface Organic Matter

The effects to surface fine organic matter will be the same as Alternative 1. The material added to the surface as a result of WSA treatments will not add to the surface organic matter. This material is undecomposed coarser material derived from non-commercial stems and will only cover 50 percent of the soil. Treatments will not add appreciably to soil productivity.

Indicator 3: Soil Organic Matter

Same as Alternative 1.

Indicator 4: Soil Porosity

The effects to soil porosity will be similar to what is described for Alternative 1. The additional treatment will increase the amount of compaction within the analysis area. Additional areas of soil disturbance will not be expected to increase the percent of compaction in any treated areas above the amount expected with Alternative 1. Soil disturbance within Alternative 3 will be reduced in areas where treatment proposed in Alternative 1 does not occur. However, existing compaction on skid trails and landings within untreated areas will also persist.

CUMULATIVE EFFECTS

Same as Alternative 1, except the addition of organic cover for watershed treatments would improve soil cover and reduce erosion rates as described in the direct and indirect effects of Alternative 3.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Indicator 1: Soil Stability and Effective Soil Cover

Table 3.11-6 shows the modeled erosion rate for Alternative 4 is similar to Alternative 3 with a decrease from 3.0 tons per acre per year down to 2.2 tons per acre per year. On a unit-by-unit basis, the number of units where the average unit erosion rates exceeded T-Factor similarly decreased over the existing condition from 186 units to 131 units. The area of Alternative 4 that has less than 50 percent soil cover decreases from nearly 59 percent to 52 percent. The number of units where the amount of soil cover is less than 50 percent in at least 15 percent of the unit decreases from 317 to 311 units. The amount of area and number of units at a ‘Moderate’ EHR rating or less increased, but improvements from added soil cover for EHR were not as dramatic as for modeled erosion rates with WEPP. The area of EHR ratings above ‘Moderate’ decreased by 2 percent from 22 percent to 20 percent and the number of units that are expected to have more than 15 percent of the unit area with a rating of ‘High’ or ‘Very High’ improved from 197 units to 191 units which is the same change in the number of units as Alternative 3.

Indicator 2: Surface Organic Matter

Same as Alternative 3.

Indicator 3: Soil Organic Matter

Same as Alternative 3.

Indicator 4: Soil Porosity

The effects to soil porosity will be similar to that described for Alternative 3. Soil disturbance within Alternative 4 will be reduced in areas where treatment is proposed in Alternative 3 does not occur. However, existing compaction on skid trails and landings within untreated areas will persist.

CUMULATIVE EFFECTS

Same as Alternative 1, except the addition of organic cover for watershed treatments would improve soil cover and reduce erosion rates as described in the direct and indirect effects of Alternative 4.

Summary of Effects Analysis across All Alternatives

Table 3.11-6 provides a summary of the effects across all alternatives for Indicators 1 and 2. Indicators 3 and 4 are dependent on analysis of LiDAR by the Remote Sensing Lab and not yet complete. For Indicators 3 and 4, the effects of each alternative are compared qualitatively. Indicators for erosion, soil cover, fine organic material, and soil organic material exceed threshold values used in the analysis.

Indicator 1: Soil Stability and Effective Soil Cover

Alternatives 1 and 2 are similar in the effects to soil stability. High erosion rates and low cover values will remain for both alternatives; however, slight improvements to average erosion rates occur in Alternative 1 due to the addition of activity fuels. Conversely, the number of units where the erosion rates exceed acceptable soil loss increases in Alternative 1 due to the decrease in soil cover in areas that have near 100 percent soil cover in the existing condition. Because of the addition of 50 percent cover prescribed in the WSA units, Alternatives 3 and 4 show marked improvement in cover values, EHR and erosion rates. The treatments are prescribed in those areas where deficiencies in soil stability pose the greatest risk to watershed resources.

Indicator 2: Surface Organic Matter

Little change is expected in Surface Organic Matter between the four alternatives.

Indicator 3: Soil Organic Matter

Little change is expected in Soil Organic Matter between the four alternatives.

Indicator 4: Soil Porosity

The overall porosity for Alternatives 1, 3, and 4 is expected to improve due to implementing the management requirement to subsoil primary skid trails and temporary road prisms situated on existing disturbance. The soil supporting most of the existing skid trails within the proposed units have reduced porosity exceeding threshold values. Porosity decreases in areas off of skid trails may also occur, but the effect is expected to be limited. Also, mechanical treatment in the action alternatives may increase the porosity by decreasing the effects of soil sealing. Porosity does not change under Alternative 2.

Table 3.11-6 Summary of Indicators by Alternative

Indicators			Alternative 1 (357 units + HT)		Alternative 2 (No Action)		Alternative 3 (368 units + HT)		Alternative 4 (350units + HT)	
#	Indicator	Metric	Existing	Post	Existing	Post	Existing	Post	Existing	Post
1	Soil Stability, Erosion	Average Erosion Rate (tons/acre)	3.1	3.0	3.1	3.1	3.1	2.2	3.0	2.2
		Number of units exceeding acceptable soil loss	178	181			194	136	186	131
1	Soil Stability, Erosion Hazard Rating	Number of units with EHR greater than Moderate rating in greater than 50 percent of unit	188	188			209	203	197	191
		Percent area greater than Moderate Rating	23	23	23	23	22	20	22	20
1	Soil Cover	Number of units with more than 50 percent of unit having less than 50 percent soil cover	304	304			335	329	317	311
		Percent area with less than 50 percent cover	58.9	58.9	60.0	60.0	59.5	52.8	58.7	51.5
2	Surface Organic Material	Percent area with less than 50 percent cover of surface organic material	61	61	61	61	61	61	61	61

HT=Hazard Tree Removal (Roadsides)

3.12 Special Areas

This section describes the affected environment and the environmental consequences for Special Areas. For the purposes of this project, Special Areas are Forest Plan management area land allocations within or adjacent to the Rim Fire perimeter that include: Special Interest Areas (SIAs); Wild and Scenic Rivers and Proposed Wild and Scenic Rivers (Wild and Scenic Rivers); and, Wilderness (USDA 2010a).

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Special Interest Areas

Three SIAs are located within the Rim Fire perimeter: Bourland Creek Trestle Historic Area; Pacific Madrone Botanic Area; and, Jawbone Falls Heritage Area. The Rim Recovery project does not include treatment units within or adjacent to the Bourland Creek Trestle SIA; therefore, that SIA is excluded from further analysis. Forest Plan direction for SIAs is to protect values, make educational opportunities available and preserve the integrity of the special interest feature for which the areas were established (USDA 2010a, p. 129). Special cutting methods will be used to salvage mortality or improve the quality of resources other than the timber resource (p. 133).

Wild and Scenic Rivers

The Wild and Scenic Rivers Act (82 Stat. 906, as amended; 16 U.S.C. 1271-1287) establishes the National Wild and Scenic River System and establishes policy for managing designated rivers. Under the Act, designated rivers “shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations” (16 USC 1271). Section 10(a) states: each component of the national wild and scenic rivers system shall be administered in such manner as to protect and enhance[7] the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. Section 12(a) states: particular attention shall be given to scheduled timber harvesting, road construction, and similar activities which might be contrary to the purposes of this Act.

FSH 1909.12, Chapter 8 includes direction to manage selected river corridors to preserve their notable values or features as part of, or for eventual inclusion in, the National Wild and Scenic River System.

Forest Plan direction for Wild and Scenic Rivers is to protect and enhance Proposed Wild and Scenic River characteristics and manage the same as designated Wild and Scenic Rivers (USDA 2010a, p. 117). Designated and proposed Wild and Scenic Rivers, along with immediate environments, will be managed to preserve their free flowing condition and protect their outstandingly remarkable values (p. 111). The Forest Plan allocates Wild classification segments to Primitive or Semi-Primitive Non-Motorized ROS; and, Scenic and Recreational classification segments to Roaded Natural ROS (p. 114). Special cutting methods will be used to improve the quality of Wild and Scenic River resources (p. 116).

Wilderness

The Wilderness Act of 1964 (public Law 88-577) and the 132 subsequent laws designating Wilderness contain numerous statutory provisions addressing management of Wilderness. It

[7] The Interagency Wild and Scenic Rivers Coordinating Council interprets **Protect** as elimination of adverse impacts and **Enhance** as improvement in conditions (IWSRCC 2002).

establishes a National Wilderness Preservation System of federal Lands where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.

Several sections of FSM 2320 provide management direction for Wilderness:

- Wilderness values shall dominate over all other considerations except where limited by the Wilderness Act, subsequent legislation, or regulations (FSM 2320.3).
- Do not maintain buffer strips of undeveloped wild land to provide an informal extension of Wilderness. Do not maintain internal buffer zones that degrade Wilderness values (FSM 2320.5).
- Manage each Wilderness as a total unit and coordinate management direction when they cross other administrative boundaries (FSM 2320.5).
- Where a choice must be made between Wilderness values and visitor or any other activity, preserving the Wilderness resource is the overriding activity (FSM 2320.6).
- Display the relationship and coordination between the Wilderness and activities present in the Wilderness, as well as activities outside of the Wilderness that affect the management of Wilderness (FSM 2322.03).
- Protect air quality and related values, including visibility, on Wilderness land designated class I by the Clean Air Act as amended in 1977 (FSM 2323.61).

Forest Plan direction for Wilderness is to: maximize the quality and naturalness of the Wilderness environment; minimize impacts to the Wilderness resource while allowing it to be used for primitive recreation and preserving scenic, scientific, educational and historical values; all NFS lands within Congressionally designated Wilderness and areas recommended for Wilderness will be managed in accordance with the Wilderness Act of 1964 (16 USC 1131-1136) as amended (USDA 2010a, p. 67).

Effects Analysis Methodology

Assumptions Specific to Special Areas

Special Interest Areas

- The Rim Recovery project will not affect the Bourland Creek Trestle SIA because it is not located within or adjacent to any proposed treatment units.
- Salvage and fuels reduction in the Pacific Madrone SIA would be conducted in such a way that project activities would not damage the integrity of the unique botanical features, the madrone trees, or seedlings and saplings.
- Salvage and roadside hazard trees through mechanical, cable and helicopter harvest methods would have no adverse effect to the Jawbone Falls SIA.
- Use of existing breaches within linear sites, such as historic railroad grades and trails, would cause no adverse effect to the Jawbone Falls SIA.
- Use of existing and development of new water sources are not anticipated to affect the Jawbone Falls SIA.

Wild and Scenic Rivers

- For the purpose of this analysis, Wild and Scenic River values or ORVs are interchangeable. ORVs are specific to each river segment and may include cultural, ecologic, fish, geologic, historic, scenic, recreation, wildlife or other special and unique features (USDA 1991c).
- Proposed treatments will not affect the free flowing conditions of any Wild and Scenic Rivers.
- Management Requirements and Best Management Practices (BMPs) outlined in Chapter 2.02 and Chapter 2.03 would protect the water quality of the rivers.
- Natural events such as landslides, downed dead trees and other hillside material falling into river corridors could block free flowing river or river segments. These natural events are unpredictable and not associated with project activity.

- Fire activity in the Tuolumne River canyon will be ongoing and is part of the evolution of the ecosystem. Scenery and other outstanding remarkable values (ORVs) are forever changing in this system with vegetative growth, fire, and regrowth.

Wilderness

- Due to stringent operating specifications within timber sale contracts there is an expectation that dust associated with the removal of logs from the Forest (hauling) would be minimal. This includes operations immediately adjacent to the Wilderness.
- For the purposes of this project, the generic term Wilderness includes the Emigrant Wilderness and the Yosemite Wilderness.
- Yosemite National Park plans to remove hazard trees adjacent to roads.
- Due to the anticipated heavy logging traffic on Cherry Creek Road and other routes that access Kibbie Ridge and Lake Eleanor, those routes would be closed to public use for safety until the project is completed or roadside hazard trees abated.
- No helicopter flights will occur over the Emigrant Wilderness or Yosemite Wilderness.
- Since no proposed treatments occur in Wilderness, the alternatives will not affect the Wilderness characteristics for Untrammeled, Undeveloped, Natural, or Special Features and Values.

Data Sources

Special Interest Areas

- GIS shapefiles with the location of the Pacific Madrone SIA.
- GIS Layers of the Stanislaus National Forest Basemap 2014.
- 2009 GIS Ortho Photo layers.
- Existing information from consultation with Indian Tribes, cultural resource records, historic archives, maps, and GIS spatial layers were used.

Wild and Scenic Rivers

- Stanislaus National Forest Wild and Scenic River Study (USDA 1991)
- Tuolumne River Wild and Scenic Management Plan (USDA 1988)
- Clavey River Ecosystem Project: Clavey River Watershed Assessment (USDA 2008)
- GIS
- Motorized Travel Management EIS (USDA 2009)

Wilderness

- Stanislaus GIS Library

Special Areas Indicators

Special Interest Areas

- **Special Interest Area Values**: SIA values are specific to each SIA and may include unique botanic, cultural, geologic, scenic, historic and memorial features.

Wild and Scenic Rivers

- **Wild and Scenic River Values**: For a river to be eligible for Wild and Scenic River designation it must be free-flowing and, with its adjacent land area, must possess one or more outstandingly remarkable values (47 Federal Register 173, September 7, 1982; p. 39454-39461). For the purpose of this analysis, Wild and Scenic River Values and Outstandingly Remarkable Values (ORVs) are interchangeable. ORVs are specific to each river segment any may include cultural, ecologic, fish, geologic, historic, scenic, recreation, wildlife or other features (USDA 1991c).

Wilderness

- **Wilderness Characteristics**: Since no proposed treatments occur in Wilderness, the alternatives will not affect the Wilderness characteristics for Untrammeled, Undeveloped, Natural, or Special Features and Values (Wilderness Assumptions). The remaining principal Wilderness characteristic described in Forest Service Handbook (FSH) 1909.12 (USDA 2007a) is:
  - ***Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation***: the area provides solitude or primitive and unconfined types of recreation including a wide range of experiential opportunities such as: physical and mental challenge, adventure and self-reliance, feelings of solitude, isolation, self-awareness and inspiration. Solitude is the opportunity to experience isolation from sights, sounds, and the presence of others from the developments and evidence of humans. The opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills are measures of primitive and unconfined recreation.

Special Areas Methodology by Action

Special Interest Areas

- A field visit revealed that Pacific madrone trees in the SIA survived the Rim Fire.
- Analysis of effects to Pacific madrone trees from activities proposed in the Rim Recovery project utilized existing data acquired primarily through past site monitoring and anecdotal information from botanists from other Forests.
- Utilizing previous archaeological inventories from past projects that meet current survey standards (1986 to present); nearly 53 percent of the proposed treatment areas were eliminated from further inventory. A strategy to intensively survey (15 to 30 meter interval spacing) the remaining treatment areas is consistent with the Rim PA.
- The timeframe for this analysis is three years, an appropriate temporal boundary because the activities associated with this project should be completed within three years.

Wild and Scenic Rivers

- The geographic extent of this analysis for direct and indirect effects is river corridor boundary, one-quarter-mile on either side of the high water mark of the rivers.
- The analysis for cumulative effects includes those effects within the river corridor and, given that nearly the entire project area drains to these rivers, cumulative effects of this project occur at the watershed scale. Chapter 3.14 (Watershed) displays potential cumulative watershed effects (e.g., sedimentation and other impacts to water quality).
- The analysis of each alternative considers whether the activities would alter ORVs of the associated river segments.
- The short-term timeframe for this analysis is three years, an appropriate temporal boundary because the activities associated with this project should be completed within three years.
- The long-term timeframe for this analysis is ten years, an appropriate temporal boundary which allows effects of completed activities associated with this project to be established.

Wilderness

- The geographic extent of this analysis is the Wilderness within one half mile of project activities. Rim Recovery project activities would occur on NFS land adjacent to the Wilderness. No project activities are planned in the Emigrant Wilderness. Yosemite National Park manages the Yosemite Wilderness. This unit of spatial analysis for determining cumulative effects is appropriate.
- The timeframe for this analysis is three years, an appropriate temporal boundary because the activities associated with this project should be completed within three years.

Special Interest Areas: Affected Environment

EXISTING CONDITIONS

Jawbone Falls Heritage Area

The Jawbone Falls SIA was established in 2000. Consisting of 47 acres, the area was identified by the Tuolumne Band of Me-Wuk Indians as sacred and one of the most significant traditional cultural properties of the Central Sierra Me-Wuk people. At the time it was established significant cultural values were identified through field surveys and consultation with Indian Tribes and other interested parties. The specific nature of the cultural resources is administratively confidential, under the provisions of the Archaeological Resource Protection Act of 1974, as amended (43 CFR 7).

From the onset of the Rim Fire, the Forest Archaeologist consulted with the Tuolumne Me-Wuk Tribal Council regarding protection of traditional/cultural areas significant to the Me-Wuk people. Native peoples currently utilize the area for traditional purposes and will continue to do so.

Historic records, maps and oral accounts encompassing the Jawbone Falls SIA boundary indicate moderate land use since the 1880s in the form of ranching, cattle grazing and railroad logging. Earliest records indicate a number of homesteads patented near the area of Jawbone Falls mainly for acquiring title to valuable timber. However, some of the existing trail and road system is likely connected to moving livestock to summer pasturage. Associated features affected by the fire include fences, wooden troughs and collapsed wooden structures (range cabins).

The West Side Lumber Company, founded in 1899, did not reach the area of the SIA until the 1940s. As the company expanded to its easternmost timber tracts during this time period, timber in and around Jawbone Falls was harvested. Associated features affected by the Rim Fire include railroad grades, cut and fill structures, donkey sets and associated equipment.

Pacific Madrone Botanic Area

The Pacific Madrone SIA consists of two small groves of Pacific madrone trees covering 15 acres. It is located along Road 1S13C in Packard Canyon where roadside hazard tree removal is proposed. The management emphasis of this SIA is to protect and manage the unique botanical features for which it was designated, namely the southern-most groves of Pacific madrone in the Sierra Nevada. Resource activities such as roadside hazard tree removal are allowed within the SIA provided the integrity of the SIA is protected (USDA 2010a). In recent years, discovery of young Pacific madrone trees and saplings outside of the SIA indicates madrone trees have been successfully reproducing and expanding their distribution in the vicinity.

The Pacific Madrone SIA occurs within an area which had not burned for more than 100 years. In the past, timber harvest occurred in the SIA, but more recently management activities have not taken place. As a result, the understory became overgrown with regeneration conifers. The habitat within the SIA tends to be comparatively cool and damp owing to the northeast aspect and position in the bottom of a perennial stream drainage. Madrone trees in the SIA survived the Rim Fire likely due to the microclimate of the site. Additionally, it is possible fire burned through this area at night when fire activity was lower. Madrone trees outside the SIA did not fare as well; most reportedly sustained canopy mortality. Pacific madrone is known to resprout from the root crown after fire, so many trees with canopy mortality will likely survive.

Special Interest Areas: Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Jawbone Falls Heritage Area

Cultural resource sites located within the boundaries of the SIA would be delineated with coded flagging and/or other effective marking (i.e., "flag and avoid") for protection prior to project implementation as stipulated in the Rim PA. Potential direct and indirect effects to the Jawbone Falls SIA are minimal as proposed treatments within the SIA would be limited to trees approved by the Tribe and selected to enhance or protect cultural values that make the SIA significant and unique. Additional actions include the reconstruction of Forest Service Roads 2N78 and 2N08Y to provide access to treatment units. Reconstruction would end near the decommissioned area at Jawbone Creek below the falls and would not affect the cultural values of the SIA.

Pacific Madrone Botanic Area

Forest Plan direction reduces the risk of roadside hazard tree removal damaging the integrity of the Pacific Madrone SIA. Where removal of hazard trees would jeopardize the integrity of the SIA by damaging or killing madrone trees, "special cutting methods" for abating the hazards would be implemented, such as falling and leaving the hazard trees (USDA 2010a). Therefore there would be no direct or indirect effects to the Pacific Madrone SIA.

CUMULATIVE EFFECTS

Jawbone Falls Heritage Area

The direct and indirect effects of Alternative 1 are minimal and would not degrade the integrity of this SIA. Other present or foreseeable future projects (Appendix B) are or will be subject to NHPA Section 106 compliance and potential effects to cultural resources would be identified at that time following stipulations in the Rim PA. Alternative 1, when combined with the past, present and foreseeable future actions and events are not expected to cumulatively lead to increased impacts to the cultural values or cultural resources of the Jawbone Falls SIA.

Pacific Madrone Botanic Area

Forest Plan direction ensures that Rim Recovery project activities would not degrade the integrity of this SIA. No other present or foreseeable future projects are planned for the SIA location (Appendix B). With no direct or indirect effects to the Pacific Madrone SIA and no foreseeable future actions, no cumulative effects occur under Alternative 1.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Jawbone Falls Heritage Area

Alternative 2 has no direct effects; indirect effects to cultural values and resources may occur through inaction. The existing threat of fire weakened trees falling naturally, and potentially damaging already fragile cultural sites, would continue unabated leading to increased potential for ground disturbance and damage to site features and cultural values.

Pacific Madrone Botanic Area

Alternative 2 has no direct effects; indirect effects may occur in untreated areas if falling dead trees damage madrone trees and saplings, or kill madrone seedlings. Downed dead trees could block germinating madrone seeds, cause excess ground level shading for madrone seedlings and create high fuel accumulations, which could burn at high intensity causing madrone crown mortality and possibly killing madrone trees, saplings or seedlings.

CUMULATIVE EFFECTS

Jawbone Falls Heritage Area

Alternative 2 poses indirect effects to this SIA. Other present or foreseeable future projects (Appendix B) are or will be subject to NHPA Section 106 compliance and potential effects to cultural resources would be identified at that time following stipulations in the Rim PA. With indirect effects to the Jawbone Falls SIA and no effects from foreseeable future actions, the minimal indirect effects described under Alternative 2 are the cumulative effects of Alternative 2.

Pacific Madrone Botanic Area

Alternative 2 poses indirect effects to this SIA. No other present or foreseeable future projects are planned for the SIA location (Appendix B). With indirect effects to the Pacific Madrone SIA and no foreseeable future actions, the indirect effects described under Alternative 2 are the cumulative effects of Alternative 2.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Pacific Madrone Botanic Area

Same as Alternative 1.

Jawbone Falls Heritage Area

Same as Alternative 1.

CUMULATIVE EFFECTS

Jawbone Falls Heritage Area

Same as Alternative 1.

Pacific Madrone Botanic Area

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Jawbone Falls Heritage Area

Same as Alternative 1.

Pacific Madrone Botanic Area

Same as Alternative 1.

CUMULATIVE EFFECTS

Jawbone Falls Heritage Area

Same as Alternative 1.

Pacific Madrone Botanic Area

Same as Alternative 1.

Wild and Scenic Rivers: Affected Environment

One congressionally designated and two proposed Wild and Scenic Rivers lie within the Rim Fire perimeter. This includes all 29 miles of the designated Tuolumne Wild and Scenic River on NFS lands; the lower half of the Clavey Proposed Wild and Scenic River (24 miles); and, all of the South Fork Tuolumne Proposed Wild and Scenic River (2 miles).

About 98 percent of the Rim Fire burned within the Tuolumne River watershed. The remaining 2 percent burned in the North Fork Merced River watershed along the southern edge of the fire. Table 3.12-1 displays the river segments affected by the Rim Fire.

Table 3.12-1 Wild and Scenic River Corridors Affected by the Rim Fire

Wild and Scenic River	Classification	Segments	(miles)
Clavey River	Wild	3	16.2
	Scenic	3	7.3
Tuolumne River	Wild	3	21.5
	Scenic	1	4.7
	Recreation	1	0.6
South Fork Tuolumne River	Scenic	1	2.5

Clavey Proposed Wild and Scenic River

The Clavey Proposed Wild and Scenic River includes 33 miles of Wild and 14 miles of Scenic segments. The Rim Fire affected half (23.5 miles) of the 47 mile river corridor: 7.3 miles of Scenic classification and 16.2 miles of Wild classification are within the analysis area. The primary ORVs of the Clavey River inside the Rim Fire perimeter include the following (USDA 1991c, p. 46-50)

- **Ecological**: The Clavey River (including Bell and Lily Creeks) has a combination of landscape ecology features making it distinct within the Sierra Nevada Mountains: 1) free-flowing characteristics; 2) abundance and quality of life zones and vegetation; 3) elevation range; and, 4) relative remoteness and lack of development.

  The Clavey River is one of the longest remaining free-flowing streams in the Sierra Nevada. It is 47 miles from source to mouth, including both headwater forks, Bell and Lily Creeks. Free-flowing condition is an important value because little remains in the Sierra Nevada. From the Feather River on the north to the Kern River on the south, all but one (the Consumnes) of the 15 major rivers in the Sierra, are impounded. Of 90 major tributaries, only four streams greater than 40 miles are free-flowing with no impoundments or diversions from headwaters to mouth. The Clavey River contains all but one Sierra Nevada life zone within its watershed. Elevation ranges from 1,200 feet at its mouth to 9,200 feet at its headwaters, allowing for all life zones except true alpine. At its headwaters, sub-alpine forests of red fir, lodgepole, western white pine and mountain hemlock combine with mountain meadows and granite-bound lakes. All forest habitats are found as elevation decreases, ending with the California chaparral type at the mouth of the river. Within the Clavey's wide variety of high to low elevation vegetative types, one is truly unique: Bell Meadow, at 6,500 feet along Bell Creek, contains the largest stand of quaking aspen (110 acres) in the southern half of the Sierra Nevada.

  Another feature of the Clavey River is its minimal development. It is almost entirely under federal ownership; even the portions outside of Wilderness are relatively undisturbed and remote. Private lands and developments such as towns and roads line portions of most other rivers in the Sierra. The Clavey, although crossed by several roads, has remained relatively undisturbed because of its remoteness, rugged nature and its north-south geographic orientation. For much of its length, the Clavey runs perpendicular to the east-west trend of major roadways in its watershed.

- **Fish**: one of the first streams in California to be designated as a Wild Trout Stream, representing a mid to low elevation trout stream in a remote location.

  Wild Trout streams provide self-sustaining trout fisheries which are not supplemented by hatchery stocking. It is believed that almost the entire basin contains only fish "native" to this portion of the Sierra Nevada. About 95 percent of the basin has an original fish assemblage. Rainbow trout is the only trout species in the basin (Lily Creek is reported to have some brook trout and brown trout may spawn at the confluence with the Tuolumne River). Rainbow trout are found in all of the Clavey and its tributaries capable of supporting coldwater fish.

  The lower portion of the Clavey also contains a native assemblage of warm water fish including Sacramento suckers, Sacramento squawfish and hardhead. Due to extensive planting of non-native trout species and the illegal introductions of non-native warm water fish species, few other streams in the Sierra contain only the original assemblage of fish species. The Clavey River may be the only "rainbow trout" river left, in the Sierra Nevada, with its original fish assemblage still intact and relatively unaffected by introduced species.

- **Scenic**: outstanding Variety Class A landscape includes a deep, V-shaped, river-cut canyon through metasedimentary rock.

  The river provides a variety of water forms including rapids, cascades and pools. Vegetation patterns are varied, including scattered ponderosa pine and oak/grass woodland. The scenic values of the lower Clavey are similar to those of the lower Tuolumne Wild and Scenic River.

- **Wildlife**: a large tract of late seral stage forest habitat is centered on the Clavey River between Reed Creek and Road 3N01.

  Five SOHAs and two fisher reproductive units are located on or adjacent to the river, within 8,000 acres of older mature forest habitat. It is unusual to have this much older mature forest habitat at this elevation in the Sierra.

- **Recreation**: hiking and fishing are the popular dispersed activities. Access is limited and portions are remote and wild, resulting in a rare opportunity for solitude and non-motorized recreation experiences, below the snow and available all year.

  This portion of the Clavey has been traversed by expert kayakers. It is a native trout fishery, and a State designated Wild Trout Stream which is significant to anglers. Hiking and swimming are the popular activities near the Clavey's confluence with the Tuolumne Wild and Scenic River.

The Rim Fire burned with varying intensity along the one-half mile wide river corridor, consuming vegetation with a basal area loss of less than 50 percent in 17 miles of the corridor, and a basal area loss of greater than 50 percent in the other 12 miles. Loss of vegetation has seriously compromised the Scenic ORV of the river corridor and resulted in reduced visual diversity and wildlife habitat.

South Fork Tuolumne Proposed Wild and Scenic River

The South Fork Tuolumne Proposed Wild and Scenic River, located in the south-central portion of the Forest, includes the 2 mile Scenic segment from the Middle Fork Tuolumne River to the Tuolumne River. Outstanding remarkable values include Scenic and Other (USDA 1991c, p. 51):

- **Scenic**: outstanding Variety Class A landscape includes a deep, rugged canyon.

  The river provides a variety of water forms including rapids, cascades, waterfalls, and pools. Rim of the World Vista, located above the river area on Highway 120 (Big Oak Flat route to Yosemite National Park), provides outstanding scenic views of the deep river canyon, all the way to its confluence with the Tuolumne Wild and Scenic River.

- **Other**: considered sensitive because they are fragile or nonrenewable.

About 65 percent of the viewshed in the one-half mile wide river corridor is affected with a basal area loss of over 75 percent due to the Rim Fire. The remaining 35percent of the river corridor viewshed sustained 25 to 75 percent basal area loss. Some randomly scattered and small (less than 1 acre) patches of less than 25 percent basal area loss exist along the corridor. Loss of vegetation severely compromised the scenic ORV for this river.

One electricity transmission line crosses over the river corridor and an aqueduct (tunnel) crosses under and parallel to the river corridor. Two un-numbered roads totaling about one-half mile access the transmission line in the river corridor. There are no recreational facilities.

Tuolumne Wild and Scenic River

The Stanislaus National Forest portion of the Tuolumne Wild and Scenic River includes 24 miles of Wild, 4 miles of Scenic, and 1 mile of Recreational segments. The river is located in the south-central part of the Forest. ORVs include fish, geologic, historic/cultural, recreation, scenic, scientific/educational, whitewater boating and Wilderness characteristics.

Lumsden Road (1N10) runs 5.9 miles along the south and west sides of the river within the scenic corridor, crossing once at the Lumsden Bridge. Routes off the Lumsden road within the river corridor include the 0.1 mile 1S52, 0.1 mile 1N10A, and 0.2 mile 1N10E. Two hiking trails, 17E40 and 17E56, run parallel to the river on the south side and are in a Wild classification segment of the river. One trailhead, one put-in for boating, 3 camping sites, and one gaging station are the only facilities within the Scenic segment of the river. Dispersed camping associated with boating occurs along the river west of Merals Pool.

The Rim Fire burned with varying intensity along the one-half mile wide river corridor, mostly consuming vegetation greater than 50 percent of the basal area. Because of steep canyon walls, an estimated 10 to15 miles has a view from the river corridor where over 75 percent of the vegetation has been consumed. This is both the west end of the river and the easterly end of the river. In areas where the corridor is flatter, about 19 miles have basal area consumption of 0 to 50 percent. Loss of vegetation has seriously compromised the Scenic ORV of the river corridor, reduced visual diversity and wildlife habitat, and created an increased risk of soil erosion within the steep slopes of the canyon.

The Tuolumne Wild and Scenic River was divided into eight segments for planning purposes, with boundaries between segments based on the types and levels of existing development, access, recreation opportunity, and the potential for classification as a unit separate from adjacent segments. Table 3.12-2 shows the eight segments, their length and classification.

Table 3.12-2 Tuolumne Wild and Scenic River Classifications

Segment	Classification	Length (miles)
Yosemite to Early Intake	Wild	5
Early Intake to Cherry Creek	Recreational	1
Cherry Creek to Lumsden Area	Wild	4
Lumsden Area	Scenic	4
Lumsden Area to Clavey River	Wild	4
Clavey River to Indian Creek	Wild	3
Indian Creek to Mohican Mine	Wild	6
Mohican Mine to Terminus	Wild	2
Total		29

Wild and Scenic Rivers: Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Clavey Proposed Wild and Scenic River

Under Alternative 1, no research is proposed; therefore, no direct or indirect effects related to that action would occur.

Salvage

Alternative 1 proposes to treat 644 acres of salvage harvest by means of tractor (130 acres), helicopter (506 acres), and skyline (8 acres) logging methods in the Scenic corridor of the Clavey River. Landings would be constructed for decking logs and piling slash materials. Whole tree yarding would occur in tractor units to reduce fuel loading. Landings would be restored post-harvest via deep tilling, contouring, and scattering of slash. Drop and lop is proposed in helicopter units A04 and A05, for a maximum of 505 acres within the river corridor. Machine pile and burning is proposed in tractor unit A03, for a maximum of 80 acres within the river corridor. Jackpot burning is proposed as needed in units A03, A04, and A05, for a maximum total of 585 acres.

The direct effects of all these activities include ground disturbance in tractor units from skidding logs to landings, potential for sedimentation runoff, and negative visual effects from logging debris on the ground. Noise disturbance from logging equipment is not a factor as the area is closed to the public during these operations. The negative visual effects of logging debris and the already burned landscape would be tempered over time with vegetation recovery activities and natural regrowth of plants and trees. BMPs and management design criteria mitigate the effects of soil disturbance, erosion, and restoration of disturbed ground. BMPs also mitigate disturbance and activities adjacent to the river itself as well as in the one-half mile wide river corridor.

Indirect effects of salvage harvest are short-term degraded scenic beauty, an ORV for these segments of the corridor. Scenic beauty would be restored over time as vegetation recovers naturally, and plant and tree diversity increases.

Roadside Hazard Trees

Roadside hazard tree removal is proposed along 1N01, 2N29, 2N29A, 3N56Y in the Scenic segments. Roadside hazard tree removal is also proposed along 0.2 miles of 2N40, which runs mostly outside the edge of the Wild segment of the Clavey River. About 5.7 miles of road and 268 acres within the Wild and Scenic River corridor would be treated by this activity. Resulting short term direct and indirect effects would be visible slash piles, stumps, and other signs of logging activity. Piles would be burned, creating additional short term visual effects. Over time, vegetation would return and obscure the products of these activities, after which scenic values should not be further affected.

Roads

Alternative 1 proposes to build 0.2 miles of new road on P3N56Y to access unit A01A within the Scenic portion of the river corridor. Live tree removal as well as hazard tree removal and a landing constructed at the terminus are proposed. The road would be gated at the end of logging operations and kept for administrative use. The direct effects of new road construction are ground disturbance, a new linear feature on the Scenic landscape, and increased easy access to the river by bike, foot, or horse. There is no apparent indirect effect. The landscape would recover over time and the linear feature would eventually be unnoticeable from the river bottom. BMPs and management requirements for new road construction, erosion, watershed, and aquatics would mitigate the direct effects of construction activities.

Alternative 1 also proposes to reconstruct 2.7 miles of roads 02N29, 02N29A, and 03N56Y. Improvements would provide for serviceability for project haul vehicles, as well as for proper hydrologic function and stream protection in accordance with applicable BMPs. Reconstruction would improve the road conditions as needed for safe and efficient haul of forest products. A number of NFS trails managed for motor vehicle use are included for reconstruction. These routes would be returned to their prior condition, including reestablishing drainage features as previously designed, when the project is complete. Direct and indirect effects from these activities include soil disturbance and vegetation removal. Reconstruction would provide safer travel for the public and a more stabilized road system for the Clavey River corridor, reducing point source sedimentation.

Alternative 1 proposes 4.7 miles of maintenance on roads 01N01, 02N29, 02N40, and 03N56Y within the river corridor. Direct and indirect effects from road maintenance are temporary in nature, resulting from soil disturbance. This is of short duration and mitigated through BMPs and management requirements for road maintenance, soils, watershed, and aquatics.

One route, P17EV11-1 accessing unit A10 is proposed for temporary use then reverted to original use post-project. Direct and indirect effects include a short term loss of recreation opportunities and are addressed in Recreation Chapter.

Indicators

The above activities would add slightly to the already degraded condition of Scenic segments of the river corridor caused by the Rim Fire. However, the activities are of short duration and would not degrade the ORVs of fish, wildlife or recreation, which have already been affected by the Rim Fire itself. Where project activities are proposed within sight distance of Wild and Scenic Rivers, distance and geographic features would obscure most treatments from the casual observer or users of those areas. Vegetation recovery, woody debris in stream channels, and hazard reduction at recreation sites would all contribute to the eventual recovery of these compromised values (also refer to 3.03 Aquatics, 3.08 Recreation and 3.14 Watershed).

South Fork Tuolumne Proposed Wild and Scenic River

Under Alternative 1, no salvage or research is proposed; therefore, no direct or indirect effects related to those actions would occur.

Roadside Hazard Trees

The proposed action includes roadside hazard tree removal on 0.2 miles and 9 acres along private road FR7858 within the Scenic portion of the South Fork Tuolumne River. Short term direct and indirect effects would be visible slash piles, stumps, and other signs of logging activity. Piles would be burned, creating additional short term visual effects. Over time, vegetation would return and obscure the effects of these activities, after which scenic values should not be further affected.

Roads

Alternative 1 proposes 0.5 miles of road maintenance within the South Fork Tuolumne River corridor on roads 01S98Y, 01S98YA spur, 01S99Y, and FR7858. Direct and indirect effects from road maintenance are temporary in nature, resulting from soil disturbance. This is of short duration and mitigated through BMPs and management requirements for road maintenance, soils, watershed, and aquatics.

Indicators

These activities are of short duration and do not degrade the ORVs of fish, wildlife or recreation which have already been affected by the Rim Fire itself. Where project activities are proposed within sight distance of Wild and Scenic Rivers, distance and geographic features would obscure most treatments from the casual observer or users of those areas. Vegetation recovery, woody debris in stream channels, and hazard reduction at recreation sites would all contribute to the eventual recovery of these compromised values (also refer to 3.03 Aquatics, 3.08 Recreation and 3.14 Watershed).

Tuolumne Wild and Scenic River

Under Alternative 1, no salvage harvesting or research is proposed; therefore, no direct or indirect effects related to these actions would occur.

Roadside Hazard Trees

Alternative 1 includes roadside hazard tree removal on about 286 acres within the Scenic corridor around the recreation facilities and gaging station, and on 6.4 miles along Lumsden Road (1N10) and its spurs 1N10C, 1N10E, and 1S52. Short term direct and indirect effects would be visible slash piles, stumps, and other signs of logging activity. Piles would be burned, creating additional short term visual effects. Over time, vegetation would return and obscure the effects of these activities, after which scenic values should not be further affected.

Roads

Alternative 1 proposes 6.4 miles of road maintenance within, or adjacent to, the Scenic section of the Tuolumne River corridor along Lumsden road (1N10) and its spurs (1N10C, 1N10E, and 1S52); and, 0.26 miles of road maintenance on road FR99001, within the Recreation section of the river corridor. Direct and indirect effects from road maintenance are temporary in nature, resulting from soil disturbance. This is of short duration and mitigated through BMPs and management requirements for road maintenance, soils, watershed, and aquatics.

Indicators

These activities are of short duration and do not degrade the ORVs of fish, wildlife or recreation which have already been affected by the Rim Fire itself. Where project activities are proposed within sight distance of Wild and Scenic Rivers, distance and geographic features would obscure most treatments from the casual observer or users of those areas. Vegetation recovery, woody debris in stream channels, and hazard reduction at recreation sites all contribute to the eventual recovery of these compromised values (also refer to 3.03 Aquatics, 3.08 Recreation and 3.14 Watershed).

CUMULATIVE EFFECTS

Clavey Proposed Wild and Scenic River

Maintaining the free-flowing condition of this river is necessary to maintain the Wild and Scenic values. The treatments proposed under Alternative 1 would not affect the existing flow regimes as construction actions do not occur within the stream channels. Constriction of flow is not anticipated as a result of road construction, as no stream crossings are proposed within the one-quarter mile buffer. Falling dead trees or dead trees rolling downhill could occur from natural processes. Minor increases in stream flow may have occurred following the fire, as fire-killed trees no longer utilize water, resulting in reduced evapotranspiration rates along the hillslopes. Removal of fire-killed trees under the proposed action would not result in any further measurable changes to evapotranspiration rates.

Maintaining high water quality is also needed to maintain Wild and Scenic values. Management requirements have been designed to minimize water quality impacts. This includes requirements such as maintaining or increasing ground cover, subsoiling compacted areas, smoothing out ruts, and improving drainage features on existing roads. While some sedimentation could occur as a result of proposed actions, it is anticipated to be minimal and of short duration and is not expected to affect the long-term beneficial uses and purposes for which the river was designated or made eligible. None of the streams with special designations such as Wild and Scenic Rivers or Heritage Trout Waters are expected to be adversely affected by sediment. No negative cumulative effects from the proposed action are expected.

Two ongoing or planned projects propose actions to occur within the Wild and Scenic River corridors: the Rim HT project, and the Twomile Ecological Restoration projects (including the Looney and Thommy timber sales, and planned activities along motorized trails and roads). Table 3.12-3 and Table 3.12-4 summarize the types and extent of activities within the river corridors proposed by these projects.

Table 3.12-3 Roadside and Powerline Hazard Tree Removal

River Corridor	Acres
Clavey Proposed Wild and Scenic River	143
Tuolumne Wild and Scenic River	20
South Fork Tuolumne Proposed Wild and Scenic River	106

The activities associated with these projects are not expected to affect the existing flow regimes as no construction is proposed or planned in the channel. Project implementation would have short-term effects on the scenic ORVs, but this would be mitigated over time with the regrowth of vegetation. There would also likely be temporary effects on recreational opportunities along roads or trails, or in areas, that are closed to recreational use during project implementation. Effects from these projects to water-based ORVs (fish and water quality) and to wildlife values within the river corridors (also refer to 3.03 Aquatics and 3.15 Wildlife) are mostly positive and the Forest Service is legally responsible to minimize and/or mitigate project effects to these resources through established management requirements. Therefore, overall effects of reasonably foreseeable future actions would be minimal and short-term, and no negative cumulative effects from the proposed actions are expected.

Table 3.12-4 Twomile Ecological Restoration Projects (Clavey Proposed Wild and Scenic River)

Planned Actions	Treatments	Acres
Looney Timber Sale	Dozer pile/Prescribed burn	44.0
	Prescribed burn	29.0
	Thin/biomass/dozer/burn	123.0
Thommy Timber Sale	Handcut/pile/burn	7.0
Trails	Close & Restore	2.5
	New Construction	0.3
	Reconstruction	0.1
	Rock Barrier	0.1
Roads	Close	2.0
	Decommission	0.3
	Maintenance	9.0
	Reconstruction	0.1

South Fork Tuolumne Proposed Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

Tuolumne Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Clavey Proposed Wild and Scenic River

No activities are proposed under this alternative. Alternative 2 would have no effect on the free-flowing condition of any of the Clavey Proposed Wild and Scenic River. Activities that may be beneficial to water quality would not occur. This includes subsoiling of existing skid trails and reconstructing roads to improve drainage and reduce hydrologic connectivity. However, the high water quality needed to maintain the Wild and Scenic values would be maintained under Alternative

2. Naturally occurring events could interrupt free flowing rivers such as landslides or trees falling over into the river. Introduction of woody debris into the river would occur naturally.

Water quality would decrease as road conditions continue to decline and sedimentation gradually increases overtime. Additionally, large woody material recruitment rates would naturally remain high in areas that sustained moderate and high vegetation severity fire conditions. In the first 10 to 20 years large woody material may alter free-flowing conditions, but would eventually provide beneficial functions such as creating pool habitats and trapping sediment.

Activities beneficial to the recovery of ORVs for wildlife, fisheries, and scenery would also not occur. The landscape would recover over time; vegetation such as forbs, grasses, and shrubs would reestablish on the landscape and bring visual and plant diversity back into the scenic corridors.

South Fork Tuolumne Proposed Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

Tuolumne Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

CUMULATIVE EFFECTS

Clavey Proposed Wild and Scenic River

No direct effects would result from the implementation of this alternative. The indirect effects described above focus on hydrologic connectivity and drainage of roads. Increased sediment would be expected from the road system if maintenance and reconstruction actions are not taken.

Tuolumne Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

South Fork Tuolumne Proposed Wild and Scenic River

Same as Clavey Proposed Wild and Scenic River.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Clavey Proposed Wild and Scenic River

Salvage

Direct and indirect effects of salvage harvesting are similar or less than those described under Alternative 1 because Alternative 3 would treat fewer acres within the Wild and Scenic corridor. This alternative would treat 297 acres by means of tractor (54 acres) and helicopter (243 acres) logging methods in the Scenic corridor of the Clavey River. Landings would be constructed for decking logs and piling of slash materials. Whole tree yarding would occur in tractor units to reduce fuel loading. Landings would be restored post-harvest via deep tilling, contouring, and scattering of slash. Drop and lop is proposed in units A04, A05A, A05B, and A05C, for a maximum of 245 acres within the river corridor. Machine piling and burning is proposed in unit A03 for a maximum of 51 acres within the river corridor. Jackpot pile burning is proposed in all five units, as needed based on post-harvest fuel loads, for a maximum of 296 acres within the river corridor.

Roadside Hazard Trees

Roadside hazard tree removal is proposed on 6.2 miles and 287 acres along 1N01, 2N29, 2N29A, 02N40, and 3N56Y in the Scenic segments of the Clavey River. Effects of roadside hazard tree removal are similar to those described under Alternative 1.

Roads

Alternative 3 proposes to reconstruct 1.9 miles of road 2N29 and 2N29A within the river corridor; fewer than that proposed under Alternative 1. Effects of road reconstruction would be similar to those described under Alternative 1.

Alternative 3 proposes 5.4 miles of maintenance on roads 01N01, 02N29, 02N40, and 03N56Y within the river corridor; slightly more than that proposed under Alternative 1. Effects of road maintenance would be similar to those described under Alternative 1.

Research

Five of the PSW study plots designated under Alternative 3 intersect the Scenic segment of the Clavey River. However, as these areas are all control plots, no timber salvage or associated activities would occur. Proposed research activities (installing study design features and instrumentation, collecting data) are limited on a spatial scale and would have no measurable impact on any ORVs.

Indicators

The effects of Alternative 3 on water quality of Wild and Scenic Rivers is anticipated to be similar or less than those described under Alternative 1.

South Fork Tuolumne Proposed Wild and Scenic River

Under Alternative 3, no salvage or research, is proposed within this corridor; therefore, no direct or indirect effects related to those actions would occur.

Roadside Hazard Trees

The effects of roadside hazard tree removal are the same as Alternative 1.

Roads

The effects of road maintenance are the same as Alternative 1.

Indicators

The effects of Alternative 3 on the water quality of Wild and Scenic Rivers is anticipated to be similar or less than those described under Alternative 1.

Tuolumne Wild and Scenic River

Under Alternative 3, no salvage harvesting, roadside hazard tree removal, or research is proposed; therefore, no direct or indirect effects related to those actions would occur.

Roads

Less road maintenance is also proposed. A total of 0.26 miles of road maintenance on road FR99001 is proposed within the Recreation section of the Tuolumne River corridor. Effects of road maintenance would be similar to those described under Alternative 1.

Forest Plan Amendment

Under Alternative 3, a proposed Forest Plan amendment would create a new Forest Carnivore Connectivity Corridor (FCCC). The FCCC overlaps 1,100 acres of the Wild and Scenic sections of the Tuolumne River corridor. This Forest Plan Amendment does not affect the river or its ORVs (Chapter 3.01).

Indicators

The effects of Alternative 3 on the water quality of Wild and Scenic Rivers is anticipated to be similar or less than those described under Alternative 1.

Cumulative Effects

Clavey Proposed Wild and Scenic River

Same as Alternative 1.

South Fork Tuolumne Proposed Wild and Scenic River

Same as Alternative 1.

Tuolumne Wild and Scenic River

Same as Alternative 1.

Alternative 4

Direct and Indirect Effects

Clavey Proposed Wild and Scenic River

Salvage

Alternative 4 proposes to treat about 7 acres of salvage harvest by means of tractor (4 acres) and helicopter (3 acres) logging methods in the Scenic corridor of the Clavey River. Landings would be constructed for decking logs and piling of slash materials. Whole tree yarding would occur in tractor units to reduce fuel loading. Landings would be restored post-harvest via deep tilling, contouring, and scattering of slash. Drop and lop is proposed in units A05C and F15, for a total of 2.7 acres within the river corridor. Jackpot pile burning is proposed in units A05C and F15, as needed based on post-harvest fuel loads, for a maximum of 2.7 acres within the river corridor. The effects of these actions would be similar to those described under Alternative 1.

Roadside Hazard Trees

Roadside hazard tree removal is proposed on 1N01, 2N29, 2N29A, 02N40, and 3N56Y in the Scenic segments, covering 7.4 miles of road and 341 acres. The additional length of road compared to Alternatives 1 and 3 is due to unit acreage for salvage logging dropped in this alternative, thereby requiring hazard tree removal along roads in those units. The effects of roadside hazard tree removal are the same as those described under Alternative 1.

Roads

Under Alternative 4, no new road construction or reconstruction is proposed; however, 7.3 miles of maintenance is proposed on roads 01N01, 02N29, 02N29A, 02N40, and 03N56Y within the river corridor. Effects of road maintenance are the same as those described under Alternative 1.

Research

The effect of the five PSW study plots are the same as described under Alternative 3.

Indicators

The effects of Alternative 4 on the water quality of Wild and Scenic Rivers is anticipated to be similar or less than those described under Alternative 1.

South Fork Tuolumne Proposed Wild and Scenic River

Same as Alternative 3.

Tuolumne Wild and Scenic River

Same as Alternative 3.

Cumulative Effects

Clavey Proposed Wild and Scenic River

Same as Alternative 3.

South Fork Tuolumne Proposed Wild and Scenic River

Same as Alternative 3.

Tuolumne Wild and Scenic River

Same as Alternative 3.

Wilderness: Affected Environment

The Emigrant Wilderness is in Tuolumne County. It is characterized by large expanses of bare, glaciated granite and sub-alpine vegetation types, numerous glacial lakes, high quality scenery and Wilderness recreation opportunities. It is bordered on the east by Toiyabe National Forest and Yosemite National Park. The Emigrant Wilderness became part of the National Wilderness Preservation System in 1975. The California Wilderness Act of 1984 added 5,855 acres to the original area. Most of the recreation use in the Emigrant Wilderness Area is for hiking, camping, backpacking, and horse-back riding; pack-stock are also commonly used. Fishing is popular at most lakes, but hunting use is light.

Commercial livestock grazing occurs in some areas. Tungsten mining in the Snow Lake area has occurred in the past. Portions of several streams which are eligible for Wild and Scenic River designation and include Kennedy Creek (proposed Wild and Scenic River), Relief Creek South Fork Stanislaus River, Buck Meadow Creek, Summit Creek, and the Cherry Creek system.

A majority of Wilderness recreation use occurs from early July through early September. Kibbie Ridge Trail can be an exception because of exposure to summer sun and heat. Recreation use does occur outside of the peak times, but visitation is considerably lower due to weather, access, school schedules, and deer hunting season. Because of the popularity of equestrian activities the Aspen Meadow and Kennedy Pack Stations operate under Outfitter and Guide Special Use Permits to provide horseback riding and pack and saddle service to Wilderness visitors.

The Emigrant Wilderness is contiguous with Yosemite Wilderness to its south. Most recreation within the geologic extent originates from the Kibbie Ridge and Lake Eleanor Trail Heads. Popular destinations from these trail heads include Eleanor and Kibbie Lakes in Yosemite National Park (Wilderness).

Cherry Lake, Cherry Lake Road, Kibbie Ridge and Lake Eleanor Trailheads are in an area of high timber removal activity. Treatments could include helicopter, tractor and roadside hazard tree removal activities.

Wilderness: Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 1, treatments proposed within a half mile of Wilderness include 18 tractor units (992 acres), three helicopter units (281 acres), two skyline units (25 acres), and roadside hazard tree removal.

Road treatments proposed within one half mile of Wilderness include 5.19 miles of maintenance, 10.80 miles of reconstruction, 0.24 miles of skid zones outside treatment units, and 0.86 miles of temporary road.

In the geographic extent, visuals (project activity), noise and dust produced during ground based and helicopter operations may negatively disrupt the solitude qualities of Wilderness character. The amount of work proposed within a half mile of Wilderness is expected to be completed within a matter of weeks to months; therefore, negative effects to Wilderness solitude would be limited in duration. Additionally, trailheads would be closed during operational periods, which would greatly reduce potential effects to Wilderness experience. Effects of trailhead closures are discussed in detail in the Chapter 3.08 (Recreation).

CUMULATIVE EFFECTS

The outstanding opportunities for solitude qualities in Wilderness character would likely continue to be degraded for the short-term (the length of time planned treatment activities occur) adjacent to the Wilderness. There are no other reasonably foreseeable projects within the geographic extent of the Wilderness that would affect Wilderness character.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

This alternative would not impact the outstanding opportunities for solitude qualities of Wilderness character; there would be no change to Wilderness character.

CUMULATIVE EFFECTS

There are no direct or indirect effects, so there are no cumulative effects.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

Special Interest Areas

Jawbone Falls Heritage Area: under Alternatives 1, 3 and 4, the direct and indirect effects are minimal and are not expected to cumulatively lead to increased impacts to the cultural values of the Jawbone Falls SIA. Indirect effects under Alternative 2 include potential for ground disturbance and damage to site features and cultural values.

Pacific Madrone Botanic Area: under Alternatives 1, 3 and 4, no direct, indirect or cumulative effects are expected in the Pacific Madrone SIA. Indirect effects under Alternative 2 include damage from falling trees.

Wild and Scenic Rivers

Under Alternatives 1, 3 and 4, proposed activities would have negative short-term effects on the scenic quality of the river corridors; however, these effects would be minimal in comparison to the already degraded scenic quality due to the Rim Fire itself. While some sedimentation could occur, it is anticipated to be minimal and of short duration and is not expected to affect the long-term beneficial uses and purposes for which these rivers were designated or made eligible. Over time as vegetation regrows, effects to the scenic beauty, vegetative diversity, and wildlife habitat are all expected to decrease until they are no longer evident.

Under Alternative 2, the high water quality needed to maintain wild and scenic values would be maintained.

Wilderness

Alternatives 1, 3 and 4 would temporarily degrade the solitude qualities of Wilderness character, while Alternative 2 would not affect solitude qualities of Wilderness character.

3.13 TRANSPORTATION

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Multiple statutes, regulations and executive orders identify the general requirement for transportation evaluation in support of Forest Service planning and decision making. These include, but are not limited to the following.

- **National Forest Roads and Trails Act of October 13, 1964, as amended (16 U.S.C. 532-538)** authorizes road and trail systems for the National Forests including granting of easements across NFS lands, construction and financing of maximum economy roads (FSM 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.
- **Highway Safety Act of 1966 (23 U.S.C. 402)** authorizes state and local governments and participating federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety.
- **National Trails System Act of October 2, 1968 (16 U.S.C. 1241-1249)** establishes the National Trails System and authorizes planning, right-of-way acquisition, and construction of trails established by Congress or the Secretary of Agriculture.
- **Surface Transportation Assistance Act of 1978, as amended (23 U.S.C. 101a, 201-205)** supersedes the Forest Highway Act of 1958. This law authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads and forest development trails (referred to as “NFS roads” and “NFS trails” in Forest Service regulations and directives); and limits the size of projects performed by Forest Service employees on forest roads. It also establishes the Federal Lands Highway Program.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

Assumptions Specific to Transportation

- The Forest transportation system is the primary data used to summarize this effects analysis. All distance figures are approximate values based on the Forest transportation atlas (including spatial GIS data and tabular INFRA data) and are limited to the accuracy of those sources which includes measurements from GIS, GPS, field instruments and aerial photography. Mileages have been updated throughout the planning process as better information has been made available and may change slightly with additional field verification and project implementation.
- All road work and infrastructure improvements will be conducted in accordance with the project management requirements.
- The spatial boundary and subject for analysis includes the existing rock material sources and water sources and the network of roads and trails within the project area.
- Effects are assessed based on a 15-year time frame, assuming all project actions associated with the transportation network will be completed by that time.

Data Sources

Forest transportation atlas: Roads and motorized trail information as contained in geographic information system (GIS) spatial data and Forest Service Infrastructure (INFRA) tabular data.

Transportation Indicators

Indicators used in the analysis of transportation effects include summaries of road work and associated impacts to the Forest transportation system. Key indicators include:

- Forest transportation system conditions
- Traffic
- Health and safety
- Qualitative effects summary based on a scale from beneficial to adverse

Transportation Methodology by Action

Actions, or the lack of action, effect roads and motorized trails in the project area. Each alternative presents a summary of effects considering the following activities.

- **Commercial Salvage**: Activities required to reduce fuel loads and improve road user safety through timber salvage and biomass removal and to process it into lumber, electrical energy, and other forest products with commercial value.
- **Wildlife/Fuels Biomass Removal**: Activities directed by the Forest Service to gather and remove additional biomass for the benefit of wildlife and further fuel reduction.
- **Post-Contract Forest Service Activities**: Additional treatment of units after the commercial salvage operations are complete that use tractors to pile and burn excess fuels, drop and lop activities, and mastication of biomass in watershed areas.
- **Restoration of Access for Recreation**: Reopening the burn area for public access and recreational activities.

Affected Environment

Existing Conditions

The project area contains 957 miles of existing roads and motorized trails managed by a variety of agencies, landowners and organizations. Table 3.13-1 displays the existing network by jurisdiction.

Table 3.13-1 Existing Transportation System by Jurisdiction

Jurisdiction	miles
Bureau of Land Management	0.6
County	21.8
National Park Service	0.3
Other	7.6
Private	146.8
State	13.1
Stanislaus National Forest	
National Forest System Roads	707.1
National Forest System Trails	18.2
Other Non-system Routes	41.5
Subtotal National Forest	**766.8**
Total	**957.0**

Source: Forest Transportation Atlas

FOREST TRANSPORTATION SYSTEM

The Forest transportation system included in this analysis is comprised of NFS roads and motorized NFS trails. The NFS trails are managed for full-size motor vehicle use and are often referred to as 4-wheel-drive trails. NFS roads are broken down by operational maintenance level, which describes the standard to which the road is currently managed. Table 3.13-2 displays the National Forest System roads under Stanislaus National Forest jurisdiction by Maintenance Level and Appendix E contains a list of each individual road within the project area.

Table 3.13-2 National Forest System Roads by Maintenance Level

ML	Summary Description	miles
5	High degree of user comfort and convenience	54.7
4	Moderate degree of user comfort and convenience at moderate travel speeds	19.8
3	Maintained for travel by prudent driver in standard passenger car	59.0
2	High clearance vehicle use	535.2
1	Intermittent use road while placed in storage	38.3
	Total	**707.1**

Source: Forest Transportation Atlas; ML=Maintenance Level

NON-SYSTEM ROADS

Table 3.13-1 shows a number of routes in the project area are managed and under jurisdictions other than the Forest Service. Other non-system roads under Forest Service jurisdiction exist on the landscape, and are not managed as part of the Forest transportation system. These include unauthorized routes and roads associated with some sort of authorized use, such as an agreement, permit, or right-of-way.

CONDITION

The conditions of the project area routes vary from well-maintained, including those treated under BAER (Burned Area Emergency Response), to badly eroding and overgrown. Due to the limitations of the NFS road maintenance program, few of the NFS roads and trails, and none of the unauthorized roads, receive frequent or regular maintenance. Figure 3.13-1 shows roads within the fire boundary are now lined with dead and dying trees, considered danger[8] trees or roadside hazards.

After containment of the Rim Fire, a BAER effort was conducted in order to protect assets from risks associated with the potential for high surface flows, flooding, and erosion during rainfall events. Assets included NFS roads and trails, as well as features on those routes including stream crossings. A number of roads were maintained during this effort, including dozens of stream crossings improvements or replacements as well as maintenance, improvement, and installation of hundreds of road surface drainage structures.

Numerous road segments accessing proposed project treatment units need improvement for logging trucks, chip vans, and other project vehicles and equipment. In the absence of regular maintenance, the surface conditions have deteriorated and the traveled ways have become partly or completely overgrown or blocked by fallen trees or washouts.

Many of the road and motorized trail segments are designated as open to public motorized traffic, for access to particular destinations, or for motorized recreation. The Forest Motor Vehicle Use Map and the Stanislaus National Forest Infra database display those designations. Currently the project area is closed to the public by temporary Forest Order, to provide for public safety and protect natural resources.

[8] While the Forest Service engineering policy uses the term “danger tree” (see glossary for definition), the synonymous term “hazard tree” is also commonly used and will be used throughout the Rim Fire Recovery EIS.

Figure 3.13-1 Dead Trees and Roadside Hazards along NFS Road 1N79

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

To support the proposed actions, existing routes will be utilized for access and removal when possible (Chapter 2.01 and Table 2.05-1). During implementation, traffic will increase due to movement of equipment, forest products, and personnel in and out of the project area. Traffic management in accordance with standard contract provisions will mitigate risks to workers and provide for public safety. Communications, including use of radios, will provide for safer and more efficient traffic flow. Temporary route closures to public traffic are expected to provide for worker and public safety during project implementation, resulting in a short-term reduction in public access. Felling and removal of roadside hazard trees will also provide for safer and more efficient Forest transportation system use during implementation of the project.

Following implementation, the combination of road maintenance, Forest transportation system improvements, and removal of roadside hazards will provide for long-term public and administrative access throughout the project area. In addition, the roadwork applied during implementation will leave the system in a more stable and functional condition, minimizing adverse resource impacts. No long-term changes to public motor vehicle use are proposed under this alternative; previously designated routes documented on the motor vehicle use map (MVUM) will remain open following project implementation.

In summary, Alternative 1 has positive direct and indirect effects on the Forest transportation system. Benefits include catching up on deferred maintenance, improving the roads to minimize adverse resource impacts, and sustaining safe public and administrative access throughout the Rim Fire area.

CUMULATIVE EFFECTS

The Rim HT project will remove hazard trees from main roads within the fire perimeter. The short-term combination of traffic from the removal of forest products from these projects will be substantial, and will require adequate traffic control, temporary public road closures, and proper communications to maintain safe and efficient traffic flow. A short-term reduction in public access will occur in order to minimize user conflicts during project implementation. Main collector and arterial forest roads will receive the majority of traffic and will have surface deterioration proportionate to the traffic volume. Maintenance activities will be necessary in order to maintain the function of these roads; otherwise the standard will be reduced.

About 100 miles of additional routes within the project area are expected to be treated under various restoration projects, including road and trail maintenance, reconstruction, and decommissioning of routes contributing to resource problems. Following implementation of these projects, a well maintained road system will exist and provide long-term public and administrative access throughout the project area.

Considering cumulative effects associated with Alternative 1, the overall long-term Forest transportation system within the project area will benefit, resulting in a safer, more efficient, and more utilized network. Long-term public and administrative access will be sustained throughout the project area.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, indirect effects include dead and weakened trees falling across roads and trails, blocking access and reducing road user safety. This will reduce access and eventually limit the long-term ability to manage and maintain the Forest transportation system within the project area. It will also result in a more dangerous, inaccessible, underutilized, and undermanaged network leading to adverse resource impacts including improperly functioning road drainage systems. Without the opportunity to utilize revenue from sales of salvaged timber, the Forest transportation system within the project area will not receive maintenance and improvement treatments, and will not likely ever return to the condition for which it was designed and managed prior to the Rim Fire.

CUMULATIVE EFFECTS

The Rim HT project will remove hazard trees from main roads within the fire perimeter. The amount of traffic from the removal of forest products from that project will be substantial. A short-term reduction in public access will occur in order to minimize user conflicts during project implementation. Surface deterioration proportionate to the traffic volume will occur on those main roads. Maintenance activities will be necessary in order to maintain the function of those roads; otherwise the standard will be reduced.

About 100 miles of additional routes within the project area are expected to be treated under various restoration projects, including road and trail maintenance, reconstruction, and decommissioning of routes contributing to resource problems. If no action is taken on the lower standard system roads as proposed under the action alternatives access to these areas will not exist for a substantial period of time and those roads outside of the 100 miles mentioned above will become inaccessible due to falling dead trees and road surface deterioration.

Alternative 3

Direct and Indirect Effects

Same as Alternative 1.

Cumulative Effects

Same as Alternative 1.

Alternative 4

Direct and Indirect Effects

Same as Alternative 1.

Cumulative Effects

Same as Alternative 1.

Summary of Effects Analysis across All Alternatives

Alternative 1 provides the most beneficial transportation effects (direct, indirect and cumulative) followed with less beneficial effects by Alternative 3 and then Alternative 4. Alternative 2 is the only alternative with adverse transportation effects (indirect and cumulative).

3.14 WATERSHED

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Protection of water quantity and quality is an important part of the mission of the Forest Service (USDA 2007). 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 following direction is relevant to the action alternatives as they affect water resources.

The Clean Water Act of 1948 (as amended in 1972 and 1987) establishes as federal policy for the control of point and non-point pollution, and assigns the states the primary responsibility for control of water pollution. Compliance with the Clean Water Act by national forests in California is achieved under state law (below).

Non-point source pollution on National Forests is managed through the Regional Water Quality Management Handbook (USDA 2011), which relies on implementation of 35 prescribed regional best BMPs, as well as 23 national BMPs (USDA 2012) relevant to this project. The Watershed Report Appendix B (project record) lists these BMPs and their associated management requirements.

The California Water Code consists of a comprehensive body of law that incorporates all state laws related to water, including water rights, water developments, and water quality. The laws related to water quality (sections 13000 to 13485) apply to waters on the national forests and are directed at protecting the beneficial uses of water. Of particular relevance for the Proposed Action is section 13369, which deals with non-point-source pollution and best management practices.

The Porter-Cologne Water-Quality Act, as amended in 2006, is included in the California Water Code. This act provides for the protection of water quality by the state Water Resources Control Board and the regional water quality control boards, which are authorized by the U.S. Environmental Protection Agency to enforce the Clean Water Act in California.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Effects Analysis Methodology

The four project alternatives were reviewed in fifteen of the eighteen HUC 6 and five HUC7 watersheds to determine effects on water resources. Beneficial uses of water and water quality objectives in the California Water Quality Control Plan (Basin Plan) of the Central Valley Regional Water Quality Control Board (CVRWQCB 2011) were utilized as a regulatory benchmark regarding the existing condition and to assess the effects of the proposed action and its alternatives on water quality. The water quality parameters considered in the watershed analysis were water temperature, sediment related parameters, and pesticides (registered borate compound). These are the pollutants with the potential of being affected by project management activities.

Assumptions Specific to Watershed

- Watershed condition from the Rim Fire will recover, as will effects of the Rim Fire Recovery Project.
- Water quality effects will occur at a magnitude below adversely affecting beneficial uses of water unless uncontrollable events occur. These include an abnormally high amount and/or intensity of precipitation or the occurrence of another fire in the project area as the watersheds recover from the effects of the Rim Fire.
- Water Quality Best Management Practices will be implemented and effective unless uncontrollable factors occur. These include an abnormally high amount and/or intensity of

precipitation or the occurrence of another fire in the project area as the watersheds recover from the effects of the Rim Fire.

- The Soils Report (project record) provides assumptions associated with Disturbed WEPP modeling.
- The Watershed Report Appendix A (project record) provides assumptions associated with Equivalent Roaded Area (ERA) modeling for cumulative watershed effects.

Data Sources

- Satellite Imagery – Worldview, Landsat, and LiDAR
- Forest Land Management Databases and planning documents – Forest Service Activity Tracking System (FACTS) and the Schedule of Proposed Actions (SOPA)
- Stanislaus StreamScape Inventory – Stream Survey Data from 2005-2012
- Benthic Macroinvertebrate Inventory, Clavey River 2007
- Burned Area Emergency Response Program – Past Fire information; Rim Fire watershed data
- Geographic Information Systems (GIS)
- CalFire – Timber Harvest Plans (THPs), Non-Industrial Timber Management Plans (NTMPs), and Notices of Emergency Timber Operations (Frese 2013-2014)
- Yosemite National Park – GIS shapefile with past and future activities within Park boundaries

Watershed Indicators

- Water Quality Parameters – temperature, sediment, pesticides (measure – meet WQ objectives)
- Stream Condition – channel form, streambank stability, pool sediment (measure – SSI protocol)
- Riparian Vegetation – recovery (measures – no damage from project activities; recruitment unimpeded)
- Ground Cover – riparian areas (measures - retention of existing; addition in riparian areas and watershed sensitive areas (WSA) (acres))
- Cumulative watershed effects (measure – ERA)

Watershed Methodology by Action

The direct, indirect and cumulative effects of the four project alternatives were evaluated using the following methods:

DIRECT AND INDIRECT EFFECTS

- Literature Review – A thorough review of the literature was conducted related to the direct and indirect effects of actions that affect the watershed resource proposed in this project.
- Modeling – Disturbed WEPP was utilized to predict project related erosion.
- Monitoring – A review of Water Quality Best Management Practices Evaluation Program (BMPEP) results on the Stanislaus National Forest for activities related to the project was conducted. BMPEP monitoring results over the past decade were useful for predicting outcomes of the management activities proposed in this project.
- Field Evaluation – Field review of proposed treatment units and watershed conditions within the project area was conducted.
- GIS – GIS was used for analyzing data collected from fieldwork, satellite imagery products and forest databases related to the project.

CUMULATIVE WATERSHED EFFECTS

A Cumulative Watershed Effects analysis was conducted using the CWE model adopted by the Pacific Southwest Region of the USDA Forest Service as a method of addressing cumulative watershed effects (USDA 1990). The model is referred to as Equivalent Roaded Area (ERA). ERA values are calculated using a computer model developed on the Stanislaus National Forest (Rutten and Grant 2008). The Watershed Report Appendix A (project record) provides further details.

Affected Environment

Watershed Setting

The Rim Fire burned through numerous watersheds in the central and southern portions of the Stanislaus National Forest, and some overlap eastward into Yosemite National Park where the remainder of the fire occurred. These watersheds are an important component of the water supply, fish and wildlife habitat, recreation, timber production and other values of the Sierra Nevada mountain range. Portions of the watersheds within the Rim Fire perimeter burned in several fires during the 20th century, while some areas have not burned in over 100 years. About 98 percent of the Rim Fire burned within the Tuolumne River watershed. The remaining 2 percent burned in the North Fork Merced River watershed along the southern edge of the fire.

Watersheds in the Rim Fire are delineated in accordance with the national watershed classification system (USGS 2013). This system is a spatial hierarchy of eight nesting watershed size classes ranging from very large (greater than 250,000 acres) to very small (less than 2,000 acres). This classification system uses the term Hydrologic Unit Code (HUC) to describe all watershed size classes (Table 3.14-1). They are called HUC levels and are numbered in order from one to eight in descending size class. Each HUC level code is a two digit number that ties to a watershed size and name. For example, HUC Level 1 is a two digit code whereas as HUC Level 5 is a 10 digit code. Table 3.14-1 shows an example of how this nesting system applies to the Rim Fire watersheds.

Table 3.14-1 Hydrologic Unit Code System (HUC)

HUC Level	HUC Name	HUC Size (average acres)	Rim Fire Examples
1	Region	100,000,000	NA
2	Sub-region	10,000,000	NA
3	Basin	7,000,000	San Joaquin River
4	Sub-basin	450,000	Tuolumne River
5	Watershed	40,000-250,000	Clavey River
6	Sub-watershed	10,000-40-000	Reed Creek
7	Drainage	2,000-10,000	Reynolds Creek
8	Sub-drainage	Less than 2,000	Lost Creek

The Stanislaus National Forest includes HUC Level 4 through 8 watersheds. (The term watershed is often used generically even though each HUC level has a unique name). The HUC Level 4 watersheds on the forest are the headwaters of large rivers that continue downstream off the forest (e.g., Tuolumne River).

Nine HUC 5 Level watersheds are within the Rim Fire; within those, are 18 HUC Level 6 watersheds. Table 3.14-2 displays the HUC Level 5 and HUC Level 6 watersheds relevant to the fire area, including total HUC Level 5 and HUC Level 6 watershed acreage. Note that the HUC Level 6 watershed acreage does not add up to that of seven of the nine HUC Level 5 watersheds. This is because in those watersheds additional HUC Level 6 watersheds are fully outside the fire perimeter. Watershed acreage within the Stanislaus National Forest boundary is less in some watersheds and will be described in the existing condition and environmental consequences sections of this report. The HUC Level 5 watersheds in Table 3.14-2 are listed clockwise around the fire area beginning where the main channel of the Tuolumne River exits the Rim Fire perimeter.

Given the large size of the fire, the HUC Level 6 watersheds are the most appropriate scale for watershed description and analysis of the effects of the Rim Fire Recovery Project. HUC Level 5 watersheds will be described for spatial context and broad scale analysis, and selected HUC Level 7 watersheds will be discussed where more detailed analysis is indicated. Figure 3.14-1 displays the HUC Level 6 watersheds relevant to the Rim Fire.

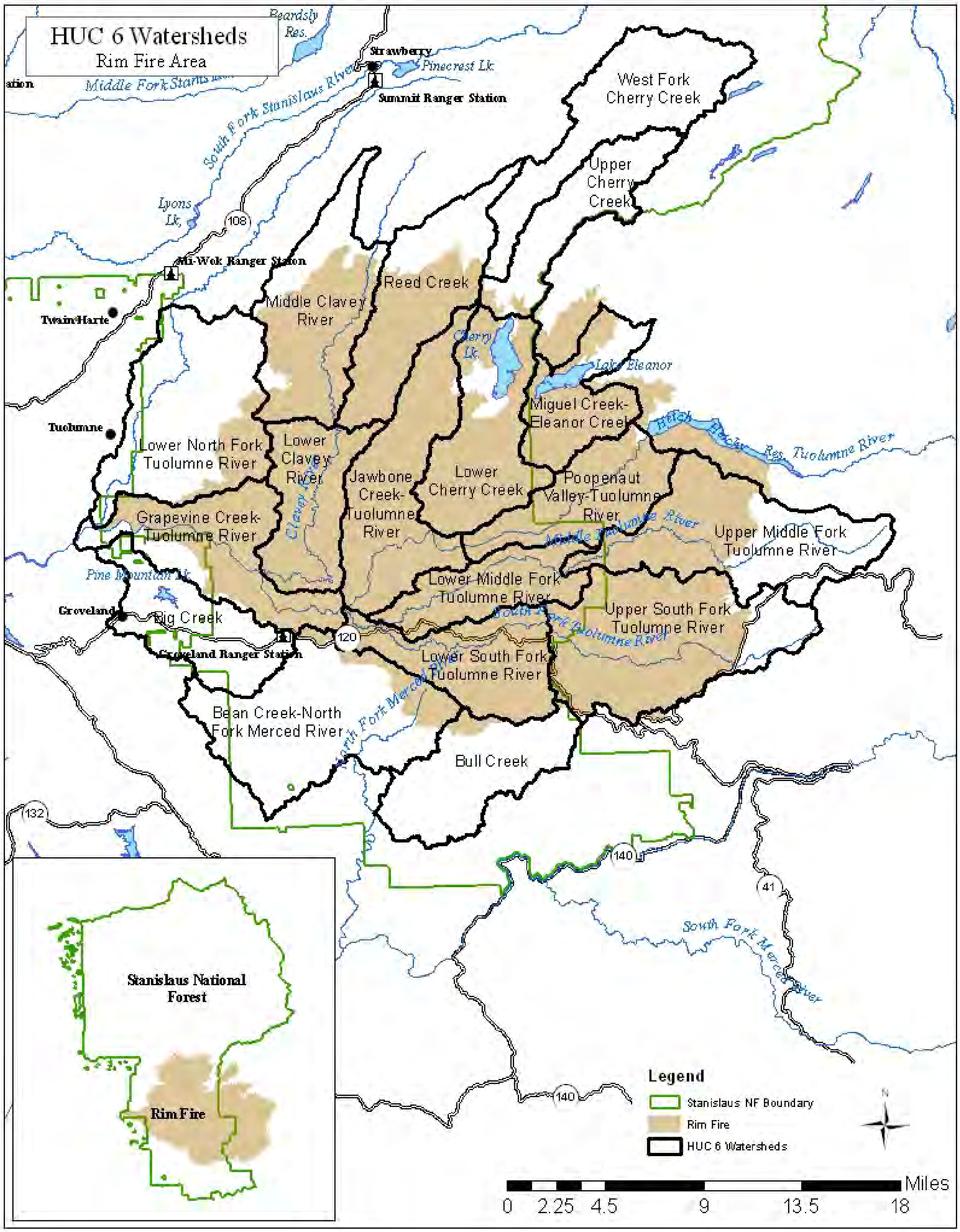

Figure 3.14-1 HUC Level 6 Watersheds in the Rim Fire Area

Table 3.14-2 Principal Watersheds in the Rim Fire Area

HUC Level 5 (40,000-250,000 acres)		HUC Level 6 (10,000-40,000 acres)	
Name	acres	Name	acres
Big Creek-Tuolumne River	81,721	Big Creek	18,734
		Grapevine Cr-Tuolumne River	23,817
		Jawbone Cr-Tuolumne River	27,629
North Fork Tuolumne River	63,849	Lower North Fork Tuolumne River	34,210
Clavey River	100,645	Lower Clavey River	17,871
		Middle Clavey River	26,912
		Reed Creek	24,527
Cherry Creek	90,892	Lower Cherry Creek	24,383
		Upper Cherry Creek	16,344
		West Fork Cherry Creek	26,149
Eleanor Creek	59,906	Miguel-Eleanor Creek	15,798
Falls Creek-Tuolumne River	124,244	Poopenaut Valley-Tuolumne River	18,232
Middle Fork Tuolumne River	46,635	Lower Middle Fork Tuolumne River	14,928
		Upper Middle Fork Tuolumne River	31,707
South Fork Tuolumne River	57,855	Lower South Fork Tuolumne River	19,988
		Upper South Fork Tuolumne River	37,866
North Fork Merced River	79,110	Bull Creek	21,064
		Bean Creek-North Fork Merced River	36,739

Existing Conditions

Several factors that affect watershed condition have occurred in the Rim Fire Recovery project area. These include natural events and management activities that create ground disturbance and alter natural hydrologic processes.

WILDFIRE EFFECTS

The Rim Fire, like almost all wildfires, is a mosaic of high, moderate and low soil burn severity plus unburned areas within the perimeter. Many past fires occurring within the Rim Fire perimeter have nearly half or more of their total acreage in the low and unburned categories that resulted in minimal to negligible watershed impact. Most watershed damage occurs from high soil burn severity, and lesser from moderate soil burn severity.

The principal effects of soil burn severity are the reduction of ground cover and infiltration capacity. High soil burn severity has the most watershed effect since it usually results in very low remaining ground cover, ranging from 0-20 percent, and the most increase in water repellency. These factors make it insufficient to adequately prevent accelerated soil erosion and, where eroded soil can reach waterways, cause stream sedimentation. Moderate soil burn severity is usually less damaging since the soil is not as impacted and the singed conifer needles fall to the forest floor partially replacing lost ground cover. Low soil burn severity is usually an insignificant factor since most pre-fire cover remains and infiltration is mostly retained.

High soil burn severity usually chars the soil crust, damaging soil structure, killing plant roots, removing all, or mostly all, ground cover (litter and duff) and often results in strongly water repellent soil. Moderate soil burn severity does less damage since its soil structure effect and degree of water repellency is usually lower. Low soil burn severity has minimal soil impact, usually scorching ground and portions of tree trunks and bases of tree crowns; few trees are killed. The combination of high and moderate soil burn severity usually represents what is known as a stand replacing fire since nearly all trees are killed. Often in forested areas, post-fire vegetation condition acts as a visual indicator of soil burn severity. High soil burn severity is indicated by fully killed trees with all needles and often many branches consumed. Moderate soil burn severity is viewed as killed trees with browned needles remaining (most fall before winter, providing natural ground cover). Low soil burn severity usually results in patchy ground fire with lower portions of trunks blackened and some lower crowns singed. Soil burn severity classes are shown in Figures 1.0-2, 1.0-3 and 1.0-4. These photos were taken shortly after the Rim Fire. Note the needlecast in the moderate soil burn severity photo, with more to come from needles still in the trees.

Soil burn severity is a measure of the effect of ground heat as a fire burns across a landscape, and is not the same as fire intensity or vegetation burn severity. Fire intensity is a measure of heat produced by a fire (BTUs). Vegetation burn severity measures both vegetation canopy mortality and vegetation basal area mortality resulting from wildfire. For the remainder of this report reference to burn severity will mean soil burn severity unless otherwise noted.

While the Rim Fire area is the largest of the fires within the forest to date, it does not have the highest soil burn severity. Its high soil burn severity is the second lowest of the principal fires within its perimeter since 1973. Though its high soil burn severity is much less than its next largest predecessor, the Stanislaus Complex Fire of 1987, the Rim Fire has resulted in about 10,000 acres of very low ground cover distributed in various sized large to small patches across the 154,530 acres of NFS land it burned. Table 3.14-3 displays soil burn severity for the six largest fires within the Rim Fire perimeter that have soil burn severity information.

Table 3.14-3 Soil Burn Severity for Selected Fires in Relation to the Rim Fire

Fire Name	Fire Year	NFS (acres)	Soil Burn Severity (%)		
			High	Mod	Low[3]
Rim	2013	176,800	7	37	56
Stanislaus Complex	1987	147,100	36	20	44
Rogge[1]	1996	19,400	0	41	59
Granite	1973	17,100	55	30	15
Ackerson[2]	1996	11,300	19	14	67
Pilot	1999	4,000	46	25	29

1 No high soil burn severity due to low fuel loading over much of the area because of new plantations after the Stanislaus Complex fire.
2 This fire was much larger overall, with most acreage in Yosemite National Park.
3 Low and Unburned

Distribution of soil burn severity within a fire area is also important. A spatial mosaic of all severities can reduce on and off site soil and water effects while concentrations of high soil burn severity can cumulatively increase effects. The largest concentrations of high soil burn severity in the Rim Fire occur in Granite Creek, within the 1973 Granite Fire, and in the Corral Creek and Reed Creek areas, both previously unburned. Other lesser high soil burn severity concentrations are scattered throughout the fire area, surrounded by moderate and/or low soil burn severity areas as well as unburned areas.

These concentration areas, and other smaller severely burned sites in the fire, were identified by the Rim Fire BAER team as a watershed value at risk for loss of soil productivity and stream sedimentation. As a result, action to minimize the risk was taken in November, 2013. Helicopters applied weed free rice straw mulch to 4,300 acres of the highest priority portions of these locations (i.e., steep slopes, high erosion risk, and stream proximity). Helicopter mulching produces a uniform layer of straw, about 1 to 1 ½ inches deep that provides 80-100 percent ground cover. An additional BAER action, mastication, was conducted on 40 acres of high soil burn severity area to increase ground cover. Mastication is mechanical chipping of small trees. Low-ground-pressure tracked equipment with an articulated arm and a chipping head provides immediate cover to bare areas.

Another burn concentration area in the Rim Fire is in the Tuolumne River canyon. It began near the Clavey River confluence and continued upstream to Cherry Creek, then up Cherry Creek to Eleanor Creek in Yosemite National Park. Much of the canyon vegetation is dominated by chaparral and other flashy fuels which burned hot and fast up canyon, where the fire then spread northward and led to the conifer dominated high soil burn severity concentrations mentioned above. The canyon soil burn severity is classed as moderate, even though vegetation was well consumed, since the fire here had little residence time and thus, minimally degraded soil properties or increased watershed runoff response. This concentration area is a near repeat of that of the Stanislaus Complex Fire in 1987. The Tuolumne River canyon burns easily, and the 26-year-old vegetation was mature and ready to burn again.

Overall in the Rim Fire, effective watershed cover exists on about 56 percent of the land within the fire perimeter (the total of the low soil burn severity and the unburned portion within the fire perimeter). This cover consists of living vegetation which primarily includes conifer trees with forest floor litter and duff, plus brush and smaller woody shrubs. This ground cover was supplemented in much of the moderately burned conifer areas due to needlecast. While this is not as effective as living cover it does provide a measure of effectiveness compared to high burn severity areas since it resists initiation of rainsplash erosion. Helicopter mulching and mastication mitigated some of the worst high soil burn severity areas, but other locations of high soil burn severity areas remain with inadequate cover.

In addition to the effects of soil burn severity on watershed condition, increased runoff can be another watershed response to fire. Reduced ground cover and impaired rainfall infiltration rates due to water repellent soil caused by fire heat can cause a short term increase in streamflow and raise the probability of flooding during large or intense storms. However, the risk of such occurrences affecting life or property values in the Rim Fire area is low. The Rim Fire is closed to public use throughout the first winter after the fire, and road damage is likely to be minimal based on winter 2013-2014 having below average precipitation without large damaging storms.

In summary, the Rim Fire was a classic mixed severity fire, not only across the entire fire, but at all watershed scales. Patch size of each soil burn severity class in this mosaic was also mixed – some patches hundreds to several hundreds of acres, others tens to hundreds, and yet others where all three classes occurred within ten acres. Mixed severity was also distributed similarly from stream to ridge within most watersheds. Riparian areas burned in a mosaic as did the hillslopes above them. The largest high soil burn severity patches occurred in the uplands, mostly on south-facing slopes where the fire could easily pre-heat fuels.

At the Rim Fire watershed scale, the amount of soil burn severity varies widely among and within all HUC level watersheds. In general it is least for the HUC 5 watersheds, more for the HUC 6 watersheds and greatest for the HUC 7 watersheds. Many HUC 5 watersheds, being the largest, have substantial portions outside the Rim Fire perimeter. The HUC 6 watersheds, though generally having more acreage within the fire, also have a highly variable amount of soil burn severity based on fire location and watershed acreage within the fire perimeter. The HUC 7 watersheds have the highest burn severity, having been selected on the basis of being watershed analysis emphasis areas due to severe burn and/or concentrated post-fire management activities.

Table 3.14-4 provides an overview of the three watershed scales and the portion each occupies within the Rim Fire and the Stanislaus National Forest. It also shows the soil burn severity of each watershed as an indicator of existing condition relative to ground cover and vegetation alteration by the fire. Rim Fire information is provided at the top of the table for comparison with the HUC Level 5, 6, and 7 watersheds. Refer to Figure 3.14-1 for the locations of the HUC 6 watersheds as well as to gain an understanding of the locations of their HUC 5 and 7 counterparts.

Table 3.14-4 shows the similarities and variations among watersheds. Watershed area within the fire perimeter ranges 1-100 percent among the HUC 5 and 6 watersheds, and all the HUC 7 watersheds are 100 percent within the perimeter. The percentage of watershed area within the Stanislaus National Forest is high for all watersheds except for portions of the four HUC 5 watersheds that extend east of the forest into Yosemite National Park.

The amount of soil burn severity across the fire also exhibits similarities and variations by watershed. Moderate soil burn severity is greater than high severity in every watershed, ranging from two to ten times as much. High soil burn severity is similar in almost all HUC 5 and HUC 6 watersheds; all nine HUC 5s are less than 10 percent as are 16 of the 18 HUC 6s. HUC 7 watersheds are dissimilar to their larger counterparts in that they almost all have greater high and moderate soil burn severity.

Table 3.14-4 also shows that 25 of the 32 watersheds have more than 50 percent acreage in the low soil burn severity/unburned class. Half of those watersheds have greater than 75 percent in this same class. The remaining seven watersheds include all five HUC 7s and two of the more heavily burned HUC 6s: Lower Cherry Creek and the Lower Middle Fork of the Tuolumne River. The fire-wide average of 56 percent in the low/unburned class is made up of a high percentage of predominantly low/unburned watersheds punctuated by several highly burned ones.

Table 3.14-4 Rim Fire Watershed Condition Overview

HUC Level and Name	HUC within Rim Fire (%)	HUC within NF (%)	Soil Burn Severity (%)		
			High	Mod	Low[3]
Rim Fire Summary[1]	-	69	7	37	56
5 – Big Creek-Tuolumne River	56	70	5	27	68
6 – Big Creek	<1	52	0	<1	>99
6 – Grapevine Creek-Tuolumne River	77	82	1	26	73
6 – Jawbone Creek-Tuolumne River	99	100	14	56	30
7 – Corral Creek	100	100	31	58	11
7 – Lower Jawbone Creek	100	100	10	75	15
5 – North Fork Tuolumne River	9	92	0	3	97
6 – Lower North Fork Tuolumne River	17	89	1	6	93
5 – Clavey River	52	100	3	15	82
6 – Lower Clavey River	100	100	4	45	51
7 – Bear Springs Creek-Lower Clavey River	100	100	7	43	50
6 – Middle Clavey River	69	100	2	11	87
6 – Reed Creek	66	100	7	16	77
7 –Lower Reed Creek	100	100	21	41	38
5 – Cherry Creek	24	93	3	12	85
6 – Lower Cherry Creek	84	98	10	43	47
7 – Granite Creek	100	100	30	62	8
6 – Upper Cherry Creek	7	100	0	1	99
6 – West Fork Cherry Creek	1	100	0	<1	>99
5 – Eleanor Creek[2]	28	2	1	9	90
6 – Miguel Creek-Eleanor Creek	76	6	4	31	65
5 – Falls Creek-Tuolumne River[2]	19	4	1	5	94
6 – Poopenaut Valley-Tuolumne River	99	30	6	33	61
5 – Middle Fork Tuolumne River[2]	68	34	7	32	61
6 – Lower Middle Fork Tuolumne River	100	100	6	57	37
6 – Upper Middle Fork Tuolumne River	53	3	8	21	71
5 – South Fork Tuolumne River[2]	88	41	4	29	67
6 – Lower South Fork Tuolumne River	100	100	4	43	53
6 – Upper South Fork Tuolumne River	83	9	3	22	75
5 – North Fork Merced River	8	81	0	3	97
6 – Bull Creek	6	100	0	2	98
6 – Bean Creek-North Fork Merced River	14	92	0	4	96

[1] Soil Burn Severity Percent is of the fire area.
[2] Substantial portion of the fire extends east into Yosemite National Park.
[3] Low and Unburned

The most visible watershed impact of the fire was in the high soil burn severity areas since it reduced ground cover to less than 20 percent, often near zero. Ground cover in the moderate soil burn severity areas was also substantially reduced as nearly all trees were killed by the fire, though needlecast replacement cover of 50 percent or more occurred in many of the conifer forested areas.

VEGETATION CONDITION

Hillslopes

The remaining live vegetation within the Rim Fire perimeter consists largely of second growth forest stands from legacy logging as well as more recent various aged timber plantations. It also consists of unlogged natural stands, some of which are very old. Despite the diversity of this vegetation, it almost all currently shares a common trait: high stand density. An excessive number of tree stems per acre creates closed canopies and an undesirable fuel ladder. This dense condition makes the forest vegetation as vulnerable in future wildfires as has recently occurred. At the scale of the Rim Fire about 44 percent of live vegetative canopy was lost, in various mosaic patterns, and about 56 percent remained largely unaffected. As Table 3.14-4 showed, the amount of soil burn severity and vegetation burn severity varied substantially among the watersheds in the fire area.

Riparian Conservation Areas

Riparian Conservation Areas (RCA) are corridors along stream channels and surrounding meadows, springs and other wetland areas that provide habitat for plants that thrive on a high water table. These riparian obligate species and include resprouting trees such as alders, big leaf maples, dogwoods, cottonwoods and aspens, shrubs such as willows, and a variety of streamside and meadow herbaceous plants. Conifers also coexist in RCAs with obligate species, often growing well near streams.

Table 3.14-5 shows the watershed effect of the Rim Fire on vegetation condition in RCAs by watershed. A 100-foot buffer along all perennial and intermittent streams (100 feet on each side for a total width of 200 feet) was selected to insure incorporation of all riparian obligate species and the principal near-stream location of shading conifers. Both soil and vegetation burn severity measures were assessed for validation of comparability. This 100-foot buffer represents an average of about 7 percent of the total area in the Rim Fire watersheds, with a range of 5-9 percent among all watersheds.

In Table 3.14-5, the RCA columns display soil and vegetation burn severity for all HUC 6 and HUC 7 watersheds in the Rim Fire. The RCA H + M column is the sum of high and moderate soil burn severity in the 100-foot stream buffer. The Watershed column displays the sum of the high and moderate burn severity for the entire watershed. The RCA H + M column is the key information for comparing soil to vegetation burn severity and RCA-to-watershed soil burn severity.

Table 3.14-5 shows that RCA soil and vegetation burn severity match closely in almost all watersheds. In 21 of 23 watersheds soil and vegetation burn severity are within 5 percent of one another, and the remaining two are 7 percent and 8 percent. In most cases the vegetation burn severity is equal to or slightly less than the soil burn severity. The two measures validate they are comparable for estimating vegetation loss. Soil burn severity has the added advantage of also being able to indicate ground cover condition.

Comparing RCA to watershed, the table shows that RCA soil burn severity is in most cases less than for the watershed as a whole. RCA soil burn severity is not higher than watershed soil burn severity in 19 of the 23 watersheds in Table 3.14-5. The four that are higher are barely so, and many of the watershed soil burn severity percentages are much higher than the RCA.

The Rim Fire burned more severely in the uplands than near the streams in nearly all watersheds, and substantially more in many. And though it burned less in RCA there was still a notable loss of the stream shade capacity of conifers and riparian obligate trees and shrubs in many watersheds. But while the conifers will be long in returning to replace shade, the riparian trees will fill the void in the short run and also provide biodiversity along stream reaches burned in the Rim Fire.

Table 3.14-5 Riparian Conservation Area Soil and Vegetation Burn Severity

HUC Level and Name	Riparian Conservation Area (RCA) (100-foot stream buffer)					Watershed (total acres)
	Soil Burn Severity % acres in RCA				Vegetation Burn Severity % acres with 75-100% Canopy Mortality	Soil Burn Severity % acres in Watershed
	High	Mod	Low	H+M		High+Mod
5 – Big Creek-Tuolumne River						
6 – Big Creek	0	0	100	0	0	0
6 – Grapevine Creek-Tuolumne River	0	11	89	11	15	27
6 – Jawbone Creek-Tuolumne River	11	38	51	49	50	70
7 – Corral Creek	41	51	9	92	88	89
7 – Lower Jawbone Creek	3	42	55	45	49	85
5 – North Fork Tuolumne River						
6 – Lower North Fork Tuolumne River	1	8	91	9	6	7
5 – Clavey River						
6 – Lower Clavey River	1	19	80	20	19	49
7 – Bear Springs Creek-Lower Clavey River	2	17	81	19	14	50
6 – Middle Clavey River	1	7	92	8	7	13
6 – Reed Creek	3	10	87	13	11	23
7 –Lower Reed Creek	12	31	56	43	41	62
5 – Cherry Creek						
6 – Lower Cherry Creek	13	34	53	47	45	53
7 – Granite Creek	35	59	6	94	91	92
6 – Upper Cherry Creek	0	0	100	0	0	1
6 – West Fork Cherry Creek	0	0	100	0	0	0
5 – Eleanor Creek[1]						
6 – Miguel Creek-Eleanor Creek	4	34	62	38	41	35
5 – Falls Creek-Tuolumne River[1]						
6 – Poopenaut Valley-Tuolumne River	5	27	68	32	32	39
5 – Middle Fork Tuolumne River[1]						
6 – Lower Middle Fork Tuolumne River	5	50	45	55	50	63
6 – Upper Middle Fork Tuolumne River	3	22	75	25	17	29
5 – South Fork Tuolumne River[1]						
6 – Lower South Fork Tuolumne River	2	23	75	25	18	46
6 – Upper South Fork Tuolumne River	4	19	77	22	17	25
5 – North Fork Merced River						
6 – Bull Creek	0	2	98	2	2	2
6 – Bean Creek-North Fork Merced River	0	2	98	2	2	4

[1] Substantial portion of the fire extends east into Yosemite National Park.

TRANSPORTATION SYSTEM CONDITION

Road density in the Rim Fire area ranges from one to six miles of road per square mile, with an average of about 4 miles per square mile. This is similar to other roaded multiple-use areas within the forest. Prior to the Rim Fire, the existing road network within its perimeter was adequate to serve the needs of forest management activities. However, up to six miles of road construction is planned for post-fire salvage harvest to reach burned areas previously not accessible. This would add less than one percent to the road network in the fire area, or negligible change in road density compared with the existing road network.

Road sediment discharge increases are expected as a result of the Rim Fire. Most increases are likely to occur in high soil burn severity areas within the Rim Fire, and to a lesser extent in moderate soil burn severity areas. Problems include locations of improper road drainage function and culverts at road-stream crossings. The undersized culverts cannot handle post-fire flow volume and the additional woody debris and sediment it carries. The quantity and effect of fire-related sediment-delivery increase is uncertain, due to variability in winter weather prior to the implementation of the Rim Fire Recovery.

STREAM CONDITION

Stream condition inventories were conducted along portions of 23 streams within the Rim Fire area between 2005 and 2012. These are part of the forestwide Stanislaus StreamScape Inventory (SSI) program to determine stream condition prior to management activities or for baseline watershed information (Frazier et al. 2008). SSI consists of 21 attributes of stream condition measured continuously along wadeable stream channels in lengths that have ranged from about 1 to nearly 10 miles. Some larger streams become wadeable by late summer, such as the Middle and South Forks of the Tuolumne River, the Clavey River and Reed Creek. They, among many of their tributaries, comprise the streams represented here. The main channel of the Tuolumne River has not been inventoried due to its size and regulated flow regime which creates unsafe SSI working conditions. Table 3.14-6 summarizes the existing condition of these streams based on key indicators.

Table 3.14-6 Rim Fire Stream Condition Summary

Stream Channel Indicators				Stream Habitat Indicators					
Streambank Stability		Channel Form		Pool Tail Fine Sediment		Pool Bed Fine Sediment		Water Temperature Maximum	
%	Streams	% Normal or Rejuvenating	Streams	%	Streams	%	Streams	Deg. C and (F)	Streams
>75	21	>75	16	<10	16	<10	18	<15 (59)	10
50-75	1	50-75	4	10-20	3	10-20	3	15-20 (59-68)	9
<50	1	<50	3	>20	4	>20	2	>20 (68)	4

Stream Channels

Streambank stability is assessed in quartile percentage classes at 100-meter increments. The summary above represents the percentage of streambank stability on all streams inventoried. Twenty one of the 23 streams have a majority of their stream length in the greater than 75 percent stability quartile with no 100-meter increments less than 50 percent stable. This indicates the streambank stability for the surveyed stream is either fully or highly likely to be greater than 75 percent, which represents a very stable stream system. Numerous streams have over 90 percent of their length fully classified in the upper quartile.

Channel form, or shape, is assessed in SSI in four classes which depict excellent to poor condition. The Normal class is one whose channel fits proper morphological features for its stream type. These factors include width-to-depth and entrenchment ratios, streambank angle, and other measures of channel shape (Rosgen 1996). The Rejuvenating class is a channel form that shows evidence of legacy disturbance but is recovering or has recovered to good condition. These classes are combined to assess condition of the channel form. For example, a stream with more than 75 percent of its length in these classes, provided the Normal class is greater, is in very good condition. Sixteen of the inventoried streams are in this condition, while the remaining streams have some portions with evidence of accelerated incision or widening.

Overall, the two stream channel indicators show a high percentage of the inventoried streams were in very good condition prior to the Rim Fire. Stream condition is expected to be affected by post-fire erosion and sedimentation though the magnitude is uncertain, and is largely reliant upon winter weather events. Effects may be mitigated in areas that received BAER hillslope and road treatments in the fall of 2013.

Stream Habitat

SSI quantitatively measures stream pool sediment serving as indicators of stream habitat quality and sedimentation. Pools are the sediment reservoirs in streams. Sediment in stream pools is an indicator of deposition from the surrounding watershed, and thus shows whether excessive input is present. Excessive sedimentation can arise from ground disturbing management activities such as salvage harvest or roads, or from natural events such as floods or mass wasting (e.g., landslides, debris flows). Fine sediment is measured since it represents the smallest soil particles, which are the key components of aquatic habitat. Excessive fine sediment in stream pool tails can reduce fish spawning success. Excess pool bed sediment reduces pool area that can be used for fish rearing and productivity. Pool tail fine sediment is calculated at pool outlets, and pool bed fine sediment is measured throughout the full length of stream pools. Pool tail sediment less than 20 percent is usually considered suitable for fish spawning. Pool bed sediment, measured as the length of fine sediment deposition in a pool, characterizes the amount of settleable material sourced from the watershed. The same percentage threshold is used for pool bed sediment as for pool tails.

As shown in Table 3.14-6, pool tail and pool bed sediment were very low in the inventoried streams. It is not excessive since presence of native fish of all age classes are common or abundant in these streams. The amount of pool sediment in these streams is an indicator of a very stable watershed landscape, including recovery from past disturbances by wildfire and ground-disturbing management activities.

Water temperature was also excellent in these streams. The SSI data are the maximum daily temperatures and all are suitable for the native aquatic organism communities. Even the streams with maximum temperatures exceeding 68 degrees Fahrenheit, a threshold of concern for cold water fish, were only slightly higher and their minimum daily temperatures are well below the threshold.

Benthic macroinvertebrates (BMI) are another indicator of stream health. They were sampled in the Clavey River in 2007 as well as several of its tributaries within the Rim Fire perimeter as part of the stream condition inventory for the Clavey River Ecosystem Project (CREP 2008). The BMI data were evaluated using the River Invertebrate Prediction and Classification System (RIVPACS) (Hawkins et al. 2000). Numeric values very close to 1 indicate reference condition, meaning streams are in as good of condition as naturally occurs. Numbers exceeding 1 are better than what is expected. A score of 0.9 or 90 percent, means the stream health is in excellent condition. Streams and their BMI scores are as follows: Two Mile Creek (0.991), Hull Creek (1.106), Clavey River (0.927), Reed Creek (1.021), Bourland Creek (1.166), Cottonwood Creek (1.166), and Bear Springs Creek (0.932). No impairment of stream habitat or water quality was evident.

Prior to the Rim Fire no significant management activity disturbances or natural events likely altered the stream conditions described previously. Effects from the Rim Fire on stream channel and aquatic habitat condition are expected to occur in winter 2013-2014 due to weather related events. The magnitude is largely dependent on storm size and frequency.

Water Quality Condition

Prior to the Rim Fire, water quality was considered excellent at all the watershed scales previously described. Throughout the main Tuolumne River and its tributaries there is substantial evidence of high quality water. The US Environmental Protection Agency maintains a list of waters with impaired water quality under Section 303(d) of the Federal Clean Water Act (CVRWQCB 2010). The Tuolumne River is not listed as an impaired stream, nor is the Merced River. At the smaller scale, SSI and BMI data collected in the Rim Fire area have shown evidence of excellent water quality where sampled in the watersheds across the fire area.

Water quality degradation resulting from erosion and stream sedimentation following the Rim Fire occurred as expected for a winter that turned out to be below average in precipitation with few storms exceeding a 1-2 year return interval. First, early winter rainfall began to mobilize easily dislodged ash and streamside sediment in highly burned areas with little ground cover. Streams and rivers ran variably turbid, some very much so, during and after storms depending on rainfall intensity, soil type and other factors. Decreases in turbidity and sediment transport occurred between storms. This process of storm driven sediment delivery and transport repeated itself over the winter. Sediment mobilization, transport and deposition were moderate, without major degradation.

Environmental Consequences

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Direct and indirect effects of proposed activities are described below for 15 of 18 HUC 6 watersheds and five HUC 7 watersheds. Three HUC 6 watersheds (Big Creek, Upper Cherry Creek, and West Fork Cherry Creek) are not assessed below due to the negligible amount of high and moderate soil burn severity in their watersheds (Table 3.14-4). The selection of five HUC 7 watersheds is described in the Watershed Report Appendix A: Cumulative Watershed Effects Analysis Methodology.

Erosion and Sedimentation

Factors Affecting Erosion and Sedimentation

Soil Compaction

Compaction of soil from mechanized equipment can lead to hydrologic effects such as lower infiltration rates and increased runoff. These effects are anticipated to be greatest in the portion of the project area where ground-based salvage logging is proposed, less where cable logging is proposed, and least where helicopter logging is proposed.

Soil Displacement

In ground-based harvesting units, soil displacement may occur where logs are dragged to skid trails using end lining. Less soil displacement occurs with hand felled trees that have 1-end suspension to a dozer or skidder. When feller-bunchers are used, there is less dragging of individual logs because the feller-buncher can “bunch” these logs into a pile for the skidder to move. However, additional displacement of soil may occur in the feller-buncher tracks, particularly where the equipment has turned.

In skyline harvesting units, soil displacement may occur in harvest corridors where full suspension is not possible and logs are dragged on the ground. In addition, portions of some skyline units with slopes less than 45 percent may utilize a feller-buncher to cut the trees. In these locations, additional soil displacement may occur as a result of feller-buncher tracks.

In helicopter units, hand felling and lifting of trees is anticipated to result in negligible soil displacement. However, portions of some helicopter units with slopes less than 45 percent may utilize a feller-buncher to cut the trees. In these locations, additional soil displacement may occur as a result of feller-buncher tracks.

Ground Cover

Management requirements were designed to maintain or increase ground cover in near-stream areas. Within RCAs, ground cover is expected to increase under the proposed action as a result of maintaining post-fire conifer needle cast, application of ground cover through logging slash or other means, and natural recovery of live vegetation. A maximum of 10 tons/acre of fuel loading is allowed.

Erosion and Sedimentation from Treatment Activities

Salvage of Merchantable and Non-Merchantable Trees

Research on salvage logging has shown large variability in sediment production. Some studies have concluded that salvage logging may reduce post-fire sediment production rates by reducing hydrophobicity and disturbing sealed soil surfaces, while others have found increased sediment production rates due to soil compaction and ground disturbance (Chase 2006). Silins et al. found that post-fire salvage logging creates more effective terrestrial sediment transport networks to stream channels and produced more sediment than areas burned but not logged (Silins et al. 2009). Others have found difficulty in distinguishing between erosion due to logging and that from the fire itself (McIver and Starr, 2001). On the Stanislaus National Forest, research following the Stanislaus Complex in 1987 found that differences in sediment production from logged and unlogged sites were not statistically significant. This was attributed to either the high variability in disturbance within each treatment or the large effect of the fire itself on sediment output (Chou et al. 1994).

The type of logging system used can affect sediment production. Helicopter logging and cable yarding systems with partial or full suspension typically have smaller impacts on sediment production (Beschta et al. 2004). Chou et al. measured 18 percent ground disturbance in cable logged units and 35 percent ground disturbance in tractor logged units following the Stanislaus Complex (Chou et al. 1994). Chase found no difference in sediment production between tractor, cable, and helicopter sites due to the variability between sites. However, he was able to conclude that post-fire salvage logging treatments that increase ground disturbance and bare soil would generate more sediment (Chase 2006).

Erosion and sedimentation monitoring on green timber sales on four national forests in California has shown that timber harvest alone rarely initiates large amounts of runoff and surface erosion. Most erosion was initiated by skid trails (Litschert and MacDonald 2009). This research found that sediment delivery from timber harvest may be reduced by locating skid trails away from streams, maintaining high surface roughness downslope of waterbars, and promptly decommissioning skid trails following harvest. Concentrated flow from a skid trail or waterbar was more likely to form a rill or sediment plume when the downslope area had low surface roughness (Litschert and MacDonald 2009). Research on salvage logging tends to agree with the research on green sales. Proper installation and maintenance of waterbars on skid trails and cable rows should help minimize the increase in sediment production due to salvage logging (Chase 2006).

Despite the variability in research results, some key points are brought up repeatedly in the literature including: (1) Minimize compaction to the extent possible; (2) Minimize soil displacement; (3) Maintain or increase ground cover to filter sediment. Management requirements and BMPs were designed to accomplish these three tasks.

Erosion modeling using Disturbed WEPP (Water Erosion Prediction Project) was conducted within the fire perimeter to determine both post-fire (pre-implementation) and post-implementation annual erosion rates for the first year post-fire. Chapter 3.11 (Soils) provides more information on the Disturbed WEPP model and assumptions, as well as unit specific analyses. Table 3.14-7 models erosion rates in each watershed.

Thirteen of the fifteen HUC 6 watersheds are anticipated to have negligible changes in erosion at the watershed scale (Table 3.14-7). The two HUC 6 watersheds with projected changes in erosion (Reed Creek and Lower Middle Fork Tuolumne River) had lower erosion rates post-implementation than post-fire. This is attributed to increased ground cover in high vegetation burn severity areas due to the addition of activity fuels. The modeling indicated that all five HUC 7 watersheds would have changed erosion rates following project implementation. Four of the five watersheds would have decreased erosion rates. One of the watersheds, Granite Creek, was projected to have an increase in erosion from 3.6 tons/acre to 3.7 tons/acre. This was attributed to the hazard tree treatment in lightly burned areas where ground cover is anticipated to decrease.

Both increases and decreases in erosion rates at the watershed scale were very minimal. The largest volumetric rate change was 0.3 tons/acre in the Corral Creek watershed and the largest percent change was -7.1 percent in the Reed Creek watershed.

Table 3.14-7 Alternative 1: Post-Fire and Post-Implementation Erosion Rates and Percent Change for Each Watershed

HUC Level and Name	Post-Fire Erosion Rate (tons/acre)	Post-Implementation Erosion Rate (tons/acre)	Erosion Rate[1] Change (%)
6 - Grapevine Creek-Tuolumne River	2.0	2.0	0.0
6 - Jawbone Creek-Tuolumne River	3.6	3.6	0.0
7 - Corral Creek	4.7	4.4	-6.4
7 - Lower Jawbone Creek	4.9	4.8	-2.0
6 - Lower North Fork Tuolumne River	0.9	0.9	0.0
6 - Lower Clavey River	2.9	2.9	0.0
7 - Bear Springs Creek	3.1	3.0	-3.2
6 - Middle Clavey River	1.2	1.2	0.0
6 - Reed Creek	1.4	1.3	-7.1
7 - Lower Reed Creek	3.2	3.1	-3.1
6 - Lower Cherry Creek	2.4	2.4	0.0
7 - Granite Creek	3.6	3.7	2.8
6 - Miguel Creek-Eleanor Creek	1.1	1.1	0.0
6 - Poopenaut Valley-Tuolumne River	1.4	1.4	0.0
6 - Lower Middle Fork Tuolumne River	2.9	2.8	-3.4
6 - Upper Middle Fork Tuolumne River	0.9	0.9	0.0
6 - Lower South Fork Tuolumne River	3.1	3.1	0.0
6 - Upper South Fork Tuolumne River	0.9	0.9	0.0
6 - Bull Creek	0.6	0.6	0.0
6 - Bean Creek-North Fork Merced River	0.7	0.7	0.0

[1] Negative percent change indicates reduced erosion. Positive percent change indicates increased erosion.

Table 3.14-8 Alternative 1: Salvage Logging by Soil Burn Severity Within 100 feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature

HUC Level and Name	Salvage Logging Within 100 Feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature (acres)		
	High Soil Burn Severity	Moderate Soil Burn Severity	Low Soil Burn Severity
6 - Grapevine Creek-Tuolumne River	0	26	35
6 - Jawbone Creek-Tuolumne River	73	177	50
7 - Corral Creek	42	66	19
7 - Lower Jawbone Creek	7	49	2
6 - Lower North Fork Tuolumne River	1	14	24
6 - Lower Clavey River	6	47	54
7 - Bear Springs Creek	6	26	31
6 - Middle Clavey River	6	72	156
6 - Reed Creek	47	101	81
7 - Lower Reed Creek	46	91	25
6 - Lower Cherry Creek	58	132	35
7 - Granite Creek	47	76	4
6 - Miguel Creek-Eleanor Creek	0	4	13
6 - Poopenaut Valley-Tuolumne River	4	4	1
6 - Lower Middle Fork Tuolumne River	47	333	140
6 - Upper Middle Fork Tuolumne River	0	12	8
6 - Lower South Fork Tuolumne River	11	174	264
6 - Upper South Fork Tuolumne River	0	6	20
6 - Bull Creek	0	6	11
6 - Bean Creek-North Fork Merced River	0	17	28

Although modeling results indicate that changes in erosion rates would likely be minimal as a result of the proposed action, stream sedimentation still has the potential to occur as a result of the proposed action, particularly in areas where logging activities create more effective sediment transport networks to stream channels. From a hydrologic standpoint, increased compaction, increased soil displacement, and changes in ground cover are most critical in the near stream areas where stream sedimentation is most likely. Knowledge of soil burn severity in these areas is important because areas of low soil burn severity have much greater potential to filter sediment than areas of high soil burn severity. Table 3.14-8 describes salvage logging acres (combined salvage units and hazard tree removal) within 100 feet of perennial or intermittent streams and SAFs by soil burn severity. All system types (ground-based, skyline, and helicopter) are included in this table.

Despite implementation of BMPs and management requirements, increased stream sedimentation is anticipated as a result of the proposed action, particularly in areas where logging activities create more effective sediment transport networks to stream channels. This is more likely to occur in the Jawbone Creek-Tuolumne River, Corral Creek, Reed Creek, Lower Reed Creek, Lower Cherry Creek, Granite Creek, and Lower Middle Fork Tuolumne River watersheds than in other HUC 6 or HUC 7 watersheds due to the larger acreages of high soil burn severity areas near streams proposed for treatment.

Piling and Burning

Lop and scatter in the helicopter units would increase ground cover and improve contact of ground cover with the soil, increasing the ability of the ground cover to filter sediment. This fuel reduction treatment is anticipated to reduce soil erosion in the units where it is implemented.

Jackpot burning and hand piling and burning would result in reduced fuel loading with very little ground disturbance. Although some soil movement could occur following these activities, it is anticipated to be minor and short term.

Machine piling could be implemented using either a dozer (dozer piling) or an excavator or other similar piece of equipment (grapple piling). Management requirements would prohibit machine piling within 25 feet of an ephemeral stream and within 50 feet of a perennial stream, intermittent stream, or SAF. The disturbance caused by dozer piling is expected to be greater than that caused by grapple piling. That is because the dozer would push the fuels into a pile, whereas an excavator would pick up and place fuels into a pile.

In areas of low soil burn severity, riparian buffers are anticipated to be largely intact and have ground cover capable of filtering sediment movement resulting from machine piling. In areas of moderate soil burn severity, riparian buffers may be variable. However, ground cover in the form of needle cast can help filter runoff caused by machine piling disturbance. In areas of high soil burn severity little, if any, ground cover remains to filter sediment laden runoff resulting from the impacts of machine piling. However, implementation of BMPs and management requirements, including increasing ground cover within 100 feet of perennial and intermittent streams and SAFs provides for increased ground cover in these areas. Although it is anticipated that some sediment could reach streams as a result of machine piling, streamside buffers, needle cast, and/or placed ground cover should minimize this.

Roads

Forest roads cause hydrological effects by concentrating and channelizing surface and subsurface flow. Following wildfire, the ability of the landscape to filter runoff from roads can be reduced due to a decrease in ground cover (Peterson 2009).

Road Construction

By altering infiltration rates, road construction can increase overland flow rates and sediment yields (USDA 2013). Soil erosion associated with roads is highest during the first year or two following construction. This is due to the cut banks and fill slopes needing time to revegetate and stabilize (Peterson 2009).

Increases in permanent road mileage by 5.4 miles as a result of the proposed action range from a 0.08 percent increase in the Upper South Fork Tuolumne River watershed to a 1.79 percent increase in the Middle Clavey River watershed. This would include 6 new permanent stream crossings along the newly constructed roads. BMPs and management requirements would limit sediment inputs to streams during road construction.

Although some erosion and sedimentation is anticipated as a result of these activities, particularly in the first year or two following construction, overall increases in erosion and sedimentation are anticipated to be low as the percent increase in road mileage is low.

Road Reconstruction and Maintenance

Reconstruction is proposed on 320 miles of roads and maintenance is proposed on an additional 216 miles of road. Activities on temporary use-revert roads (8.4 miles) are anticipated to be similar to reconstruction. On road surfaces that are draining well, maintenance is important because a lack of road maintenance can result in progressive degradation of road-drainage structures and functions (USDA 2013). However, increased drainage features such as culverts and dips are needed on some roads to minimize hydrologic effects. This is particularly important with increased runoff from hillslopes following fire. In these situations, reconstruction is required to adequately improve drainage features and minimize impacts.

Erosion and sedimentation is anticipated along maintained and reconstructed roads. However, implementation of BMPs and management requirements are expected to minimize these effects. Road reconstruction may actually reduce erosion and sedimentation that is currently occurring as this treatment would involve improving road drainage features.

Temporary Road Construction

Of the 13.9 miles of temporary roads identified for use under Alternative 1, 10.0 miles (72 percent) already exist on the ground as non-system routes. While additional traffic on these routes would cause soil disturbance and has the potential for increased erosion and sedimentation, these routes would be decommissioned following use, resulting in a net decrease of 10.0 miles of road on the landscape. The 3.9 miles of new temporary roads would reduce infiltration and lead to potential increases in erosion and sedimentation. However, decommissioning these roads after use would reduce these impacts in the long term.

Material Source Development

Of the seven material source sites proposed for use, Jawbone Quarry, Duckwall Quarry, and Bourland Quarry are located closest to surface waters. Jawbone Quarry and Bourland Quarry are about 200 feet from the nearest stream and are bounded by a road, which would prevent further expansion towards surface waters. Duckwall Quarry is located on private land and has an intermittent channel running under the site through a culvert. Soil burn severity was primarily low surrounding this site, so the potential of vegetation to filter sediment moving off site remains high. All three sites were utilized in previous timber sales with no reports of water quality concerns.

Due to distance from surface waters, roads preventing site expansion towards surface waters, filtering potential of remaining vegetation, and applications of BMPs and management requirements, erosion and sedimentation originating from material source sites are anticipated to be negligible.

Water Source Development

Eighty-one potential water sources are identified under the proposed action. However, BMPs and management requirements include minimum flow requirements for both fish-bearing and non-fish bearing streams. It is anticipated that many of the proposed drafting sites would not be approved for use due to low flows.

BMP effectiveness monitoring shows that water source development was completed effectively in the past and resulted in only minimal sediment inputs to streams. The effects of water source development on erosion and sedimentation are anticipated to be minimal under the proposed action.

Fuel Loading

The proposed action would reduce the fuel loading in the project area watersheds. Coarse woody debris would be reduced to about 10 tons/acre. This would result in lower flame lengths and fireline intensities, allowing for direct attack of future wildfires. These reduced fuel loadings could be maintained with prescribed fire. Increased erosion following fire is related to the amount of vegetation removed. Prescribed burns, by design, do not consume extensive areas of organic matter (Baker 1990). Therefore, prescribed fires have little impact on erosion and sedimentation, whereas intense wildfires may have substantial impacts (Brooks et al. 1997). Reducing fuel loading and then maintaining this with prescribed fire has less potential for erosion and sedimentation than allowing fuel loading to increase as snags fall and having another large stand-replacing wildfire in the future. The Fuels Report (project record) has more information on fuel loading.

Riparian Vegetation

Riparian vegetation may be beneficially affected by the proposed action where burned overstory trees are removed. Increasing sunlight in streamside areas provides an energy input that often stimulates regrowth of the riparian plant community. Though this effect is largely a result of the fire removing stream shade cover and moisture competition, removal of burned tree boles may have a slight incremental effect. Another variable affecting riparian plant growth is the short term increase in streamflow and near-stream ground water following a fire as a result of a reduction in plant transpiration due to tree mortality.

One fen was identified within the roadside hazard tree removal area. No fens are within salvage treatment units. Removal of hazard trees near the fen is not anticipated to affect it, as management requirements such as equipment exclusion zones would be implemented.

There are about 60 acres of meadows identified within the proposed action treatment units. Removal of trees along meadow edges is not expected to affect meadows, as management requirements would be implemented.

Stream Condition

Stream Flow

Water yield typically increases in the first year following wildfire due to a reduction in soil water storage, interception, and evapotranspiration when vegetation is killed. This change decreases with time as vegetation reoccupies a watershed (Peterson et al. 2009). Under the proposed action, live trees would only be removed if they are a hazard tree and pose a risk to health and safety. Otherwise, all trees proposed for harvest would be dead and their removal would not affect soil water storage, interception, or evapotranspiration beyond the changes that already occurred as a result of the fire.

Modeling has indicated that increased surface roughness promotes infiltration and reduces overland flows, leading to reduced storm peak events and total flows (Smith et al. 2011). BMPs and management requirements under the proposed action would involve adding ground cover and minimizing compaction. Therefore, measurable changes in stream flow are not anticipated to result under the proposed action.

Stream Morphology

Prior to the Rim Fire, stream surveys throughout the project area indicated that most stream banks were stable and that channel form was predominately either normal (no active downcutting or evidence of accelerated past incision) or rejuvenating (evidence of legacy disturbance, but channel has recovered or is recovering to good condition).

Increased high peak flows following the Rim Fire have the potential to cause channel incision, primarily in low-gradient stream reaches with small, mobile substrate. However, measureable changes in flow are not anticipated as a result of the proposed action. Therefore, if channel incision does occur within the project area, it is likely the result of the fire or from large storms, not the proposed action.

Stream banks that were stable pre-fire may no longer have adequate cover to maintain their stability. This is particularly the case in areas of high soil burn severity. As discussed above, riparian vegetation is resilient following fires and is expected to flourish in the post-fire conditions of increased sunlight and water. This would allow for natural recovery of bank stability. The effect of the proposed action on streambank stability is expected to be minimal. Mechanized equipment exclusion zones are applied to all streams so that equipment is only allowed on stream banks at designated crossing locations. Skid trail stream crossings are limited to two per mile on perennial and intermittent streams and three per mile on ephemeral streams. Management requirements to maintain or provide ground cover within 100 feet of perennial and intermittent streams would provide for stability while riparian vegetation recovers.

Large Woody Debris

Following wildfire, snags falling into streams may be the main source of wood to streams until trees in the post-fire riparian areas are large enough to fall into streams and create habitat (Reeves 2006). Under the proposed action, existing downed large woody debris in the channel would be retained. In addition, a minimum of 20 pieces of large woody debris per mile of perennial or intermittent stream would be retained and felled into the stream channel. As a result of the proposed action, large woody debris levels in streams would increase in the short term following project implementation. Levels would be lower, in the long term, however, than if harvesting did not occur near stream channels. The Aquatics section gives more information on large woody debris.

Water Quality (Beneficial Uses of Water)

Uses of water for the Tuolumne River from its source to New Don Pedro Reservoir are municipal and domestic supply, irrigation, stock watering, power, contact and non-contact recreation, warm and cold water freshwater habitat, and wildlife habitat. Existing uses of water for the Merced River from its source to McClure Lake are irrigation, power, contact and non-contact recreation, warm and cold water freshwater habitat, and wildlife habitat. A potential use for the Merced River is municipal and domestic water supply (CVRWQCB, 2011). Beneficial uses are maintained when their related water quality objectives are met. Water quality objectives that could be affected by the proposed action are water temperature, sediment related parameters (sediment, settleable material, suspended material, and turbidity), and pesticides. There are no 303(d) listed impaired waterbodies within the project analysis area. This indicates that water quality is excellent at this large scale.

Water Temperature

Stream channel shade is highly influential in regulating water temperatures (Rutherford et al. 2004). Channel shade was reduced in portions of the project area where near-stream trees were killed by the fire. Removal of the near-stream dead conifer trees is anticipated to have very little effect on stream shading. These trees, if left standing, would provide little to no shade in the future. Therefore, warm and cold water freshwater habitat would not be affected by the proposed action.

Sediment-Related Parameters

None of the sediment related beneficial uses of water should be impaired as a result of the proposed action. Minor, short term increases in sediment related parameters are expected but not to the extent of adversely affecting beneficial uses. Anticipated sediment increases vary by watershed based on amount of project activity and watershed effects of the Rim Fire. None of the streams with special designations such as Wild and Scenic Rivers or Heritage Trout Waters are expected to be adversely affected. No known impairment of beneficial uses has occurred as a result of other past fire salvage harvesting on the Stanislaus National Forest in settings where the percentage of high soil burn severity was greater than the Rim Fire.

Pesticides (Registered Borate Compound)

A registered borate compound is proposed for application to tree stumps 14 inches and greater in diameter to limit the spread and establishment of new centers of annosum root disease within mixed severity harvest areas. Following application to tree stumps, rainfall and consequent runoff could lead to contamination of standing water or streams. In addition, accidental spills into a small body of water are possible (USDA 2006). However, given the highly focused application method for borate, application of granular product to cut tree stump surfaces, the potential to contaminate surface water is limited. In addition, management requirements, including not applying within 10 feet of surface water, when rain is falling, or when rain is likely that day (i.e. when the National Weather Service forecasts 50 percent or greater chance), would minimize any actual effect to a minor or negligible amount. Effects to municipal and domestic supply, contact and non-contact recreation, and warm and cold freshwater habitat are not anticipated. The Risk Assessment in the Vegetation Report has more information on the registered borate application.

Cumulative Effects

The process for analyzing cumulative watershed effects (CWE) consists of two steps: (1) an office evaluation which consists of determining the risk of cumulative effects using a predictive model and researching watershed history, and (2) field evaluation of streamcourse indicators of cumulative effects.

Step 1, the risk of cumulative effects, is evaluated using the Forest Service equivalent roaded acreage (ERA) methodology, adopted by Region 5 as a method of addressing cumulative watershed effects (USDA 1990). A description of the ERA methodology can be found in the Watershed Report Appendix A: Cumulative Watershed Effects Analysis Methodology.

Step 2, field evaluation, is necessary for comparing the modeled ERA prediction with actual and expected future field conditions. Project-related water quality parameters and watershed condition are evaluated via in-stream and near-stream indicators of condition. This evaluation is essential to help interpret cumulative effects of past projects and potential cumulative effects given proposed activities and other reasonably foreseeable future activities. Field review was used to verify that the geographic and temporal extent of analysis was adequate for evaluation of cumulative watershed effects (Connaughton 2005).

Equivalent Roaded Acres (ERAs)

The CWE ERA analysis for the Rim Fire Recovery EIS was conducted on all lands (public and private) within twelve HUC 6 and five HUC 7 level watersheds. GIS analysis was used to calculate acreages of activities in the watersheds. ERA values for these activities were summed and then were compared to a Threshold of Concern (TOC). The TOC for all HUC 6 and HUC 7 watersheds analyzed was 12-14 percent. Table 3.14-9 gives a summary of ERA values by watershed.

Previous analyses on the forest have indicated that the effects of livestock grazing at the watershed scale are low. Ground disturbance from livestock grazing is essentially a site issue rather than a watershed scale issue. This is because impacts of livestock grazing tend to be higher in low gradient stream channels through meadows than in upland areas, and these low gradient areas make up a small percentage of the watershed acreage. This results in little change to ERA values. Because of this, impacts of grazing are considered narratively for this project, but not quantitatively.

Table 3.14-9 Alternative 1: Annual Percent ERA for each HUC 6 and HUC 7 Analysis Watershed

HUC Level and Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
6 - Grapevine Creek-Tuolumne River	4.31	3.51	2.52	2.37	2.19	2.01	1.83	1.70	1.56	1.43
6 - Jawbone Creek-Tuolumne River	16.24[1]	14.89[1]	11.79	10.34	8.80	7.08	5.46	4.51	3.57	2.63
7 - Corral Creek	20.03[1]	21.39[1]	17.96[1]	15.86[1]	13.61[1]	10.80	8.01	6.70	5.39	4.08
7 - Lower Jawbone Creek	14.00[1]	12.75[1]	9.47	8.58	7.55	6.26	4.98	4.20	3.43	2.66
6 - Lower Clavey River	9.59	8.94	7.13	6.40	5.65	4.78	3.93	3.27	2.62	2.00
7 - Bear Springs Creek	13.00[1]	12.44[1]	10.28	9.14	8.00	6.67	5.37	4.38	3.38	2.50
6 - Middle Clavey River	4.93	5.42	4.93	5.32	5.62	5.77	5.05	4.44	3.83	3.24
6 - Reed Creek	8.23	9.47	8.48	8.05	7.17	6.12	5.04	4.30	3.58	2.85
7 - Lower Reed Creek	17.47[1]	18.10[1]	15.40[1]	13.40[1]	11.50	9.23	7.07	5.90	4.73	3.56
6 - Lower Cherry Creek	11.36	10.11	7.91	6.95	5.93	4.82	3.74	3.15	2.55	1.96
7 - Granite Creek	26.52[1]	24.13[1]	19.54[1]	16.92[1]	14.18[1]	11.18	8.29	6.82	5.35	3.90
6 - Miguel Creek-Eleanor Creek	3.69	2.64	1.36	1.12	0.89	0.63	0.37	0.32	0.28	0.23
6 - Poopenaut Valley-Tuolumne River	4.56	3.30	1.91	1.63	1.32	0.99	0.66	0.60	0.54	0.49
6 - Lower Middle Fork Tuolumne River	12.72[1]	15.13[1]	13.25[1]	12.18[1]	10.92	9.34	7.82	6.62	5.43	4.25
6 - Upper Middle Fork Tuolumne River	3.74	2.78	1.74	1.36	0.99	0.60	0.22	0.20	0.17	0.15
6 - Lower South Fork Tuolumne River	9.13	9.91	8.58	7.94	7.50	6.51	5.59	4.87	4.15	3.44
6 - Upper South Fork Tuolumne River	3.19	2.47	1.56	1.34	1.11	0.88	0.66	0.60	0.54	0.47

[1] Denotes watersheds over the TOC

HUC 6 and 7 Watersheds

Management requirements and BMPs were proposed to maintain or improve current conditions in the watersheds. This includes increasing ground cover within 100 feet of perennial and intermittent streams and special aquatic features and exclusion zones for ground-based equipment. Effectiveness monitoring is done annually on projects throughout the forest at randomly selected sites to determine if BMPs were effective. If Alternative 1 was selected, additional monitoring beyond effectiveness monitoring would be required by the Central Valley Regional Water Quality Control Board for all watersheds (both HUC 6 and HUC 7) over the TOC. Forensic monitoring inspections would be conducted during the winter period. These inspections are designed to detect potentially significant sources of pollution such as failed management measures or natural sources. The goal of winter forensic monitoring is to locate sources of sediment production in a timely manner so that rapid corrective action may be taken where feasible and appropriate (CVRWQCB 2005). In addition, in accordance with the Region 5 Forest Service Water Quality Management Handbook, project-level in-channel monitoring would be conducted following the Stream Condition Inventory (SCI) protocol (USDA 2011, Frazier et al. 2005).

Stream condition in the project area watersheds was evaluated to identify indications of past or present cumulative effects, and the potential for adverse impacts from future cumulative effects. The evaluation of stream condition included pre-fire stream surveys in most watersheds following the StreamScape Inventory (SSI) Protocol, which included observations of streambed sediment, streambank stability, and attributes of stream morphology (Frazier et al. 2008).

All watersheds which exceeded the TOC are discussed in detail below.

Jawbone Creek-Tuolumne River (HUC 6), Corral Creek (HUC 7), and Lower Jawbone Creek (HUC 7)

<u>ERA Summary</u>

Under Alternative 1, the ERA in the Jawbone Creek-Tuolumne River watershed would increase from its current 14.68 percent (no action) to 16.24 percent in the first year of implementation, 2014. This is the maximum ERA. The ERA falls back below the TOC by 2016 and by 2023 is down to 2.63 percent. The previous activities in the watershed, which have an ERA value of 9.99 percent in 2014, are large contributors to the high ERA values. These activities include the fire itself, fire suppression, timber harvest on private and NFS lands before the fire, and salvage activities on private lands after the fire.

The ERA in the Corral Creek HUC 7 watershed would increase from its current 16.33 percent (no action) to 20.03 percent in the first year of implementation, 2014. This would further increase in 2015, with a maximum ERA of 21.39 percent. The ERA falls back below the TOC by 2019 and by 2023 is down to 4.08 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due in large part to the previous activities in the watershed, which have an ERA value of 12.71 percent. With few previous land management activities in the watershed, the main reason the previous activities ERA was so high was because 89 percent of the watershed burned at high or moderate soil burn severity.

The ERA in the Lower Jawbone Creek HUC 7 watershed would increase from its current 11.80 percent (no action) to 14.00 percent in the first year of implementation, 2014. This is the maximum ERA. The ERA falls back below the TOC by 2016 and by 2023 is down to 2.66 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due in large part to the previous activities in the watershed, which have an ERA value of 9.95 percent. With few previous land management activities in the watershed, the main reason the previous activities ERA was so high was because 85 percent of the watershed burned at high or moderate soil burn severity.

Stream Condition Summary

Pre-fire stream surveys in the Jawbone Creek-Tuolumne River watershed were conducted in Drew Creek and Corral Creek. Surveys indicated that the condition of Drew Creek was good overall (i.e., stable banks, normal channel morphology, and low pool bed sediment). The RCA surrounding Drew Creek burned at low severity, so stream condition post-fire is likely the same as pre-fire. Very little treatment is proposed under Alternative 1 in the southern part of the Jawbone Creek-Tuolumne River watershed near Drew Creek, so stream condition is anticipated to remain good.

Pre-fire stream surveys in Corral Creek, on the other hand, showed much of the channel to be rejuvenating from past disturbance. Pre-fire bank stability was moderate, and is likely to be greatly reduced by the fire. This stream is still sensitive to further disturbance. Due to this sensitivity, additional management requirements were put in place for Corral Creek. A large equipment exclusion zone prohibits mechanized equipment between Corral Creek and its near-stream roads. Ground cover will be maintained or provided along its banks to minimize erosion and increase stability. This is in addition to 700 acres of straw mulch that was applied to the area as part of BAER treatments. Despite these treatments, Corral Creek is one of the areas which have the greatest potential for stream sedimentation following treatment.

Pre-fire stream surveys were not conducted in the Lower Jawbone Creek HUC 7 watershed. However, the acreage of high soil burn severity in this watershed was relatively low (10 percent). There was only 3 percent high soil burn severity within 100 feet of streams, meaning that most of the high soil burn severity was on the hillslopes. In this watershed, only 7 acres of salvage logging treatment is proposed in a high soil burn severity area within 100 feet of a perennial stream, intermittent stream, or SAF. This low acreage of treatment proposed within the highest risk area makes it likely that any increases in sedimentation would be minimal.

The proposed action is anticipated to result in increased sedimentation in the Jawbone Creek-Tuolumne River watershed, particularly in the Corral Creek HUC 7 watershed. However, management requirements and BMPs are anticipated to minimize these effects to the extent feasible. Monitoring is anticipated to identify any problem areas so that corrective action could be taken quickly. Due to these mitigations, the proposed action is not anticipated to result in adverse off-site cumulative effects to sediment-related water quality parameters or to watershed condition (i.e. degradation of stream channel morphology, accelerated erosion or loss of soil productivity). The proposed action also is not anticipated to result in cumulative effects to water temperature, as only dead trees would be removed and these provide minimal shade.

Bear Springs Creek (HUC 7)

ERA Summary

The ERA in the Bear Springs Creek HUC 7 watershed would increase from its current 11.36 percent (no action) to 13.00 percent in the first year of implementation, 2014. This is the maximum ERA. The ERA falls back below the TOC by 2016 and by 2023 is down to 2.50 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due in large part to the previous activities in the watershed, which have an ERA value of 5.92 percent. These previous activities include the fire itself, in which 50 percent of the watershed burned at moderate or high soil burn severity, as well as timber activities (both green tree sales and salvage) on private lands. An additional 4.20 percent of the ERA is attributed to planned salvage activities on private land as well as hazard tree removal on NFS lands along maintenance level 3, 4, and 5 roads.

Stream Condition Summary

Pre-fire stream surveys were not conducted in the Bear Springs Creek HUC 7 watershed. However, the acreage of high soil burn severity in this watershed was low (7 percent). Only 2 percent high soil burn severity occurs within 100 feet of streams, meaning that most of the high soil burn severity was on the hillslopes. In the Bear Springs Creek watershed, only 6 acres of salvage logging treatment is proposed in a high soil burn severity area within 100 feet of a perennial stream, intermittent stream, or SAF. This low acreage of treatment proposed within the highest risk area makes it likely that any increases in sedimentation would be minimal. Due to implementation of management requirements and BMPs, as well as monitoring to identify problem areas, the proposed action is not anticipated to result in adverse off-site cumulative effects to sediment-related water quality parameters or to watershed condition (i.e. degradation of stream channel morphology, accelerated erosion or loss of soil productivity). The proposed action also is not anticipated to result in cumulative effects to water temperature, as only dead trees would be removed and these provide minimal shade.

Lower Reed Creek (HUC 7)

ERA Summary

The ERA in the Lower Reed Creek HUC 7 watershed would increase from its current 14.98 percent (no action) to 17.47 percent in the first year of implementation, 2014. This would further increase in 2015, with a maximum ERA of 18.10 percent. The ERA falls back below the TOC by 2018 and by 2023 is down to 3.56 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due in large part to the previous activities in the watershed, which have an ERA value of 12.38 percent in 2014. These previous activities include the fire itself, in which 62 percent of the watershed burned at moderate or high soil burn severity, as well as timber activities (both green tree sales and salvage) on private and NFS lands.

Stream Condition Summary

Reed Creek and Niagara Creek are the main channels in the Lower Reed Creek watershed. Reed Creek had high bank stability pre-fire and had 99 percent of its length in a normal channel form. Niagara Creek had more evidence of past instability, with sections of low bank stability (6 percent of surveyed length) and almost half its length incised, incised and widened, or rejuvenating. Despite this, both streams had low pool bed and pool tail sediment.

In the Lower Reed Creek watershed, 46 acres of salvage logging treatment is proposed in a high soil burn severity area within 100 feet of a perennial stream, intermittent stream, or SAF. Reed Creek is bedrock controlled and highly erosion resistant, so changes in stream channel form are unlikely. Niagara Creek is more sensitive to disturbance, as its dominant substrate is gravel which is much more easily mobilized in high flows. Management requirements and BMPs were designed to address this sensitivity. This includes equipment exclusion zones and ground cover treatments. In addition, about 1,900 acres of straw mulch was applied to this watershed as part of BAER treatments. Despite these treatments, the Lower Reed Creek HUC 7 watershed is one of the areas which have the greatest potential for stream sedimentation following treatment.

The proposed action is anticipated to result in increased sedimentation in the Lower Reed Creek watershed. However, management requirements and BMPs are anticipated to minimize these effects to the extent feasible. Monitoring is anticipated to identify any problem areas so that corrective action could be taken quickly. Due to these mitigations, the proposed action is not anticipated to result in adverse off-site cumulative effects to sediment-related water quality parameters or to watershed condition (i.e. degradation of stream channel morphology, accelerated erosion or loss of soil productivity). The proposed action also is not anticipated to result in cumulative effects to water temperature, as only dead trees would be removed and these provide minimal shade.

Granite Creek (HUC 7)

ERA Summary

The ERA in the Granite Creek HUC 7 watershed would increase from its current 24.68 percent (no action) to 26.52 percent in the first year of implementation, 2014. This is the maximum ERA. The ERA falls back below the TOC by 2019 and by 2023 is down to 3.90 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due primarily to the previous activities in the watershed, which have an ERA value of 17.66 percent in 2014. These previous activities include the fire itself, in which 92 percent of the watershed burned at moderate or high soil burn severity, as well as timber activities (both green tree sales and salvage) on private and NFS lands.

Stream Condition Summary

No pre-fire SSI data was collected for the Granite Creek watershed. In this watershed, 47 acres of salvage logging treatment is proposed in a high soil burn severity area within 100 feet of a perennial stream, intermittent stream, or SAF. The granitic soil prevalent in this watershed is highly erodible. About 30 percent of the watershed burned at high soil burn severity, and an additional 62 percent burned at moderate soil burn severity. Because of this sensitivity, about 750 acres of straw mulch was applied to the Granite Creek watershed as part of BAER treatments.

The proposed action is anticipated to result in increased sedimentation in the Granite Creek watershed. This watershed experienced the greatest burn severity of any of the HUC 7 watersheds. However, management requirements and BMPs are anticipated to minimize these effects to the extent feasible. Monitoring is anticipated to identify any problem areas so that corrective action could be taken quickly. Due to these mitigations, the proposed action is not anticipated to result in adverse off-site cumulative effects to sediment-related water quality parameters or to watershed condition (i.e. degradation of stream channel morphology, accelerated erosion or loss of soil productivity). The proposed action also is not anticipated to result in cumulative effects to water temperature, as only dead trees would be removed and these provide minimal shade.

Lower Middle Fork Tuolumne River (HUC 6)

ERA Summary

The ERA in the Lower Middle Fork Tuolumne River watershed would increase from its current 9.96 percent (no action) to 12.72 percent in the first year of implementation, 2014. This would further increase in 2015, with a maximum ERA of 15.13 percent. The ERA falls back below the TOC by 2018 and by 2023 is down to 4.25 percent. The ERA is over the 12-14 percent threshold of concern for this watershed. This is due in large part to the previous activities in the watershed, which have an ERA value of 7.21 percent in 2014. These previous activities include the fire itself, in which 63 percent of the watershed burned at moderate or high soil burn severity, as well as timber activities on private and NFS lands.

Stream Condition Summary

Nearly 10 miles of pre-fire stream survey data was collected on the main stem of the Middle Fork Tuolumne River. Bank stability was very high and channel form was normal for its entire length, indicating no evidence of past channel incision. Pool tail and pool bed fines were also low. Part of this watershed was burned previously in the Pilot Fire, and good pre-Rim Fire condition indicates that impacts of past wildfire have not affected stream channel stability. The areas of high soil burn severity in the Lower Middle Fork Tuolumne River watershed were relatively small patches well distributed throughout the watershed. This spatial mosaic of all severities can reduce on and off site soil and water effects.

The proposed action is anticipated to result in increased sedimentation in the Lower Middle Fork Tuolumne River watershed. However, management requirements and BMPs are anticipated to minimize these effects to the extent feasible. Monitoring is anticipated to identify any problem areas so that corrective action could be taken quickly. Due to these mitigations, the proposed action is not anticipated to result in adverse off-site cumulative effects to sediment-related water quality parameters or to watershed condition (i.e. degradation of stream channel morphology, accelerated erosion or loss of soil productivity). The proposed action also is not anticipated to result in cumulative effects to water temperature, as only dead trees would be removed and these provide minimal shade.

Grazing

Active grazing allotments are located in all of the analysis HUC 6 and HUC 7 watersheds except Miguel Creek-Eleanor Creek. The resumption of grazing on these allotments has the potential to slow recovery of riparian vegetation and increase ground disturbance, particularly along stream banks. However, Forest Plan Standards and Guidelines require the prevention of disturbance from livestock from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines. It also limits browse to no more than 20 percent of the annual leader growth on mature riparian shrubs and no more than 20 percent of individual seedlings. In this project area the browse limit would apply to streamside areas where riparian obligates trees and shrubs are naturally resprouting and reseeding after the fire. Although resumption of grazing within the analysis watersheds is anticipated to result in ground disturbance and a reduction in riparian vegetation, these effects are anticipated to be localized and adherence to Standards and Guidelines should allow for riparian vegetation recovery to progress naturally.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Erosion and Sedimentation

Factors Affecting Erosion and Sedimentation

Soil Compaction

Under the no action alternative, soil compaction from management activities would not occur. However, activities under the action alternatives designed to reduce soil compaction would not occur either. Field review and LiDAR imagery has indicated an extensive skid trail network within the project area. Many of these pre-existing skid trails were not properly decommissioned in the past, and thus are concentrating runoff and causing erosion and sedimentation. Under the action alternatives, existing skid trails would be re-used to the extent practicable, and then subsoiled and waterbarred, reducing compaction and the risk of erosion and sedimentation. This would not occur under Alternative 2.

Soil Displacement

Soil displacement would not occur as a result of Alternative 2.

Ground Cover

Under the no action alternative, ground cover in high soil burn severity areas is expected to be lower than that found under any action alternative. That is because ground cover treatments such as drop and lop, mastication, and lop and scatter of activity fuels would not occur. Over time, trees falling would increase ground cover in these areas. Live vegetative recovery would increase over time under the no action alternative. This recovery is anticipated to be faster than under the action alternatives because disturbance by heavy equipment would not occur. Ground cover is expected to be less under Alternative 2 than the action alternatives until the area could naturally regain ground cover, through both the falling of snags and the recovery of live vegetation.

Erosion and Sedimentation from Treatment Activities

Salvage of Merchantable and Non-Merchantable Trees

Erosion modeling using Disturbed WEPP (Water Erosion Prediction Project) was conducted within the fire perimeter to determine both post-fire (pre-implementation) and post-implementation erosion rates for the first year post-fire. With only one exception, erosion rates for HUC 6 and HUC 7 watersheds under the no action alternative were either the same or greater than erosion rates under any action alternative. This was attributed to the increase in ground cover that would occur under the action alternatives, but would not occur under the no action alternative. Logging activities create more effective sediment transport networks to stream channels. These transport networks would not be created under Alternative 2. However, sediment transport networks originating from existing skid trails would not be mitigated by subsoiling under Alternative 2, as they would be under the action alternatives.

Piling and Burning

No piling and burning would occur under Alternative 2, so there is no risk of erosion and sedimentation.

Roads

Road Construction

The increased overland flow rates and sediment yields associated with road construction would not occur under Alternative 2.

Road Reconstruction and Maintenance

One of the purposes of the Rim Fire Recovery project is to improve road infrastructure to ensure proper hydrologic function. Reconstruction and maintenance would not occur under Alternative 2, so the goal of ensuring proper hydrologic function would not be met. Any sediment related issues associated with roads within the project area would continue on current trends and may degrade with time. Roadside hazard trees would not be removed under the no action alternative. This means that many maintenance level 2 roads would be closed to access either through gates or through snags falling across roads. This would limit the ability of the forest to conduct storm patrols on roads. Excessive concentrations of downed trees and debris above stream crossings could increase the risk of future crossing failures by causing plugging problems at culverts and bridges. Because access on these roads would be limited, discovery of the problem sites would be delayed, likely resulting in greater damage to road surfaces and subsequent stream sedimentation.

Temporary Road Construction

The increased overland flow rates and sediment yields associated with new temporary road construction would not occur under Alternative 2. However, 70-72 percent of the temporary roads proposed for use under the action alternatives already exist on the ground. These roads would be decommissioned following use, resulting in a net decrease of up to 22.7 miles of road on the landscape. This decommissioning of existing roads would not occur under the no action alternative.

Material and Water Source Development

No material or water sources would be developed under Alternative 2, so there is no risk of erosion and sedimentation.

Fuel Loading

The no action alternative would allow for fuel loading to increase in the project area. Nearly all snags would be expected to fall by 20 years post-fire. The limbs and boles from these fallen trees would accumulate as surface fuels. This fuel is expected to increase each decade as trees fall over. Within 10 years, surface fuels are projected to average 78 tons per acre due to dead trees falling over. Within 30 years, surface fuels are projected to average 98 tons per acre.

Increased erosion following fire is related to the amount of vegetation removed. Prescribed fires, by design, do not consume extensive areas of organic matter (Baker 1990). Therefore, they have little impact on erosion and sedimentation, whereas intense wildfires may have substantial impacts (Brooks et al. 1997). The high fuel loadings that are projected to occur under Alternative 2 could not be maintained with prescribed fire. Fire behavior is expected to increase once standing dead is on the ground. A future reburn under such extreme fuel loading would likely lead to soil erosion and sedimentation much more severe than that caused by the reduction of fuel loading under the action alternatives and maintaining these reduced loadings in the future by utilizing prescribed fire.

Riparian Vegetation

Under Alternative 2, there would be no disturbance to riparian vegetation. However, the removal of burned tree boles could have a slight incremental effect on increasing sunlight, and this would not occur under Alternative 2.

Stream Condition

Stream Flow

No changes in stream flow are anticipated as a result of the no action alternative.

Stream Morphology

Ground cover treatments along stream banks have the potential to increase bank stability post-fire, particularly in areas where a high percentage of ground cover was consumed by the fire. These treatments would not occur under Alternative 2. Bank stability would increase over time as live vegetation recovered, but percent cover along stream banks would likely be lower under Alternative 2 than the action alternatives until live vegetative recovery occurs.

Large Woody Debris

Levels of large woody debris (LWD) in streams would be high under Alternative 2 as all snags would be retained and over time many near-stream snags would fall into streams. The effects of these fallen snags on roads were discussed above in the Erosion and Sedimentation section. The effect of this high level of LWD on stream condition is uncertain. In streams with low levels of LWD this extra loading may be beneficial in storing stream sediment. In streams with high levels of LWD, this extra loading may be excessive. Larger rivers should be capable of transporting these high loads of LWD to downstream reservoirs.

Water Quality (Beneficial Uses of Water)

Water Temperature

No effect to water temperature is anticipated under Alternative 2.

Sediment-Related Parameters

Ground disturbance from mechanized equipment that could lead to stream sedimentation would not occur under Alternative 2. However, activities that could reduce stream sedimentation, such as ground cover treatments, subsoiling of existing skid trails, road reconstruction to reduce hydrologic connectivity, and decommissioning of existing temporary roads would not occur.

Pesticides (Registered Borate Compound)

A registered borate compound would not be used under Alternative 2.

Summary

Beneficial uses of water would continue to be met.

CUMULATIVE EFFECTS

Equivalent Roaded Acres (ERAs)

Table 3.14-10 shows ERAs were calculated for twelve HUC 6 and five HUC 7 watersheds.

HUC 6 and 7 Watersheds

ERAs exceed the threshold of concern in one HUC 6 and three HUC 7 watersheds under the no action alternative. These high values can be attributed to the fire itself as well as past and future management activities on private and NFS lands.

Grazing

Same as Alternative 1.

Table 3.14-10 Alternative 2: Annual Percent ERA for each HUC 6 and HUC 7 Analysis Watershed

HUC Level and Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
6 - Grapevine Creek-Tuolumne River	3.91	2.99	2.05	1.95	1.83	1.70	1.58	1.51	1.43	1.35
6 - Jawbone Creek-Tuolumne River	14.68[1]	11.68	8.58	7.33	5.99	4.68	3.47	2.93	2.38	1.84
7 - Corral Creek	16.33[1]	12.95[1]	9.39	7.76	6.03	4.31	2.60	2.37	2.14	1.91
7 - Lower Jawbone Creek	11.80	8.73	5.61	4.98	4.17	3.39	2.60	2.31	2.02	1.73
6 - Lower Clavey River	8.41	6.45	4.44	3.93	3.39	2.86	2.33	1.99	1.66	1.37
7 - Bear Springs Creek	11.36	9.11	6.82	5.95	5.06	4.18	3.29	2.72	2.14	1.67
6 - Middle Clavey River	3.64	3.25	2.73	3.36	3.86	4.28	3.82	3.46	3.10	2.76
6 - Reed Creek	7.06	6.17	5.50	5.30	4.63	3.95	3.22	2.85	2.48	2.11
7 - Lower Reed Creek	14.98[1]	12.43[1]	9.51	7.92	6.39	4.85	3.43	2.98	2.53	2.07
6 - Lower Cherry Creek	10.58	8.30	5.99	5.16	4.28	3.41	2.56	2.20	1.84	1.48
7 - Granite Creek	24.68[1]	20.33[1]	15.82[1]	13.39[1]	10.86	8.33	5.92	4.93	3.94	2.96
6 - Miguel Creek-Eleanor Creek	3.47	2.22	0.98	0.77	0.56	0.36	0.15	0.15	0.14	0.14
6 - Poopenaut Valley-Tuolumne River	4.45	3.06	1.68	1.41	1.11	0.81	0.51	0.48	0.46	0.43
6 - Lower Middle Fork Tuolumne River	9.96	7.68	5.23	4.66	3.95	3.36	2.84	2.62	2.41	2.21
6 - Upper Middle Fork Tuolumne River	3.66	2.61	1.56	1.20	0.83	0.47	0.11	0.11	0.11	0.11
6 - Lower South Fork Tuolumne River	7.01	5.62	3.97	3.75	3.69	3.30	2.91	2.72	2.53	2.34
6 - Upper South Fork Tuolumne River	3.07	2.22	1.28	1.09	0.88	0.69	0.50	0.47	0.44	0.41

[1] Denotes watersheds over the TOC

Alternative 3

DIRECT AND INDIRECT EFFECTS

Erosion and Sedimentation

Factors Affecting Erosion and Sedimentation

The potential for soil compaction and displacement are similar to Alternative 1 because similar acreages of mechanical treatment are proposed and because management requirements and BMPs prescribed under Alternative 1 are also prescribed under Alternative 3.

Alternative 3 includes site-specific requirements for increasing ground cover to reduce erosion and sedimentation in watershed sensitive areas (WSAs). WSAs are portions of the watersheds that were determined to be at high risk of soil erosion and sedimentation due to the combined effects of the Rim

Fire and proposed recovery activities. Criteria for evaluating the existence of WSAs include: proposed recovery activities, burn severity, percent slope, slope shape, slope length, existing and potential soil cover, proximity to intermittent and perennial drainages, and proximity to high runoff response soils. Two treatments are prescribed to achieve increased ground cover: mastication and drop and lop. Mastication is proposed on 1,309 acres of WSAs and would involve grinding or shredding dead trees less than 10 inches dbh into chunks less than 2 feet in length to create ground cover. Drop and lop is proposed on an additional 2,228 acres of WSAs under Alternative 3. This treatment would involve felling non-merchantable trees less than 10 inches dbh and lopping them into pieces in lengths short enough such that the dropped material is not stacked and has as much ground contact as practical. A minimum 50 percent effective ground cover is desired under both treatment techniques. A maximum of 10-20 tons/acre of fuel loading is allowed. Under Alternative 3, research would be conducted to determine the effectiveness of these ground cover treatments at reducing erosion and sedimentation.

Erosion and Sedimentation from Treatment Activities

Salvage of Merchantable and Non-Merchantable Trees

As described under Alternative 1, erosion modeling using Disturbed WEPP (Water Erosion Prediction Project) was conducted within the fire perimeter to determine both post-fire (pre-implementation) and post-implementation erosion rates. Table 3.14-11 models erosion rates in each watershed.

Table 3.14-11 Alternative 3: Post-Fire and Post-Implementation Erosion Rates and Percent Change for Each Watershed

HUC Level and Name	**Post-Fire Erosion Rate** (tons/acre)	**Post-Implementation Erosion Rate** (tons/acre)	**Erosion Rate[1] Change** (%)
6 - Grapevine Creek-Tuolumne River	2.0	1.9	-5.0
6 - Jawbone Creek-Tuolumne River	3.6	3.3	-8.3
7 - Corral Creek	4.7	3.5	-25.5
7 - Lower Jawbone Creek	4.9	4.4	-10.2
6 - Lower North Fork Tuolumne River	0.9	0.9	0.0
6 - Lower Clavey River	2.9	2.7	-6.9
7 - Bear Springs Creek	3.1	2.7	-12.9
6 - Middle Clavey River	1.2	1.1	-8.3
6 - Reed Creek	1.4	1.2	-14.3
7 - Lower Reed Creek	3.2	2.5	-21.9
6 - Lower Cherry Creek	2.4	2.3	-4.2
7 - Granite Creek	3.6	3.4	-5.6
6 - Miguel Creek-Eleanor Creek	1.1	1.1	0.0
6 - Poopenaut Valley-Tuolumne River	1.4	1.4	0.0
6 - Lower Middle Fork Tuolumne River	2.8	2.4	-14.3
6 - Upper Middle Fork Tuolumne River	0.9	0.9	0.0
6 - Lower South Fork Tuolumne River	3.1	2.8	-9.7
6 - Upper South Fork Tuolumne River	0.9	0.9	0.0
6 - Bull Creek	0.6	0.6	0.0
6 - Bean Creek-North Fork Merced River	0.7	0.7	0.0

[1] Negative percent change indicates reduced erosion. Positive percent change indicates increased erosion.

Seven of the fifteen HUC 6 watersheds are anticipated to have negligible changes in erosion at the watershed scale (Table 3.14-11). The eight HUC 6 watersheds with projected changes in erosion had lower erosion rates post-implementation than post-fire. This is attributed to increased ground cover in high vegetation burn severity areas due to mastication, drop and lop, and the addition of activity fuels. The modeling also indicated that all five HUC 7 watersheds would have decreased erosion rates following project implementation. The largest erosion rate change was a reduction of 1.2 tons/acre (-25.5 percent) in the Corral Creek watershed.

Although modeling results indicate that erosion rates either would not measurably change or would decrease as a result of Alternative 3, stream sedimentation still has the potential to occur as a result of this alternative, particularly in areas where logging activities create more effective sediment transport networks to stream channels. Table 3.14-12 shows salvage logging acres (combined timber units and hazard tree removal) within 100 feet of perennial or intermittent streams and SAFs by soil burn severity. All system types (ground-based, skyline, and helicopter) are included in this table.

Despite implementation of BMPs and management requirements, increased stream sedimentation is anticipated as a result of Alternative 3, particularly in areas where logging activities create more effective sediment transport networks to stream channels. This is more likely to occur in the Jawbone Creek-Tuolumne River, Corral Creek, Reed Creek, Lower Reed Creek, Lower Cherry Creek, Granite Creek, and Lower Middle Fork Tuolumne River watersheds than in other HUC 6 or HUC 7 watersheds due to the larger acreages of high soil burn severity areas near streams proposed for treatment.

Table 3.14-12 Alternative 3: Salvage Logging by Soil Burn Severity Within 100 feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature

HUC Level and Name	**Salvage Logging Within 100 Feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature** (acres)		
	High Soil Burn Severity	**Moderate Soil Burn Severity**	**Low Soil Burn Severity**
6 - Grapevine Creek-Tuolumne River	0	23	34
6 - Jawbone Creek-Tuolumne River	76	234	78
7 - Corral Creek	45	92	23
7 - Lower Jawbone Creek	8	53	3
6 - Lower North Fork Tuolumne River	1	14	24
6 - Lower Clavey River	6	56	78
7 - Bear Springs Creek	6	26	31
6 - Middle Clavey River	6	49	134
6 - Reed Creek	48	105	82
7 - Lower Reed Creek	47	94	25
6 - Lower Cherry Creek	49	113	38
7 - Granite Creek	37	55	3
6 - Miguel Creek-Eleanor Creek	0	4	13
6 - Poopenaut Valley-Tuolumne River	4	4	1
6 - Lower Middle Fork Tuolumne River	47	327	137
6 - Upper Middle Fork Tuolumne River	0	12	8
6 - Lower South Fork Tuolumne River	11	169	260
6 - Upper South Fork Tuolumne River	0	3	23
6 - Bull Creek	0	7	11
6 - Bean Creek-North Fork Merced River	0	17	28

Mastication

Mastication is proposed on 1,309 acres of WSAs and would involve grinding or shredding dead trees less than 10 inches dbh into chunks less than 2 feet in length to create ground cover. Research in the Lake Tahoe Basin indicated that creating 25 percent ground cover with masticated material was effective at filtering sediment in unburned areas (Harrison 2012).

Although heavy equipment is used in the mastication treatment, it is not expected to cause measurable erosion and sedimentation. This treatment creates ground cover and thus is used to prevent erosion and filter sediment. BMPs and management requirements for ground-based mechanized equipment apply to mastication. This includes requirements such as equipment exclusion zones and restrictions on wet weather operations.

Piling and Burning

The effects of piling and burning under Alternative 3 are anticipated to be similar or less than those found under Alternative 1. One difference is that dozer piling is prohibited in WSAs. In these areas, grapple piling is the only machine piling technique allowed. Because of this, less dozer piling acres are proposed under Alternative 3 than Alternative 1. The effects of grapple piling on erosion and sedimentation are anticipated to be less than dozer piling because materials are picked up and moved into piles rather than pushed into piles. Another difference is that allowable fuel loading under Alternative 1 is 10 tons/acre, while it is 10-20 tons/acre under Alternative 3. This would result in the need for slightly less piling under Alternative 3.

Roads

Alternative 3 includes about 1 mile of new road construction, 324 miles of road reconstruction, 201 miles of road maintenance, 3.3 miles of temporary use-revert and 35 miles of temporary road construction. This would include 1 new permanent stream crossing along a newly constructed road.

Road Construction

The effects of new road construction on erosion and sedimentation are anticipated to be less under Alternative 3 than Alternative 1. This is because only 1.04 miles of new road construction are proposed under Alternative 3, whereas Alternative 1 proposes 5.4 miles. In addition, Alternative 1 proposed 6 perennial and intermittent stream crossings, while Alternative 3 proposes only 1 intermittent stream crossing. The change in permanent road mileage as a result of Alternative 3 is a 0.65 percent increase in the Middle Clavey River watershed. BMPs and management requirements would limit sediment inputs to streams during road construction. Although some erosion and sedimentation is anticipated as a result of this activity, particularly in the first year or two following construction, overall increases in erosion and sedimentation are anticipated to be low as the percent increase in road mileage is low.

Road Reconstruction and Maintenance

Effects of road reconstruction and maintenance on erosion and sedimentation are expected to be similar to those described for Alternative 1, as the mileage proposed for these treatments are similar and the same BMPs and management requirements would be implemented.

Temporary Road Construction

Of the 32.2 miles of temporary roads identified for use under Alternative 3, 22.7 miles (70 percent) already exist on the ground as non-system routes. While additional traffic on these routes would cause soil disturbance and has the potential for increased erosion and sedimentation, these routes would be decommissioned following use, resulting in a net decrease of 22.7 miles of road on the landscape. The construction of new temporary roads would reduce infiltration and lead to potential increases in erosion and sedimentation. However, decommissioning these roads after use would reduce these impacts in the long term.

Material and Water Source Development

The effects of material and water source development on erosion and sedimentation are anticipated to be the same for Alternative 3 as Alternative 1 as the sites proposed for use are the same.

Fuel Loading

Fuel loading would decrease in the project area watersheds under Alternative 3. Coarse woody debris would be reduced to 10-20 tons/acre in all units proposed for treatment. This is slightly higher than the 10 tons/acre prescribed under Alternative 1. Allowable tons/acre increase under Alternative 3 to provide for increased ground cover capable of filtering erosion, and for other resource benefits. This tonnage would still result in lower flame lengths and fireline intensities, allowing for direct attack of future wildfires. Reducing fuel loading and then maintaining these fuel loads with prescribed fire has less potential for erosion and sedimentation than allowing fuel loading to increase as snags fall and having another large stand-replacing wildfire in the future.

Riparian Vegetation

The effects of Alternative 3 on riparian vegetation are similar to that described for Alternative 1. Management requirements require retention of remaining post-fire obligate riparian shrubs and trees that have live crown foliage or are resprouting. Riparian vegetation may be beneficially affected by Alternative 3 where burned overstory trees are removed.

One fen exists within the roadside hazard tree removal area. No fens are within salvage treatment units. Removal of hazard trees near the fen is not anticipated to affect it, as management requirements such as equipment exclusion zones would be implemented.

Alternative 3 includes 63 acres of meadows within treatment units. Removal of trees along meadow edges is not expected to affect meadows, as management requirements would be implemented.

Stream Condition

Stream Flow

The effects of Alternative 3 on stream flow are anticipated to be similar to those described for Alternative 1. Live trees would only be removed if they are a hazard tree and pose a risk to health and safety. Otherwise, all trees proposed for harvest would be dead and their removal would not affect soil water storage, interception, or evapotranspiration beyond the changes that already occurred as a result of the fire. Treatments that increase ground cover, such as mastication and drop and lop, or minimize compaction, such as subsoiling, promote infiltration and reduce overland flows, leading to reduced storm peak events and total flows. Therefore, measurable changes in stream flow are not anticipated to result under Alternative 3.

Stream Morphology

The effects of Alternative 3 on stream morphology are anticipated to be similar to those described under Alternative 1. Channel incision is not expected as a result of Alternative 3, as measureable changes in stream flow are not anticipated. Management requirements and BMPs are expected to protect bank stability.

Large Woody Debris

Under Alternative 3, existing downed large woody debris (LWD) in the channel would be retained. In addition, a minimum of 5 large snags per acre would be retained within 100 feet of perennial streams to provide for future recruitment of LWD. As a result of this snag retention, large woody debris levels in streams would increase over time following project implementation. Levels would be lower, however, than if harvesting did not occur near stream channels and all snags were retained. The Aquatics Report (project record) provides more information on large woody debris.

Water Quality (Beneficial Uses of Water)

The effects of Alternative 3 on water temperature, sediment-related parameters, and water quality as a result of pesticides (registered borate compound) are anticipated to be similar to those described under Alternative 1. There is a slight increase in total unit acreage under Alternative 3, due primarily to the addition of 3,000 acres of wildlife treatment units designed to allow for improved deer passage. However, management requirements and BMPs are designed to minimize impacts. Alternative 3 also identified watershed sensitive areas for additional ground cover treatments (mastication and drop and lop), which should further mitigate impacts under these alternatives.

CUMULATIVE EFFECTS

Equivalent Roaded Acres (ERAs)

ERAs were calculated for twelve HUC 6 and five HUC 7 watersheds. Results of these analyses were similar to that found under Alternative 1. Table 3.14-13 shows the ERA values for Alternative 3.

HUC 6 and 7 Watersheds

ERA values for twelve of the seventeen HUC 6 and HUC 7 watersheds were equal or slightly less for Alternative 3 than Alternative 1. These values decreased by up to 0.50 percent for Alternative 3 in 2014. Five HUC 6 and HUC 7 watersheds had higher ERA values than Alternative 1. The largest increase in 2014 was 0.95 percent in the Corral Creek watershed. ERA increases were attributed primarily to the addition of wildlife treatment units to improve deer passage. The other substantial difference between Alternative 1 and Alternative 3 was the development of WSA treatments for increased ground cover under Alternative 3. This increased ground cover is anticipated to reduce the risk of cumulative watershed effects.

With slight differences in ERA values between Alternative 1 and Alternative 3, the watersheds that exceeded the TOC were the same. Therefore, cumulative effects for Alternative 3 are anticipated to be the same as described for Alternative 1.

Grazing

Same as Alternative 1.

Table 3.14-13 Alternative 3: Annual Percent ERA for each HUC 6 and HUC 7 Analysis Watershed

HUC Level and Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
6 - Grapevine Creek-Tuolumne River	4.31	3.50	2.51	2.36	2.18	2.00	1.83	1.69	1.56	1.43
6 - Jawbone Creek-Tuolumne River	16.56[1]	16.08[1]	12.96[1]	11.41	9.78	7.91	6.15	5.05	3.96	2.87
7 - Corral Creek	21.08[1]	25.40[1]	21.84[1]	19.43[1]	16.86[1]	13.551	10.24	8.42	6.60	4.79
7 - Lower Jawbone Creek	14.17[1]	13.27[1]	9.95	9.01	7.94	6.59	5.25	4.41	3.59	2.77
6 - Lower Clavey River	9.62	9.80	8.20	7.40	6.57	5.59	4.61	3.82	3.04	2.30
7 - Bear Springs Creek	12.91[1]	12.78[1]	10.76	9.58	8.40	7.02	5.66	4.61	3.56	2.62
6 - Middle Clavey River	4.76	5.15	4.65	5.07	5.39	5.58	4.90	4.31	3.73	3.17
6 - Reed Creek	8.20	9.40	8.40	7.96	7.06	6.02	4.94	4.22	3.51	2.79
7 - Lower Reed Creek	17.38[1]	17.99[1]	15.26[1]	13.20[1]	11.25	8.99	6.86	5.70	4.55	3.40
6 - Lower Cherry Creek	11.27	9.96	7.77	6.80	5.79	4.70	3.64	3.07	2.49	1.92
7 - Granite Creek	26.02[1]	23.02[1]	18.47[1]	15.93[1]	13.29[1]	10.41	7.65	6.30	4.96	3.63
6 - Miguel Creek-Eleanor Creek	3.68	2.61	1.34	1.09	0.86	0.61	0.36	0.31	0.27	0.22
6 - Poopenaut Valley-Tuolumne River	4.56	3.29	1.89	1.61	1.30	0.97	0.64	0.59	0.53	0.48
6 - Lower Middle Fork Tuolumne River	12.77[1]	15.17[1]	13.26[1]	12.16[1]	10.87	9.28	7.77	6.56	5.38	4.21
6 - Upper Middle Fork Tuolumne River	3.74	2.78	1.74	1.36	0.99	0.60	0.22	0.20	0.17	0.15
6 - Lower South Fork Tuolumne River	9.12	9.83	8.50	7.87	7.42	6.44	5.52	4.81	4.10	3.40
6 - Upper South Fork Tuolumne River	3.18	2.42	1.50	1.28	1.06	0.84	0.62	0.57	0.51	0.46

[1] Denotes watersheds over the TOC

Alternative 4

DIRECT AND INDIRECT EFFECTS

The direct and indirect effects of Alternative 4 are the same as those for Alternative 3 with the exception of those described below.

Erosion and Sedimentation

Factors Affecting Erosion and Sedimentation

Drop and lop is proposed on an additional 1,309 under Alternative 4 compared to an additional 2,228 acres of WSAs under Alternative 3. This treatment would involve felling non-merchantable trees less than 10 inches dbh and lopping them into pieces in lengths short enough such that the dropped material is not stacked and has as much ground contact as practical. A minimum 50 percent effective ground cover is desired. A maximum of 10-20 tons/acre of fuel loading is allowed. Under Alternative 4, research would be conducted to determine the effectiveness of these ground cover treatments at reducing erosion and sedimentation.

Erosion and Sedimentation from Treatment Activities

Salvage of Merchantable and Non-Merchantable Trees

As described under Alternative 1, erosion modeling using Disturbed WEPP (Water Erosion Prediction Project) was conducted within the fire perimeter to determine both post-fire (pre-implementation) and post-implementation erosion rates. Table 3.14-14 models erosion rates in each watershed.

Seven of the fifteen HUC 6 watersheds are anticipated to have negligible changes in erosion at the watershed scale (Table 3.14-14). The eight HUC 6 watersheds with projected changes in erosion had lower erosion rates post-implementation than post-fire. This is attributed to increased ground cover in high vegetation burn severity areas due to mastication, drop and lop, and the addition of activity fuels. The modeling also indicated that all five HUC 7 watersheds would have decreased erosion rates following project implementation. The largest erosion rate change was a reduction of 1.2 tons/acre (-25.5 percent) in the Corral Creek watershed.

Table 3.14-14 Alternative 4: Post-Fire and Post-Implementation Erosion Rates and Percent Change for Each Watershed

HUC Level and Name	**Post-Fire Erosion Rate** (tons/acre)	**Post-Implementation Erosion Rate** (tons/acre)	**Erosion Rate[1] Change** (%)
6 - Grapevine Creek-Tuolumne River	2.0	1.9	-5.0
6 - Jawbone Creek-Tuolumne River	3.6	3.3	-8.3
7 - Corral Creek	4.7	3.5	-25.5
7 - Lower Jawbone Creek	4.9	4.4	-10.2
6 - Lower North Fork Tuolumne River	0.9	0.9	0.0
6 - Lower Clavey River	2.9	2.7	-6.9
7 - Bear Springs Creek	3.1	2.7	-12.9
6 - Middle Clavey River	1.2	1.1	-8.3
6 - Reed Creek	1.4	1.2	-14.3
7 - Lower Reed Creek	3.2	2.7	-15.6
6 - Lower Cherry Creek	2.4	2.3	-4.2
7 - Granite Creek	3.6	3.4	-5.6
6 - Miguel Creek-Eleanor Creek	1.1	1.1	0.0
6 - Poopenaut Valley-Tuolumne River	1.4	1.4	0.0
6 - Lower Middle Fork Tuolumne River	2.8	2.4	-14.3
6 - Upper Middle Fork Tuolumne River	0.9	0.9	0.0
6 - Lower South Fork Tuolumne River	3.1	2.8	-9.7
6 - Upper South Fork Tuolumne River	0.9	0.9	0.0
6 - Bull Creek	0.6	0.6	0.0
6 - Bean Creek-North Fork Merced River	0.7	0.7	0.0

[1] Negative percent change indicates reduced erosion. Positive percent change indicates increased erosion.

Although modeling results indicate that erosion rates either would not measurably change or would decrease as a result of Alternative 4, stream sedimentation still has the potential to occur as a result of this alternative, particularly in areas where logging activities create more effective sediment transport networks to stream channels. Table 3.14-15 shows salvage logging acres (combined salvage units and hazard tree removal) within 100 feet of perennial or intermittent streams and SAFs by soil burn severity. All system types (ground-based, skyline, and helicopter) are included in that table.

Roads

Alternative 4 includes about 315 miles of road reconstruction, 209 miles of road maintenance, 3.3 miles of temporary use-revert, and 34 miles of temporary road construction. No road construction, with associated stream crossings, is planned.

Road Construction

The increased overland flow rates and sediment yields associated with road construction would not occur under Alternative 4, as no road construction is proposed.

Temporary Road Construction

Of the 30.5 miles of temporary roads identified for use under Alternative 4, 22.1 miles (72 percent) already exist on the ground as non-system routes. While additional traffic on these routes would cause soil disturbance and has the potential for increased erosion and sedimentation, these routes would be decommissioned following use, resulting in a net decrease of 22.1 miles of road on the landscape. The construction of new temporary roads would reduce infiltration and lead to potential increases in erosion and sedimentation. However, decommissioning these roads after use would reduce these impacts in the long term.

Water Quality (Beneficial Uses of Water)

Alternative 4 includes a slight decrease (500 acres) in total unit acreage under as compared to Alternative 1.

Table 3.14-15 Alternative 4: Salvage Logging by Soil Burn Severity Within 100 feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature

HUC Level and Name	Salvage Logging Within 100 Feet of a Perennial Stream, Intermittent Stream, or Special Aquatic Feature (acres)		
	High Soil Burn Severity	Moderate Soil Burn Severity	Low Soil Burn Severity
6 - Grapevine Creek-Tuolumne River	0	23	34
6 - Jawbone Creek-Tuolumne River	76	234	78
7 - Corral Creek	45	92	23
7 - Lower Jawbone Creek	8	53	3
6 - Lower North Fork Tuolumne River	1	14	24
6 - Lower Clavey River	6	56	78
7 - Bear Springs Creek	6	26	31
6 - Middle Clavey River	5	35	125
6 - Reed Creek	30	91	81
7 - Lower Reed Creek	29	80	25
6 - Lower Cherry Creek	49	113	38
7 - Granite Creek	37	55	3
6 - Miguel Creek-Eleanor Creek	0	4	12
6 - Poopenaut Valley-Tuolumne River	4	4	1
6 - Lower Middle Fork Tuolumne River	47	327	137
6 - Upper Middle Fork Tuolumne River	0	12	8
6 - Lower South Fork Tuolumne River	11	168	259
6 - Upper South Fork Tuolumne River	0	3	23
6 - Bull Creek	0	7	11
6 - Bean Creek-North Fork Merced River	0	17	28

CUMULATIVE EFFECTS

Equivalent Roaded Acres (ERAs)

ERAs were calculated for twelve HUC 6 and five HUC 7 watersheds. Results of these analyses were similar to that found under Alternative 1. Table 3.14-16 shows the ERA values for Alternative 4.

Table 3.14-16 Alternative 4: Annual Percent ERA for each HUC 6 and HUC 7 Analysis Watershed

HUC Level and Name	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
6 - Grapevine Creek-Tuolumne River	4.31	3.50	2.51	2.36	2.18	2.00	1.83	1.69	1.56	1.43
6 - Jawbone Creek-Tuolumne River	16.56[1]	16.08[1]	12.96[1]	11.41	9.78	7.91	6.15	5.05	3.96	2.87
7 - Corral Creek	21.08[1]	25.40[1]	21.84[1]	19.43[1]	16.86[1]	13.55[1]	10.24	8.42	6.60	4.79
7 - Lower Jawbone Creek	14.17[1]	13.27[1]	9.95	9.01	7.94	6.59	5.25	4.41	3.59	2.77
6 - Lower Clavey River	9.62	9.80	8.20	7.40	6.57	5.59	4.61	3.82	3.04	2.30
7 - Bear Springs Creek	12.91[1]	12.78[1]	10.76	9.58	8.40	7.02	5.66	4.61	3.56	2.62
6 - Middle Clavey River	4.66	5.02	4.54	4.98	5.30	5.50	4.83	4.26	3.69	3.14
6 - Reed Creek	8.01	8.70	7.58	7.19	6.34	5.41	4.43	3.81	3.19	2.57
7 - Lower Reed Creek	16.77[1]	15.93[1]	12.93[1]	10.99	9.19	7.22	5.37	4.50	3.64	2.77
6 - Lower Cherry Creek	11.22	9.71	7.49	6.54	5.54	4.49	3.46	2.92	2.38	1.84
7 - Granite Creek	26.02[1]	22.93[1]	18.29[1]	15.69[1]	12.98[1]	10.14	7.41	6.10	4.79	3.50
6 - Miguel Creek-Eleanor Creek	3.66	2.54	1.26	1.02	0.79	0.55	0.30	0.27	0.23	0.20
6 - Poopenaut Valley-Tuolumne River	4.56	3.29	1.89	1.61	1.30	0.97	0.64	0.59	0.53	0.48
6 - Lower Middle Fork Tuolumne River	12.77[1]	15.17[1]	13.26[1]	12.16[1]	10.87	9.28	7.77	6.56	5.38	4.21
6 - Upper Middle Fork Tuolumne River	3.74	2.78	1.74	1.36	0.99	0.60	0.22	0.20	0.17	0.15
6 - Lower South Fork Tuolumne River	9.11	9.76	8.41	7.79	7.35	6.38	5.47	4.77	4.07	3.38
6 - Upper South Fork Tuolumne River	3.18	2.41	1.48	1.27	1.04	0.83	0.61	0.56	0.51	0.45

[1] Denotes watersheds over the TOC

Summary of Effects Analysis across All Alternatives

Erosion and Sedimentation

Under Alternative 1, erosion rates as a result of salvage harvest are anticipated to have negligible change in most HUC 6 watersheds. Two HUC 6 watersheds are projected to have decreased erosion and one watershed is projected to have increased erosion. Sedimentation increases due to salvage harvest are anticipated to be highest in HUC 6 watersheds with treatments proposed within 100 feet of streams in high soil burn severity areas (Jawbone Creek-Tuolumne River, Reed Creek, Lower Cherry Creek, and Lower Middle Fork Tuolumne River). Of the piling and burning activities, dozer piling has the highest potential for sedimentation and could occur in any of the treatment units. This alternative has the highest mileage of road construction, leading to the largest potential for road related erosion and sedimentation. Alternative 1 proposed 6 perennial and intermittent stream crossings, while Alternative 3 proposes only 1 intermittent stream crossing and Alternative 4 has no road construction nor proposed stream crossings. While road reconstruction and maintenance cause disturbance, improving and maintaining drainage features can reduce erosion from current levels. Temporary road construction would involve the construction of new temporary roads and the use of existing non-system roads, all of which would be decommissioned following use. This decommissioning would result in fewer roads on the landscape post-project than pre-project. Some sedimentation could occur as a result of material source and water source development.

Under Alternative 2, erosion rates in HUC 6 watersheds are anticipated to be similar to those watersheds under Alternative 1 and similar to or higher than those watersheds under Alternatives 3 and 4 due to a lack of ground cover. New sediment transport networks would not be created. However, reductions in soil compaction on existing skid trails would not occur, so these sediment transport networks would remain in place. There is no risk of erosion and sedimentation from piling and burning, road construction, material source development, or water source development. Road reconstruction and maintenance would not occur, so hydrologic connectivity of roads and streams would remain. Temporary road construction would not occur, so temporary roads already existing on the landscape would not be decommissioned.

Under Alternatives 3 and 4, erosion rates for HUC 6 watersheds are anticipated to have either negligible change or reduced erosion rates. Sedimentation increases due to salvage harvest are anticipated to be highest in HUC 6 watersheds with treatments proposed within 100 feet of streams in high soil burn severity areas (Jawbone Creek-Tuolumne River, Reed Creek, Lower Cherry Creek, and Lower Middle Fork Tuolumne River). Watershed sensitive areas (WSAs) were delineated for these alternatives and ground cover treatments were prescribed (mastication and drop and lop) to reduce the risk of sedimentation. Of the piling and burning activities, dozer piling has the highest potential for sedimentation. These alternatives have restrictions that prohibit dozer piling in WSAs. Alternative 3 has only 1 mile of permanent road construction with 1 associated stream crossing and Alternative 4 has no permanent road construction. While road reconstruction and maintenance cause disturbance, improving and maintaining drainage features can reduce erosion from current levels as described in Alternative 2. Temporary road construction would involve the construction of new temporary roads and the use of existing non-system roads, all of which would be decommissioned following use. This decommissioning would result in fewer roads on the landscape post-project than pre-project. Some sedimentation could occur as a result of material source and water source development.

Fuel Loading

Under Alternative 1, fuel loading would be reduced to 10 tons/acre of surface fuels, allowing for direct attack of future wildfires and maintenance of reduced fuel loading with prescribed fire.

Under Alternative 2, fuel loading would increase over time, to an estimated 98 tons/acre of surface fuels in 30 years. This would not allow for direct attack of wildfires or use of prescribed fire. A future reburn under such extreme fuel loading conditions would likely lead to soil erosion and sedimentation more severe than that caused by fuel reduction treatments.

Under Alternatives 3 and 4, fuel loading would be reduced to 10-20 tons/acre of surface fuels, allowing for direct attack of future wildfires and maintenance of reduced fuel loading with prescribed fire.

Riparian Vegetation

Under Alternatives 1, 3 and 4, removal of burned overstory trees may provide slight increases in sunlight, benefitting regrowth of riparian obligate trees and shrubs. Management requirements would prevent disturbance to riparian vegetation, including at a fen and numerous meadows.

Under Alternative 2, no removal of burned overstory trees would occur, so no benefits of slight increase in sunlight would occur. There would be no disturbance to riparian vegetation.

Stream Condition

Under Alternative 1, measurable changes in stream flow or channel incision are not anticipated. Stream banks in high soil burn severity areas may receive increased cover as part of ground cover treatments, resulting in improved bank stability. Snags would be felled into stream channels for increased LWD.

Under Alternative 2, no changes in stream flow or channel incision are anticipated. There would initially be less ground cover along stream banks than the action alternatives because no ground cover would be added. Over time, near-stream snags would fall into streams, leading to large levels of LWD.

Under Alternatives 3 and 4, measurable changes in stream flow or channel incision are not anticipated. Stream banks in high soil burn severity areas may receive increased cover as part of ground cover treatments, resulting in improved bank stability. Snags would be left adjacent to stream channels, allowing for natural recruitment of LWD, but at levels much less than Alternative 2.

Water Quality (Beneficial Uses of Water)

Under Alternatives 1, 3, and 4, water temperature is not expected to be affected. Some sedimentation would likely occur, particularly in areas which have high soil burn severity adjacent to streams. The potential for the registered borate compound to contaminate surface water is limited. Effects to beneficial uses are not anticipated.

Under Alternative 2, no changes to water temperature, stream sedimentation, or water quality related to pesticide applications are anticipated. Effects to beneficial uses are not anticipated.

Compliance with the Forest Plan and Other Direction

Standards and Guidelines

The Watershed Report and Forest Plan Compliance Checklist (project record) describe the S&Gs applicable to watershed resources, as well as how the S&Gs would be met under the action alternatives.

Beneficial Uses of Water

All alternatives are expected to result in maintenance of the applicable beneficial uses of water in the Water Quality Control Plan (Basin Plan) for the California Central Valley Water Quality Control Board (CVRWQCB 2011). Water temperature, sediment, and water quality following pesticide use are not expected to be adversely altered. Domestic and municipal water supplies and power are not adversely affected by the proposed action or alternatives. Recreational contact and non-contact waters are suitable for human use. Warm and cold freshwater habitat and wildlife habitat are not adversely affected by the proposed action or alternatives.

Water Quality Best Management Practices (BMPs)

Alternatives 1, 3 and 4 comply with the intent and procedural requirements of BMPs (USDA 2011, USDA 2012). If any of the action alternatives are implemented, or a combination thereof, applicable BMPs would be followed. BMPs would not be implemented under Alternative 2 (No Action), as no recovery activities would occur under this alternative.

3.15 WILDLIFE

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

The purpose of this section is to evaluate and disclose the effects of the Rim Recovery project to Threatened, Endangered, and Sensitive wildlife species; pursuant to:

- The National Forest Management Act (1976)
- Forest Service Manual and Handbooks (FSM and FSH 2670)
- Threatened and Endangered Species: Endangered Species Act (ESA) of 1973:
  - Review, through the biological evaluation process, actions and programs authorized, funded, or carried out by the Forest Service to determine their potential for effect on Threatened and Endangered species and species proposed for listing.
  - Avoid all adverse impacts on Threatened and Endangered species and their habitats, except in the following situations: when it is possible to compensate adverse effects totally through alternatives identified in a biological opinion rendered by USFWS; when an exemption has been granted under the Endangered Species Act; or when USFWS biological opinion recognizes an incidental taking.
  - Initiate consultation or conference with USFWS when the Forest Service determines that proposed activities may have an effect on Threatened or Endangered species; are likely to jeopardize the continued existence of a proposed species; or result in the destruction or adverse modification of critical or proposed critical habitat.
- Sensitive Species:
  - As part of the National Environmental Policy Act process, review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species.
  - Avoid or minimize impacts to species whose viability has been identified as a concern.
  - If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- National Forest Management Act (NFMA) and implementing regulations (CFR 219.19).
- Other species of conservation concern:
  - Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.

The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Threatened and Endangered species are those federally listed by the USFWS; Candidate species are candidates to become Proposed species but issuance of a proposed rule is currently precluded by higher priority listing actions (USFWS 1998). Sensitive species are those designated by the Regional Forester with the goal of proactively developing and implementing management practices to ensure that those species do not become Threatened or Endangered, and therefore require protection under the Endangered Species Act because of Forest Service actions (FSM 2670). Sensitive species are species identified where population viability is a concern because of 1) downward population trends and per or 2) diminished habitat capacity that would reduce species distribution. Habitat descriptions, species population trends, and the status of known or suspected limiting factors are summarized by USDA 2001, 2004, the R5 Sensitive species evaluation form 2012, and Keane 2013 and are incorporated here by reference. Table 3.15-1 shows the wildlife species addressed in the first portion of section 3.15. Rational for why a species is not addressed in this section is in the Wildlife BE.

Table 3.15-1 Endangered (E), Threatened (T), Candidate (C), Sensitive species (S), and other species of conservation concern considered in this analysis. Some species may also be identified as Management Indicator Species (MIS) or Neotropical Birds further on in this section

Common Name	Scientific Name	Status	Detailed in this section
Threatened and Endangered			
Invertebrates			
Valley Elderberry Longhorn Beetle	*Desmocerus californicus dimorphus*	T	yes
Sensitive			
Birds			
Bald Eagle	*Haliaeetus leucocephalus*	S	yes
California Spotted Owl	*Strix occidentalis occidentalis*	S, MIS	yes
Great Gray Owl	*Strix nebulosa*	S	yes
Northern Goshawk	*Accipiter gentilis*	S	yes
Willow Flycatcher	*Empidonax traillii*	S	no
Mammals			
American Marten	*Martes americana sierrae*	S, MIS	yes
Pacific Fisher	*Martes pennanti pacifica*	S, C	yes
California Wolverine	*Gulo gulo luteus*	S	no
Sierra Nevada Red Fox	*Vulpes vulpes necator*	S	no
Fringed Myotis	*Myotis thysanodes*	S	yes
Pallid Bat	*Antrozous pallidus*	S	yes
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	S	no
Other species of conservation concern			
Other Species of particular conservation concern for this project			
Black-backed Woodpecker	*Picoides arcticus*	MIS, SCC	yes
Mule Deer	*Odocoileus hemionus*	MIS, SCC	yes

Effects Analysis Methodology

Assumptions Specific to Wildlife

While some of these assumptions may be debatable, the comparison of alternatives using these assumptions is valid because the same assumptions are applied to all alternatives.

- For the snag retention management requirement in Old Forest Emphasis Area (OFEA), Home Range Core Area (HRCA), and Forest Carnivore Connectivity Corridor (FCCC) units, intent is to retain legacy structure where it exists for long-term resource recovery needs (i.e. the development of future old forest habitat with higher than average levels of large conifer snags and down woody material). This management requirement will retain all hardwood snags greater than or equal to 12 inches diameter at breast height (dbh) and in addition, retain 30 square feet basal area of conifer snags per acre by starting at the largest snag and working down, with a minimum of four and a maximum of six per acre (the maximum number was identified to meet economic and fuel reduction objectives in the purpose and need). We assume based on pre-fire stand exam data that on average this will result in retention of six 30 inch dbh snags per acre on a unit basis (six 30 inch dbh trees equal to 30 square feet basal area per acre). This requirement applies to Alternatives 3 and 4.
- For the snag retention management requirements in General Forest and other land allocations not managed for old forest emphasis objectives, intent is to retain snags in patches, avoiding uniformity across large areas. This management requirement will retain all hardwood snags greater than 12 inches dbh and in addition, retain the largest conifer snags greater than 15 inches

dbh at the rate of 4 per acre on a unit basis in mixed conifer (6 per acre in red fir). We assume based on pre-fire stand exam data that this is equivalent to an approximate basal area retention rate of 12 square feet per acre (four 24 inch dbh trees equal to 12 square feet basal area per acre). This requirement applies to all action alternatives. In Alternative 1, this requirement applies to all units.

- Snag retention along range fence units is a best estimate but is dependent on hazard tree criteria developed in cooperation with Yosemite National Park. On FR6469 in great gray owl PAC 16, hazards to the range fence may be felled but will be left in place.
- For the down woody material retention management requirement, emphasis is for retention at a rate of 15 to 20 tons per acre on a unit basis in OFEA, HRCA, FCCC, and roadside hazard units within Protected Activity Centers (PACs) while retention in general forest units is within the broader range of 10 to 20 tons per acre. “Of the largest” is defined as greater than 12 inches in diameter at midpoint and first retaining greater than 45 inches at midpoint if available, then greater than 24 to 45 inches at midpoint if available, then greater than 12 inches to 24 inches at midpoint if available.
- Pile and burn treatments will only take place where fuel loading exceeds 20 tons per acre and burning will not reduce large coarse woody debris below the 10 tons per acre standard.
- Hazard tree abatement would include the removal of all dead trees that have the potential to hit a target. A target is defined as the road prism or facilities such as fences or structures. Live trees may qualify as hazards if they are expected to fall and hit a target within the next two years. Very few green trees are expected to be removed based on the criteria, and all green trees would be identified and marked by qualified Forest Service personnel. We assume the amount of green tree removal as hazards will be conservative and that strict guidelines for marking, developed by Forest Health Protection (FHP) staff, will be followed.
- Dead trees have been defined for this project as trees with no visible green needles. Salvage of fire-killed trees would result in the removal of dead trees only, not trees that are declining or may die in the near future.
- The proposed application of a borax-based fungicide (Sporax) on cut stumps is considered very low risk and is not expected to result in adverse effects to terrestrial wildlife. The risk of exposure or ingestion is far below the level of concern (USDA 2006b).
- Unit boundaries were developed using GIS data at various scales. The level of inaccuracy of a line on a map at most scales used was approximately 20 feet. When utilizing these data on the ground, some variation in unit boundaries may occur. The scope of these variations were considered in our effects analysis.

Data Sources

- California Wildlife Habitat Relationships (CWHR, Ahlborn 2006).
- California Natural Diversity Database (CNDDB, CDFW 2014a).
- Natural Resource Information System (NRIS Wildlife, USDA 2014b).
- Deer telemetry data (CDFW).
- Black-backed woodpecker occupancy model by Tingley et al. 2014.
- GIS layers including: RAVG database, Worldview Imagery, Stanislaus vegetation database, land allocations, project unit boundaries and road treatments.
- Project survey reports and incidental detection records.
- Scientific literature and internal reports.
- Wildlife BE Appendix.

Wildlife Indicators

Wildlife indicators vary by species and are stated under the environmental consequences for each species.

Wildlife Methodology by Action

PROJECT ACTION AREA

Unless otherwise specified, the analysis area used to analyze the direct and indirect effects on wildlife and wildlife habitat is approximately 155,000 acres and includes Stanislaus National Forest System lands within the Rim Fire perimeter. The analysis area is based on 1) acres burned in a distinct geographic area and administrative setting that influences the purpose and need of proposed activities, 2) area of impact to forest vegetation from the wildfire and subsequent proposed project activities, 3) furthest measurable extent of changes to disturbance levels and habitat modification that would occur as a result of implementing any of the proposed alternatives, and 4) consistency with the analysis area described in the Rim Recovery EIS reports for fire and fuels, soils, and vegetation because ecologically, the dynamics among these elements are inherently linked with terrestrial wildlife habitat.

CUMULATIVE EFFECTS

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 Rim Fire perimeter (257,314 acres) was chosen as the cumulative effects analysis area for several reasons. Treatments are proposed in and would modify burned areas within the Rim Fire area only. Selection of the Rim Fire area for analysis provides an appropriate context for the reasonable determination of effects to species considered herein and their habitat. Relevant cumulative effects, particularly other projects that have or will treat areas within the fire perimeter are effectively addressed. This analysis is bounded in time for short-term effects (up to 20 years) and long-term effects (20 to 50 years). Past activities are considered part of the existing condition. Appendix B provides a list and description of past, present and reasonably foreseeable future actions considered for the Rim Recovery project. All activities listed and described are not expected to affect all species considered in this document. See individual species analysis sections for further discussion of relevant present and reasonably foreseeable future actions.

Valley Elderberry Longhorn Beetle: Affected Environment

Species Account

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is listed as Threatened under the Endangered Species Act. There is no Designated Critical Habitat on the Stanislaus National Forest. The valley elderberry beetle (VELB) is thought to range from the Central Valley into the eastern portion of the Coast Range and the foothills of the Sierra Nevada up to approximately 3,000 feet (USFWS 1999). This species is most often found along the margins of rivers and streams in the lower Sacramento River and upper San Joaquin Valley. The current known range of the VELB extends from southern Shasta County south to Fresno County (Barr 1991). When the VELB was originally listed as Threatened, it was only known from 10 populations; however, after extensive surveys it is known from almost 200 locations. USFWS has proposed to delist the VELB, based on the ongoing protection and restoration of habitat and because of the many populations of VELB discovered after the species was listed (USFWS 2006). At the time of listing, the main risk to VELB was the loss of valley riparian habitat; from 80 to over 90 percent of this habitat had been lost in the Central Valley. In recent years, this loss has been somewhat mitigated through regulatory protection, reserves, and restoration efforts. However, the primary habitat in the Central Valley remains limited due to levee and river maintenance projects (USFWS 2006).

Although surveys confirmed similar occupancy between 1991 and 2001, Collinge (2001) documented a 10 percent decline in the number of sites with elderberry shrubs. This decline resulted in a reduction in total numbers of occupied sites and shrub groups. Loss of riparian habitat and resulting fragmentation in the VELBs range may have resulted in a loss of populations and reduced occupancy rates (Ibid).

Surveys focus on suitable habitat in project areas below 3,000 feet in elevation. Low suitability areas (i.e., dense shrubs and forested stands) are not typically surveyed but it is likely mature plants would have been detected if present. Elderberry plants with the distinctive exit holes VELB create have been documented in the Tuolumne and Clavey River canyons. Most documented sites are alongside roads, due to the limited access and management in much of the river canyons. While several elderberry plants with exit holes have been documented within the analysis area, no VELB detections were made as a result of surveys.

The project is located within the potential elevation and geographic range of the species. The nearest documented occurrence was one beetle on an elderberry shrub almost 24 miles to the west of the fire near Jamestown in 2002. Their presence within the analysis area is unknown. However, presence is assumed where elderberry plants of adequate size occur below 3,000 feet in elevation. Adequate size is defined as stems greater than one inch in diameter at the base (Barr 1991).

Habitat Account

Habitat for the VELB consists of elderberry shrubs and trees in a variety of habitats and plant communities, but most often in riparian, elderberry savannah or moist valley oak woodlands. Common associated plants include *Populus* spp., Salix spp., *Fraxinus* spp., *Quercus* spp., *Juglans* spp., *Acer negundo, Rubus* spp., *Toxicodendron diversiloba, Vitis californica, Rosa* spp., and *Bacrecharis* spp. (USFWS 2006). VELB appear to favor sites with high elderberry densities and are limited in dispersal and colonization of new sites (Collinge et al. 2001).

The Rim Fire may have eliminated much of the suitable habitat for VELB in the Tuolumne and Clavey River canyons in the short-term. Elderberry plants damaged by fire are expected to resprout and new plants typically appear the season following fire (Crane 1989). Nonetheless, resprouting plants and new sprouts will likely take several seasons to reach suitable size for VELB. Several recorded plants on the Lumsden Road (1N10), on Road 1S01along Highway 120, and the Cherry Lake Road were severely damaged by the fire. Any beetles or larvae in these areas would likely have perished with the plants, and would be unlikely to recolonize from other locations because of the extent of fire in the Tuolumne River Canyon. The burn severity of known plants along the Tuolumne River is not known, but they may have burned with lower intensity.

There are about 24,713 acres of potential habitat within the analysis area. There are about 24,817 acres of potential habitat area within the cumulative analysis area. This is mainly in the river canyons where treatments are not proposed.

Eggs are laid in late spring on elderberry stems greater than 1 inch in diameter, as measured at the base, on healthy and unstressed plants. Larvae excavate passages into the elderberry shrub where they may remain in larval form for as long as two years before they emerge as adults. Exit holes are usually on stems greater than 0.5 inches in diameter, with 70 percent of the exit holes at heights of 4 feet or greater; these holes are circular to slightly oval, with a diameter of 7 to 10 mm (Barr 1991).

VELB has been found only in association with its host plant, elderberry. Adults feed on the foliage and perhaps flowers, and are present from March through early June (Barr 1991).

Risk Factors

Risk factors for VELB include:

- Loss or alteration of habitat. The primary threat to VELB survival is the loss or alteration of habitat. Stream development and urbanization have resulted in the removal of significant amounts of suitable habitat. On NFS lands, cattle grazing has heavily damaged elderberry in some areas and may have reduced the quantity and quality of available habitat.

- Pesticides and Herbicides. Individual beetles, localized beetle populations, and plants are subject to injury or loss from pesticide applications. Pesticides pose a risk to the VELB and its host plant. Some chemicals from the valley are known to drift upslope and into the Sierra on prevailing wind currents (McConnell et al. 1998, Bradford et al. 2010). Smaller amounts of pesticides and herbicides are used in the local area by the Forest Service to control shrubs and noxious weeds, and lesser amounts are used by surrounding local landowners.
- Predation. Predation by birds, other insects, and small mammals may have negative effects on localized populations.
- Argentine Ant. The widely established non-native Argentine ant (*Linepithema humile*) also poses a threat to VELB. While Argentine ants are common in the core valley habitat of the VELB, it does not appear to be widely established in the Sierra foothills, likely due to summer drought or winter cold.

Management Direction

Conservation Guidelines for VELB are provided in USFWS (1999). The proposed management requirements would mitigate adverse effects to this species under the proposed action and are consistent with the VELB Conservation Measures.

Valley Elderberry Longhorn Beetle: Environmental Consequences

The action alternatives could result in direct and indirect effects to the VELB through the following activities:

- Salvage of fire-killed trees, including roadside hazard trees.
- Fuel treatments (e.g., pile burning).

These activities may have direct and indirect effects on VELB through the following:

- Project related death, injury, or disturbance.
- Project related modifications to habitat quality.

Death, injury, or displacement

Death or injury from project related activities would be unlikely to occur given the mechanical activity buffers around suitable habitat (elderberry plants with stems greater than one inch) and Limited Operating Periods (LOPs) which would eliminate the potential for dust and smoke impacts. Larvae and the elderberry plants would be protected by buffers from mechanical operations. However, there is the potential for death or injury if a tree were felled and it crushed an elderberry plant or beetle.

Habitat modification

Because all identified elderberry plants with stems greater than one inch in diameter would be flagged and a buffer applied restricting mechanical activities, no modifications to habitat quality are expected.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the VELB and to determine how well project alternatives comply with Forest Plan Direction and the species' conservation strategies.

1. Disturbance potential
2. Habitat alteration potential

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Because there is a small difference in the amount of treatment areas proposed under the action alternatives, the effects are expected to be the same and are therefore analyzed together.

Indicator 1. Because virtually all of the VELB lifecycle is spent on elderberry shrubs, either inside the stems as larvae or on the foliage or flowers as adults, the greatest risk to individuals would come from activities in the immediate vicinity of elderberry plants.

Buffers applied to individual plants where no mechanical activity would occur and LOPs in place during the adult flight period restricting mechanical activities and pile burning would eliminate almost all risk to individuals associated with implementation of the action alternatives.

Indicator 2. Table 3.15-2 displays the proposed activities within the potential elderberry habitat area for the action alternatives.

Table 3.15-2 Proposed treatments within potential elderberry habitat area

Alternative	Removal of Fire-Killed Trees: Salvage and Hazard tree (acres)	Road Treatments: (temporary road construction, reconstruction, maintenance) (miles)	Percent of Potential Habitat Area Treated
1	1,055	13	4
3	573	13	2
4	573	13	2

Under Alternative 1, the additional 482 acres of proposed treatment is associated with hazard tree removal along Lumsden Road where there are documented occurrences of elderberry plants. Very few, if any hazard trees remain along this route so any additional effects associated with these acres are considered negligible.

Most of the documented plants in the project area were burned at varying levels of intensity in the Rim Fire. Because of the current open condition in burned areas where trees would be removed, it is expected that any plants sufficiently large enough to support VELB will be found. It is likely that if plants are not detected during surveys, they are small and isolated, and would not provide suitable habitat value for VELB. If new plants are detected prior to or during project implementation, all mitigation measures would be applied.

The protective measures proposed for this project have been applied repeatedly on the Stanislaus National Forest, for road improvements, noxious weed control, vegetation management, and prescribed burning, and have been successful in preventing damage to individual plants.

While there is some risk of disturbance or damage during implementation from vehicles using adjacent roads or people on foot, this risk is considered negligible and not beyond risks associated with ongoing activities and uses on public lands. Operating heavy equipment may result in excess deposition of dust and other particulate matter on individual plants; however, a study of proximity to roads and dust impacts to elderberry plants found no evidence of negative effects (Talley et al. 2006).

Elderberry plants in the project area may benefit from mechanical removal of dead trees because it would reduce the risk of direct impacts when the trees fall. Elderberry plants burned by the fire are expected to resprout vigorously and benefit from the more open, post-fire habitat, along with the greater availability of water, light, and minerals.

Thus, based on the above analysis, the potential for disturbance or habitat alteration with respect to VELB is either insignificant (cannot be meaningfully measured, detected, or evaluated) or discountable (extremely unlikely to occur).

CUMULATIVE EFFECTS

In making the determination for Alternative 1, 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 was considered. A list of the actions considered can be found in Appendix B.

Habitat modification was used as a relative measure of cumulative effects of the action alternatives.

Habitat Modification

The potential habitat area below 3,000 feet elevation is almost entirely within the Tuolumne River Canyon and its tributaries, which is managed by the Forest Service and the Bureau of Land Management. Much of the Tuolumne River are designated and managed as Wild and Scenic River.

Federal Lands

The Rim Hazard Tree Removal project is the only present action on public lands within the potential habitat area. This project is not likely to affect habitat suitability for VELB because management requirements in place will protect elderberry plants and the valley elderberry longhorn beetle.

There are no foreseeable future actions on federal lands within the potential habitat area below 3,000 feet.

Private Lands

The cumulative effects analysis area contains private timberland, residential areas, and rangeland. Some of the private inholdings include meadows and associated riparian habitat that may support elderberry shrubs. There are also power plants, dams, powerlines, and other facilities associated with Hetch-Hetchy in the Tuolumne River Canyon and Cherry Creek within the elevation range of VELB. There are 58 acres of private land where emergency fire salvage plans have been submitted to Cal Fire.

Headwater disturbances, which result in downstream flooding or mudslides, could result in the destruction of elderberry plants (USFWS 1984). Activities on private lands that may result in the incidental take of elderberry plants include removal of fuels around residences and infrastructure, grazing, introduction of noxious weeds, irrigation and landscaping, or habitat conversion such as recreation buildings or paved areas.

Alternative 1 Contribution/Summary

Because the Rim Recovery project is not expected to result in any measurable effects to VELB, it is not expected to contribute to cumulative effects.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur. Under Alternative 2, no indirect effects are expected because no active management would occur; however, there may be consequences under this alternative primarily related to the influence no action may have on future wildfires and how future wildfires may impact VELB habitat.

Indicator 1. Because no management activities would occur under this alternative, there would be no project related direct effects to individual valley elderberry longhorn beetles or larvae.

Indicator 2. Within the areas that burned at high severity, elderberry shrubs and other herbaceous and shrub vegetation is expected to be established within 3 to 5 years. Elderberry shrubs that are of appropriate size for beetle and larvae occupancy would provide additional suitable habitat for VELB. These benefits are expected in the short-term (10 to 20 years).

When wildfire returns to this landscape, the elderberry shrubs providing suitable habitat for VELB in or near areas that burned at high severity may be at increased risk of loss. One of the greatest risks to VELB is habitat loss. Within 10 years, the fuel loading is predicted to be four to eight times higher (78 tons per acre) than the desired condition (Rim EIS Fuels Report). However, predicting the effect no action would have on future wildfires and VELB habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (Rim EIS Fuels Report). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

CUMULATIVE EFFECTS

The cumulative effects discussion under Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands and listed in Appendix B.

Alternative 2 Contribution/Summary

The cumulative contribution of Alternative 2 is attributed to the influence no action may have on how future wildfires may adversely impact elderberry habitat. Since no fire killed trees would be removed, fuel loading would increase over time, resulting in increased fire intensity and a greater potential for loss of suitable habitat when wildfire returns to this landscape.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1 except Alternative 3 does not treat the 482 acres along Lumsden Road.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 3.

CUMULATIVE EFFECTS

Same as Alternative 1.

Valley Elderberry Longhorn Beetle: Summary of Effects

Alternatives 1, 3, and 4 would be unlikely to have any adverse direct or indirect effects to the VELB.

All elderberry plants capable of supporting VELB would be flagged and avoided. LOPs would be in place under all action alternatives to eliminate negative impacts from dust or smoke. Since there would be no removal of dead trees under Alternative 2, there would be no potential direct and indirect effects such as death or injury of individuals, or loss of potential habitat if a tree fell onto an elderberry shrub that is occupied by individuals.

Determinations

Implementing the Rim Recovery Project action alternatives has a very small potential to impact individual valley elderberry longhorn beetles and the elderberry habitat required by the species. The planned surveys and buffers established around individual plants and project management requirements would greatly reduce the potential risk associated with potential direct and indirect effects to individual VELB or associated elderberry plants. The project does not occur within Designated Critical Habitat for the species and would have no effect on critical habitat; however, the primary constituent elements occur within and adjacent to the planning area indicating suitable habitat is present. Therefore, the following determinations are supported by the analysis contained herein. Specifically, the potential for effects to VELB from implementation of the alternatives are either discountable (i.e. extremely unlikely to occur) or insignificant (i.e. cannot be meaningfully measured, detected, or evaluated).

Alternative 1 may affect but is not likely to adversely affect the valley elderberry longhorn beetle or its Designated Critical Habitat.

Alternative 2 will not affect the valley elderberry longhorn beetle or its Designated Critical Habitat.

Alternative 3 may affect but is not likely to adversely affect the valley elderberry longhorn beetle or its Designated Critical Habitat.

Alternative 4 may affect but is not likely to adversely affect the valley elderberry longhorn beetle or its Designated Critical Habitat.

Valley Elderberry Longhorn Beetle: Compliance

On August 8, 1980, VELB was listed as a Threatened species (45 FR 52803). Critical Habitat was also designated at this time, but does not occur on the Stanislaus National Forest. The action alternatives would not affect the recovery plan objectives for the VELB. The recovery plan objectives for VELB are to minimize further degradation, development, or environmental modification of VELB habitat, and to delist the VELB (USFWS 1984).

VELB Conservation Strategy Guidelines

The United States Department of the Interior, Fish and Wildlife Service issued Conservation Guidelines (USFWS 1999) to assist Federal agencies, during project planning, to avoid or minimize adverse effects on the valley elderberry longhorn beetle. The following guidelines and previous consultation recommendations from the Service were used when developing management requirements the Rim Recovery project:

Fence and flag all areas to be avoided during construction activities. In areas where encroachment on the 100 foot buffer has been approved by the Service, provide a minimum setback of 20 feet from the dripline of each elderberry plant.

Apply a limited operating period from April 1 through June 30 prohibiting pile burning and mechanical activities within 100 feet of elderberry plants to prevent smoke and dust impacts to beetles.

Bald Eagle: Affected Environment

Species and Habitat Account

The bald eagle (*Haliaeetus leucocephalus*) is currently managed as a USDA Forest Service Sensitive species (Update to the Regional Forester's Sensitive species list, July 3, 2013, USDA 2013g). In USFS Region 5 the bald eagle breeds primarily in specific and localized areas of large rivers and lakes of the northern third of California with scattered nesting throughout the state (R5 Sensitive species evaluation form of 2012, USDA 2012d).

Bald eagles typically nest in live trees, some with dead tops, and build a large (about 6 foot diameter), generally flat-topped and cone-shaped nest usually below the top with some cover above the nest (Jackman and Jenkins 2004). In general, bald eagles require a large tree to accommodate a large nest in a relatively secluded location within the range of their tolerance of human disturbance (Ibid). Diurnal perch habitat is characterized by the presence of tall, easily accessible; often predominate trees adjacent to shoreline foraging habitat (Buehler 2000). The entire breeding cycle, from initial activity at a nest through the period of fledgling dependency, is about 8 months (Ibid).

In the Rim Fire area there is one bald eagle nest. The nest is at Cherry Lake. This site has been occupied for more than 15 years. Although nest trees have changed over this period, the nest site has consistently been in the same general stand on the Cherry Lake shoreline. The post-fire condition of the nest, nest tree, and nest stand all appear intact and suitable (Roy Bridgman, pers.comm.). After over 15 years of being occupied as a bald eagle territory, it appears the carrying capacity of Cherry Lake is limited to one pair of breeding bald eagles. Bald eagles also use the Cherry Lake area during migration and for overwintering (NRIS Wildlife database, USDA 2014b).

Risk Factors

Risk factors potentially affecting bald eagle abundance and distribution include nest site loss and disturbance, and loss of habitat and habitat elements such as potential nest or roost trees (USDA 2001, R5 Sensitive species evaluation form 2012).

Management Direction

Current management direction is to follow all law, regulation, and policy as it relates to bald eagle because the species is still vulnerable to potential disturbance impacts and is still within the delisting monitoring period (R5 Sensitive species evaluation form of 2012). Forest Plan Direction (USDA 2010a) p. 43 states: When nesting bald eagles are found, implement suitable restrictions on nearby activities based on the Regional habitat management guidelines and the habitat capability model for the species. Protect all historic and active nests, as required by the Eagle Protection Act and the Migratory Bird Treaty Act.

The Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The Act provides criminal and civil penalties for persons who disturb nest sites by substantially interfering with normal breeding, feeding, or sheltering behavior (USFWS 2007).

The Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703-712, prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted by regulation. The MBTA was enacted in 1918; a 1972 agreement supplementing one of the bilateral treaties underlying the MBTA had the effect of expanding the scope of the Act to cover bald eagles and other raptors.

Habitat management guidelines to follow for bald eagle are provided by the National Bald Eagle Management Guidelines (USFWS 2007).

Bald Eagle: Environmental Consequences

The project alternatives could result in direct and indirect effects to the bald eagle through the following activities:

- Salvage harvest of fire-killed trees.
- Salvage harvest of roadside hazard trees.
- New permanent road construction, temporary road construction, and road reconstruction.
- Landing construction and use.
- Use of material sources and water sources.
- Biomass and similar fuel treatments.

These actions may have direct and indirect effects on bald eagles through the following:

- Project related death, injury, or disturbance.

- Project related modifications to habitat quantity and/or quality.

Death, injury or disturbance

Death, injury, and disturbance are potential direct effects to consider for bald eagle (USDA 2004). Project activities have the potential to cause death or injury by tree-falling or by the use of heavy equipment. There is the potential for death or injury if nest trees are not protected and are felled while being used by nesting birds during the reproductive season. In addition, historic nest trees could be removed if not identified and protected.

Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. Human presence in nest stands and loud noise in the vicinity of nest stands have the potential to change normal behavior and potentially impair essential behavior patterns of the bald eagle related to breeding, feeding, or sheltering. The potential for disturbance is minimized by following the National Bald Eagle Management Guidelines (USFWS 2007) and by the implementation of Limited Operating Periods (LOPs). Disturbance issues are expected to be most pronounced within a half-mile of nests (USFWS 2007).

Habitat modification

Salvage harvest of fire-killed trees and salvage harvest of roadside hazard trees could remove snags or live trees that could potentially serve as bald eagle perch sites or nest trees. There is considerable uncertainty with regards to treatment intensity in roadside hazard salvage units because treatment intensity is subject to a wide range of environmental conditions (e.g. drought and moisture stress) related to tree status.

New permanent road construction, temporary ("temp") road construction, road reconstruction, and landing construction, may also modify bald eagle habitat. If conducted in or too near bald eagle nest stands, project roads or landings could result in increased habitat fragmentation, disturbance, and lower habitat capability for bald eagle (USFWS 2007, Pyron et al. 2009). Biomass removal and other understory treatments outside of nest stands is generally not an issue and none are proposed in the nest stand.

As bald eagles focus nesting, roosting, and perching behaviors along lake shorelines, habitat modification effects are expected to be most pronounced within 500 feet of lake shorelines (Jackman and Jenkins 2004).

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the bald eagle and to determine how well project alternatives comply with Forest Plan Direction and species conservation strategies:

1. Project activities within a half-mile of the known bald eagle nest.
2. Treatment units within 500 feet of lake shorelines.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Table 3.15-3 shows four salvage units occur within a half-mile of the known bald eagle nest. These units are subject to the bald eagle Limited Operating Period (LOP) management requirement. One roadside hazard tree salvage unit skirts the edge of the half-mile buffer but is basically outside the ½ mile buffer circle. No landings, water sources, or material sources occur in the half-mile buffer. As any tree removal is beyond the critical distance identified in USFWS 2007, and as LOPs are in place for all project activities within a half-mile of the bald eagle nest, the potential effect of this indicator is minimized and below identified concern thresholds.

Table 3.15-3 Units within one-half mile of bald eagle nests

Project activity	Distance to nest site (feet)
Unit O1A. Salvage harvest	1,284
Unit O1B. Salvage harvest	538
Unit O08. Salvage harvest	1,658
Unit O09. Salvage harvest	950

Indicator 2. Only one treatment unit occurs within 500 feet of the Cherry Lake shoreline, as noted in the Wildlife BE maps appendix. The unit is a roadside hazard salvage unit on route 1N15Y. Route 1N15Y is gated closed to public access, but may be used for facility maintenance needs. There is considerable uncertainty with regards to treatment intensity in roadside hazard salvage units because treatment intensity is subject to a wide range of environmental conditions (e.g. drought and moisture stress) related to tree status. If conducted aggressively, hazard tree salvage could remove trees bald eagles are known to use within this unit (Rich, pers.obs.) and thus, lower habitat capability in approximately 25 acres of prime bald eagle habitat. However, because the road is gated closed to public use, and because it is unlikely that a target would be present within potential tree failure zones, probably fewer than three and more likely no trees would be removed. Assuming the latter, no measurable effect to bald eagle would occur within the expected treatment scope of this unit.

Cumulative Effects

Relevant risk factors potentially affecting bald eagle abundance and distribution have been identified and primarily include nest site loss and disturbance, and loss of habitat and habitat elements such as potential nest or roost trees (USDA 2001, R5 Sensitive species evaluation form 2012).

Based on relevant risk factors and location, the following present and reasonably foreseeable actions from Appendix B are the most relevant to bald eagle: Rim HT project, and recreation. As this project and the Rim HT project includes implementation of required LOPs, and as recreation is limited to existing and mostly quiet uses in this area (i.e. primarily trailhead parking and hiking), Alternative 1 will not likely contribute cumulatively to other actions.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur. The indirect effects of no action are not an issue because the influence no action would have on fire risk to bald eagle habitat is highly speculative.

CUMULATIVE EFFECTS

The effects of no action would be localized to the area surrounding Cherry Lake. The influence no action would have on bald eagle is largely speculative but probably not measurably significant.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 1.

CUMULATIVE EFFECTS

Same as Alternative 1.

Bald Eagle: Summary of Effects

Numerical values for both indicators are the same for all action alternatives. Thus, effects are the same for all action alternatives.

Determinations

The action alternatives may affect individuals but are not likely to result in a trend toward Federal listing or loss of viability for the bald eagle. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is demonstrated.

Alternative 2 will not affect the bald eagle.

Bald Eagle: Compliance

Regional habitat management guidelines are provided by USFWS 2007. As per USFWS 2007, the proposed activities in the action alternatives fall under Category C. Timber Operations. Under Category C, the following is required:

- Avoid removal of trees within 330 feet of the nest at any time.
- Avoid timber harvest operations during the breeding season within specified buffers.

The action alternatives demonstrate compliance with USFWS 2007 as follows:

- No tree removal is proposed within 330 feet of the nest.
- The following is a management requirement that avoids timber harvest operations during the breeding season:

Maintain a Limited Operating Period (LOP) prohibiting vegetation treatments, new road construction, blasting, landing construction, and helicopter flight paths within 0.5 miles of the known bald eagle nest (January 1 through August 31) unless surveys conducted by a Forest Service biologist confirm non-nesting status.

This project complies with forest plan direction and the National Bald Eagle Management Guidelines (USFWS 2007).

California Spotted Owl: Affected Environment

Species and Habitat Account

The California spotted owl (*Strix occidentalis occidentalis*) is currently managed as a USDA Forest Service Sensitive species (Update to the Regional Forester's Sensitive species list, July 3, 2013).

California spotted owls are top trophic-level avian predators associated with heterogeneous forests characterized by areas with large trees, large snags, and large down woody material (North et al. 2009, Roberts and North 2012, Keane 2013). California spotted owls show the strongest associations with mature forest conditions for nesting and roosting but will forage in a broader range of vegetation types (Keane 2013). Recent research indicates that California spotted owls will occupy landscapes that experience low-to moderate-severity wildfire, as well as areas with mixed-severity wildfire that includes some proportion of high-severity fire (Bond et al. 2009, Bond et al. 2010, Roberts et al. 2011, Lee et al. 2012, Bond et al. 2013, Lee et al. 2013). Clark (2007) found that while spotted owls did roost and forage within high severity burn areas, the use was very low suggesting that this cover type was poor habitat for California spotted owls. Thus, uncertainties remain regarding long-term occupancy and demographic performance of spotted owls at burned sites (Keane, pers.comm.).

Specifically, uncertainty exists regarding how the amounts and patch sizes of high-severity fire will affect California spotted owl occupancy, demographics, and habitat over long time frames (Ibid).

For the past two decades, California spotted owl management has been based on recommendations provided by the California Spotted Owl Technical Report (Verner et al. 1992) and incorporated into forest plan direction at a bioregional scale (USDA 1993, 2001, 2004). This direction uses a system of land allocations of protected activity centers (PACs) and home range core areas (HRCAs) that are specifically managed for owl habitat and heterogeneous old forest conditions. The management of owl habitat and heterogeneous old forest condition is specifically focused on large structures, with an emphasis on a forest mosaic infused with large trees, large snags, and large down logs (North et al. 2009, Roberts and North 2012). Spotted owl sites are known as “activity centers” because the spotted owl is a central place forager, meaning activities are typically centered around a specific location (Verner et al. 1992). Sites are identified through the use of protocol surveys (USDA 1991a). Protocol surveys have been conducted throughout the Rim Fire area for the past two decades. These surveys are best described as opportunistic depending upon planned activities and funding levels but have occurred at a level such that inventory information for the analysis area is considered essentially complete (USDA, unpublished data, NRIS Wildlife database).

California spotted owl PACs are delineated surrounding each territorial owl activity center detected on National Forest System lands since 1986 (USDA 2010a, p. 183). PACs are delineated to encompass the best available 300 acres of habitat in as compact a unit as possible. A home range core area (HRCA) includes the PAC and is established surrounding each territorial California spotted owl activity center detected after 1986. The core area amounts to 1,000 acres based on 20 percent of the area described by the sum of the average breeding pair home range plus one standard error (USDA 2010a, p. 188).

Forest Plan direction requires that after a stand-replacing event such as the Rim Fire, specialists evaluate habitat conditions to determine if there is sufficient suitable habitat remaining, and if there are opportunities for re-mapping to better encompass suitable habitat. If there is insufficient suitable habitat for a PAC around the activity center, the PAC may be removed from the conservation network (USDA 2010a, p. 184). The post-fire PAC evaluation was completed with technical assistance from Pacific Southwest Region Research Station (PSW) owl scientists. For the analysis, each PAC was evaluated within the Rim Fire boundary using several criteria. The three main criteria used were 1) acres of post-fire suitable habitat defined as CWHR 4M, 4D, 5M, and 5D (including class 6) burned at less than 75 percent basal area mortality, 2) percent of PAC within a 496 acre (200 hectare) circle burned at high severity (defined as greater than 75 percent basal area mortality), and 3) percent of pre-fire suitable habitat burned at high severity. Forty-six California spotted owl sites are located within the Rim Fire perimeter. An additional four sites are located primarily outside of the Rim Fire perimeter. These four sites were not included in the larger analysis because 1) the activity center did not occur within the fire perimeter, 2) no PAC acres occurred within the fire perimeter, and 3) approximately 10 percent or less of the home range core area occurred within the fire perimeter. Thus, these four sites were considered suitable and their boundaries were left as is. Of the 46 sites substantially within the Rim Fire perimeter, they clustered into three categories as shown in Figure 3.15-1 where Category 1 sites are shown in red, Category 2 sites in green, and Category 3 sites in orange:

Ten sites cluster into Category 1 (red), 27 sites into Category 2 (green), and 9 sites into a Category 3 (orange). Details on individual sites are provided in the Wildlife BE Appendix.

Category 1 (red): These 10 sites burned primarily at high severity across the 200 ha analysis area, had nearly all pre-fire suitable habitat burn at high severity, and have small amounts of post-fire suitable habitat. It is clear that these sites have very low to no probability of continued occupancy. Thus, it is appropriate to remove these sites from the conservation network.

Category 2 (green): These 27 sites have lower amounts of high severity fire within the 496 acre analysis area, lower amounts of suitable habitat loss, and high amounts of remaining suitable habitat. Available literature suggests that these sites have high probabilities of continued occupancy. Thus, it is appropriate to consider these sites as suitable post-fire, and that it is appropriate to keep the boundaries intact as is.

Category 3 (orange): These 9 sites have intermediate high severity values. Based on the scientific literature, there is some uncertainty as to the probability of occupancy for sites within this range of values. The literature does document that individuals can persist in sites within these ranges of high severity burn, though this is an uncertainty requiring further research to identify where more specific thresholds might exist. Thus, in order to reduce uncertainty in occupancy, it is appropriate to re-map the boundaries of these sites to encompass habitat of better quality where possible and to consider the re-mapped sites as suitable. It would also be particularly important to research owls in these sites so more can be learned about occupancy thresholds.

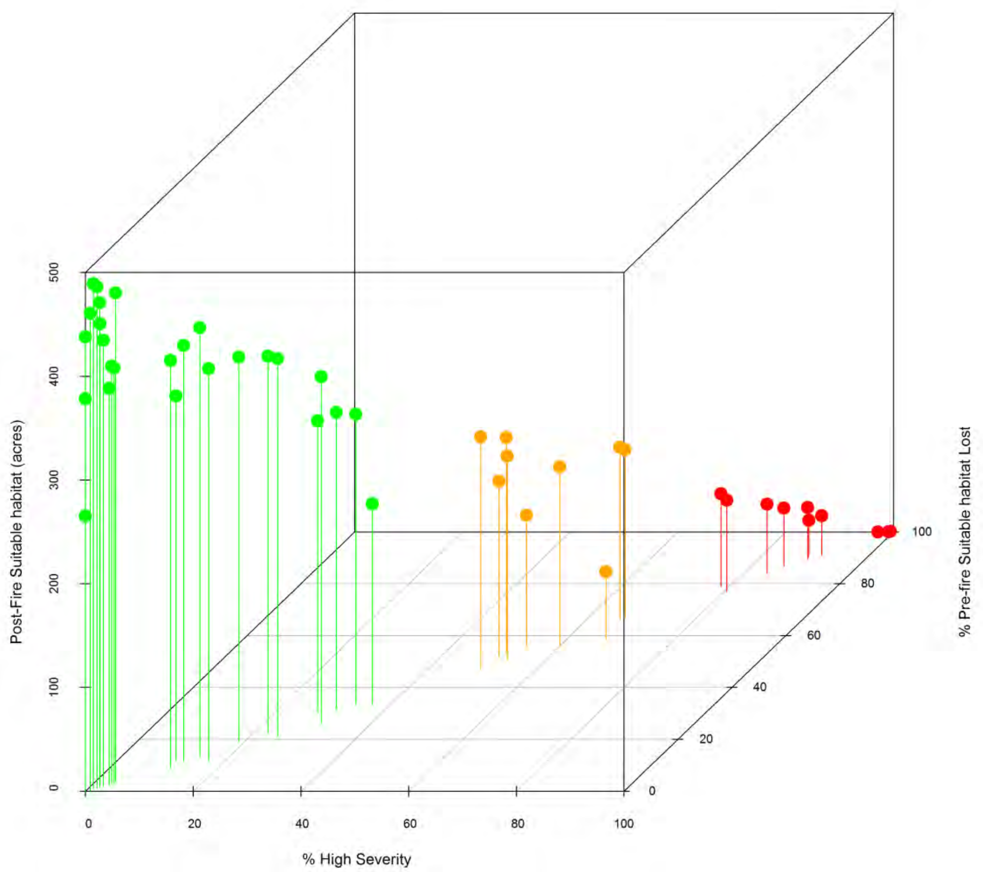

Figure 3.15-1 Pin graph of post-fire California spotted owl PAC condition

Area of Concern

The Rim Fire area is located in Spotted Owl Area of Concern 6. Area of Concern 6 was identified as an area with habitat fragmentation creating a potential bottleneck in the distribution of owls on the west slope of the Sierra Nevada. Areas of concern were identified in the California Spotted Owl Technical Report (Verner et al. 1992) and were defined as areas within the range of California spotted owl where potential gaps in habitat and the associated loss of forest connectivity were a potential issue. Thus, the Rim Fire area may be considered particularly important to the distribution of California spotted owl. An analysis of how changes to habitat in each alternative relates to the distribution of the California spotted owl can be found in MIS policy and the MIS report written for this project (USDA 2007 MIS FEIS, Rim Recovery MIS report 2013). Areas of Concern represent areas where management decisions may have a disproportionate potential to affect the California spotted owl population (USDA 2004).

Risk Factors

Risk factors potentially affecting California spotted owl abundance and distribution have been identified and primarily include nest site loss and disturbance, and loss of habitat and habitat elements, especially large snags and large down woody material (USDA 2001, USDA 2012d).

Management Direction

Current management direction is summarized by describing the desired future condition of land allocations (Robinson 1996). The California spotted owl is an at-risk species associated with old forest ecosystems (USDA 2004). The following land allocations pertain to California spotted owl and old forest ecosystems: Protected Activity Centers (PACs), Home Range Core area (HRCA), Old Forest Emphasis Area (OFEA), and proposed Forest Carnivore Connectivity Corridor (FCCC).

The desired condition for California spotted owl PAC is to have 1) at least two tree canopy layers; 2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; 3) at least 60 to70 percent canopy cover; 4) some very large snags (greater than 45 inches dbh); and 5) snag and down woody material levels that are higher than average.

The desired condition for California spotted owl HRCA is to encompass the best available habitat in the closest proximity to the owl activity center (USDA 2004 ROD pp. 39-40). HRCAs consist of large habitat blocks that have: 1) at least two tree canopy layers; 2) at least 24 inches dbh in dominant and co-dominant trees; 3) a number of very large (greater than 45 inches dbh) old trees; 4) at least 50 to 70 percent canopy cover; and 5) higher than average levels of snags and down woody material.

The desired condition for Old Forest Emphasis Area (OFEA) is to provide habitat conditions for mature forest associates (spotted owl, northern goshawk, American marten, and Pacific fisher). Specifically, forest structure and function across old forest emphasis areas generally resemble pre-settlement conditions. High levels of horizontal and vertical diversity exist at the landscape-scale (roughly 10,000 acres). Stands are composed of roughly even-aged vegetation groups, varying in size, species composition, and structure. Individual vegetation groups range from less than 0.5 to more than 5 acres in size. Tree sizes range from seedlings to very large diameter trees. Species composition varies by elevation, site productivity, and related environmental factors. Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. Figure 3.15-2 shows forest structure and function generally resembling pre-settlement conditions (SNEP 1996, drawing by Robert Van Pelt).

The desired future condition of FCCC is to provide habitat connectivity for fisher and marten, linking Yosemite National Park and the North Mountain inventoried roadless area west to the Clavey River. For habitat connectivity, a future forested area is desired with a minimum of 50 percent of the forested area having at least 60 percent canopy cover. Higher than average levels of large snags and large down woody material is also desired (as in USDA 2004). Habitat structures are important to retain that may constitute rest sites as described in Lofroth et al. 2010 (plate 7.8). Desired conditions in FCCC for fisher and marten also provide suitable habitat conditions for California spotted owl.

Figure 3.15-2 Typical pre-settlement mixed conifer forest, western Sierra Nevada

California Spotted Owl: Environmental Consequences

The project alternatives could result in direct and indirect effects to the California spotted owl through the following activities:

- Salvage harvest of fire-killed trees.
- Salvage harvest of roadside hazard trees.
- New permanent road construction, temporary road construction, and road reconstruction.
- Landing construction and use.
- Use of material sources and water sources.
- Biomass and similar fuels treatments.

These actions may have direct and indirect effects on California spotted owls through the following:

- Project related death, injury, or disturbance.
- Project related modifications to habitat quantity and/or quality.

Death, injury or disturbance

Project activities have the potential to cause death or injury by tree-falling or by the use of heavy equipment. There is the potential for death or injury if nest trees are felled while being used by nesting birds during the reproductive season. In addition, historic nest trees could be removed. The mobility of the species in question and the management requirement of LOPs, make it highly improbable that death or injury would occur as a result of project activities. Flagging and avoiding current and historic nest trees provides a way to minimize nest tree loss or noncompliance with the Migratory Bird Treaty Act.

Project activities have the potential to cause disturbance mainly because of the use of loud macrehinery. Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, project roads, landings, material sources, and water sources. Loud noise has the potential to change normal behavior patterns during the period operations would take place and potentially impair essential behavior patterns of the spotted owl related to breeding, feeding, or sheltering. The potential for disturbance is minimized by the implementation of Limited Operating Periods (LOPs) as a management requirement.

The location of nest sites or activity centers are more uncertain following large-scale disturbance events (Keane, pers. comm.); conducting surveys to establish or confirm any new locations of nests or activity centers is a way to address this movement uncertainty. Conducting protocol surveys is a management requirement common to all alternatives.

Habitat modification

Salvage harvest of fire-killed trees and salvage harvest of roadside hazard trees primarily removes snags and existing down woody material. Salvage harvest of roadside hazard trees may also remove existing living trees meeting certain criteria for hazard definition. The removal of snags reduces future recruitment of down woody material.

Short-term, within the next ten years, snags and down woody material function as habitat elements important for owl prey. Snags also serve as potential hunting perch sites that may be utilized by foraging owls. Recent research indicates that prey species may be abundant and available in the post-fire environment. Work by Bond et al. (2009, 2013) indicates that owls preferentially select high-severity fire areas for foraging and that foraging owls with burned forest within the home range appear to utilize a variety of prey, particularly gophers (*Thomomys* spp.) and flying squirrels (*Glaucomys sabrinus*). Bond et al. (2013) also found that wood rats (*Neotoma* spp.), sciurid squirrels (Family Sciuridae), and deer mice (*Peromyscus* spp.) were represented as important prey items for owls within a post-fire habitat mosaic. Results from studies of small mammal habitat associations demonstrate the species-specific importance of habitat elements such as shrubs, downed logs, snags, and truffles (Keane 2013). The time elapsed since fire is closely correlated with habitat elements and the composition of prey species. For example, post-fire habitats are typically rich in gophers and deer mice in the first decade following a fire, followed by wood rats when understory conditions are well developed in the following decades and finally by sciurid squirrels and flying squirrels when trees reach maturity (Ingles 1965, Quinn and Keeley 2006). A diversity of prey species within a habitat mosaic can be expected to benefit predators such as the spotted owl (Roberts and North 2012). Post-fire salvage logging may adversely affect rates of owl occupancy (Lee et al. 2012).

Long-term over several decades, large snags and large down logs are considered biological legacies in the post-fire environment and play important roles in the structure of the future forest (Lindenmayer et al. 2008). For example, large snags and large down logs are fundamental to the definition of old forest and are important attributes for the development of the old forest ecosystem and associated species such as the spotted owl. Snags may stand for decades and in time, may become future nest trees for spotted owl as the regenerating forest nears maturity. Snag dynamics in the Sierra Nevada are complex and snags fall at different rates depending on many factors (Cluck and Smith 2007). Once recruited into the down woody material on the ground, this coarse woody debris again serves as an important element in owl habitat (Verner et al. 1992). Thus, decaying wood serves different functional roles overtime, first providing cover for spotted owl prey in the complex early seral stage of the forest, and ultimately decaying and playing a critical role in soil development of old forests. For example, logs in decay class five (i.e. highly decayed) are associated with hypogeous fungi (i.e. truffles), which in turn serve as a primary food source for spotted owl prey in old forests -- the flying squirrel in particular (Verner et al. 1992).

New permanent road construction, temporary road construction, road reconstruction, and landing construction also modify habitat. In particular, road construction and continued use can result in increased habitat fragmentation, disturbance, and lower habitat capability for spotted owl (Pyron et al. 2009). Basic road maintenance such as grading and cleaning culverts is generally not an issue for wildlife. Basic road maintenance protects water quality and soils by preventing degradation of road drainage structures and function (3.14 Watershed). The use of water sources may reduce water availability for spotted owls and their prey, especially in drought years. Landing construction results in habitat fragmentation. Helicopter landings are typically between 1 and 3 acre in size and tractor landings are typically .25 to 1 acre in size.

The removal of snags and down woody material can be expected to reduce fuel loading. The reduction in fuel loading can be expected to promote the development of old forest habitat. However, the effectiveness of the various treatments proposed is difficult to predict and there is considerable uncertainty with how salvage logging influences future fire. A review of recent research on this topic and the associated controversy can be found in Long et al. (2013, Ch. 4.3 pp. 6-7). Salvage logging is controversial because few short-term positive ecological effects and many potential negative effects have been associated with post-fire logging (Ibid).

The effect salvage logging has on the fire severity of a re-burn is likely to remain widely variable depending on numerous factors including how future prescribed fire management is planned and implemented. However, as stated in Chapter 3.05 (Fuels), there is general consensus that the removal of smaller diameter material (activity fuels and biomass) is likely to be the most effective in reducing flame lengths and fire line intensities. Piling and burning activity fuels is an effective method for disposal and is expected to promote development of mature forest (Stephens et al. 2009). Also, preventing high fuel loadings along roadsides can reasonably be expected to play an important role in reducing fire severity to developing mature forest habitat, especially where roads are identified as critical fire management features (Crook et al. 2013). Roadside hazard salvage treatments involve the removal of snags and live trees identified as hazards to public safety. There is considerable uncertainty with regards to treatment intensity in roadside hazard salvage units because treatment intensity is subject to a wide range of environmental conditions (e.g. drought and moisture stress) related to tree status.

As spotted owls focus their activities in the best available habitat around roost and nest sites known as activity centers (Verner et al. 1992), habitat modification effects are expected to be most pronounced in PACs.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the spotted owl and to determine how well project alternatives comply with Forest Plan Direction and species conservation strategies:

1. Number of current and historic nest sites within PACs in treatment units or within .25 mile of potentially disturbing activities.
2. Acres of treatment unit overlap within PACs.
3. Acres of areas managed for old forest condition with higher than average levels of large snags and higher than average levels of large down woody material.
4. Miles of new permanent road construction and other project road miles in PACs by road type.
5. Number of material sources, water sources, and landings in owl habitat.
6. Acres of fuels treatments by type (biomass, pile and burn) including deer forage units and watershed soil cover treatments (mastication, drop and lop).

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Potentially five known activity center nest trees intersect with roadside hazard tree units and 26 known activity center nest trees are within .25 mile of potentially disturbing activities. It is expected that the implementation of LOPs and protocol surveys will minimize disturbance potential to these sites. However, there is no provision in this alternative to flag and avoid current and historic nest trees or trigger special coordination measures designed to promote nest tree protection. Therefore, it is likely that approximately 14 percent of spotted owl territories could be negatively affected by nest tree loss.

Indicator 2. Under Alternative 1, 2,017 acres of roadside hazard salvage treatments would occur within post-fire suitable PACs. Site-specifically, Table 3.15-4 shows California spotted owl sites would be potentially affected by habitat fragmentation at varying degrees ranging from 0 acres of overlap to approximately 40 percent of a PAC. There is no provision in this alternative to mitigate treatment overlap by adding equivalent acreage to the PAC. This would result in a potential net loss of 2,015 acres of owl habitat and possibly influence continued occupancy probabilities (Seamans and Gutierrez 2007) in approximately 50 percent of spotted owl territories.

Indicator 3. Under Alternative 1, zero acres of salvage units managed for old forest condition would be managed for higher than average levels of large conifer snags and large down woody material. Large down woody material would be retained at the average management rate of 10 to 20 tons per acre for all units. Higher than average levels of large conifer snags and large down woody material is a management objective in areas managed for old forest condition (USDA 2010a p. 190). Table 3.15-5 shows acres by snag retention levels in basal area (BA) in areas managed for old forest condition. Not leaving higher than average levels of large conifer snags and large down woody material would likely reduce habitat and would fall short of desired conditions described under management direction and habitat modification sections for this species.

Table 3.15-4 Treatment unit overlap within post-fire PACs, Alternative 1

PAC Number	Roadside hazard tree treatment acres
MPA0019 - McCauley Ranch	65
TUO0010 - Soldier Creek	42
TUO0011 - Big Creek	116
TUO0012 - Ackerson Creek	46
TUO0024 - SF Tuolumne	101
TUO0026 - Rush Creek	57
TUO0027 - N Bear Mountain	93
TUO0032 - Reynold's Creek	17
TUO0034 - D54 Niagara Creek	30
TUO0039 - Ackerson Mountain	28
TUO0040 - MF Tuolumne	84
TUO0053 - Brushy Creek	128
TUO0054 - Thompson Peak	0
TUO0059 - L 13 Mile Creek	39
TUO0061 - D51 Bear Spring Creek	108
TUO0065 - L Reynold's Creek	43
TUO0078 – Crocker	28
TUO0085 - Harden Flat NW	98
TUO0129 - U 2 Mile Creek	72
TUO0130 - Camp Clavey	96
TUO0146 - Hunter Creek	18
TUO0148 - U 13 Mile Creek	89
TUO0149 - Cottonwood Creek	91
TUO0151 - L Cottonwood Creek	64
TUO0176 - Clavey-Wolfin	84
TUO0187 - Thompson Meadow	24
TUO0188 - Loney Creek	59
TUO0205 - N Niagara	59
TUO0210 – Buchanan	3
TUO0218 - L Skunk Creek	62
TUO0219 - U Cherry Lake	19
TUO0255 - Box Spring	30
TUO0256 - Clavey River	0
TUO0257 - Westside E	76
TUO0258 - Westside W	29
TUO0261 - U Camp 25	19
Total	2,017

Table 3.15-5 Snag retention level in basal area per acre, Alternative 1

	12 square feet BA/acre* General Forest matrix management average (USDA 2010 p.44).	30 square feet BA/acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).	100-120 square feet BA/acre Low intensity salvage treatment units (PSW Research).
Unit acres	28,326	0	0

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 4. Table 3.15-6 shows Alternative 1 has 0.9 miles of new permanent road construction, 31.3 miles of road reconstruction, 0.6 miles of "skid zones", and 2.2 miles of temporary road occurring in suitable PACs. A total of 35 project road miles intersect PACs. Of the road reconstruction miles, 2.2 miles would occur in suitable PACs on routes currently decommissioned or not designated for motor vehicle travel. The remaining road reconstruction miles occur mainly on open Maintenance Level 2 roads.

Table 3.15-6 Project road miles in PACs by road type, Alternative 1

Spotted Owl PAC*	Miles			
	New permanent construction	Reconstruction	Skid zone	Temporary Road
MPA0019 - McCauley Ranch		1.3		
TUO0010 - Soldier Creek		0.4		0.1
TUO0011 - Big Creek		2.4	0.1	
TUO0012 - Ackerson Creek		0.7	0.1	0.1
TUO0024 - SF Tuolumne		2.4		
TUO0026 - Rush Creek		1.5		
TUO0027 - N Bear Mountain		2.0		
TUO0032 - Reynold's Creek		0.3		
TUO0034 - D54 Niagara Creek		0.5		
TUO0039 - Ackerson Mountain		0.3		
TUO0040 - MF Tuolumne		1.5		
TUO0053 - Brushy Creek		2.1	0.2	
TUO0059 - L 13 Mile Creek		0.1		
TUO0061 - D51 Bear Spring Creek		2.3		
TUO0078 - Crocker		0.9		
TUO0085 - Harden Flat NW		2.2		
TUO0129 - U 2 Mile Creek		1.1		0.1
TUO0130 - Camp Clavey	0.4	1.6		
TUO0148 - U 13 Mile Creek		0.8		
TUO0149 - Cottonwood Creek		1.7	0.0	
TUO0151 - L Cottonwood Creek		1.4		
TUO0188 - Loney Creek		1.3		
TUO0218 - L Skunk Creek		1.3		
TUO0219 - U Cherry Lake		0.4		
TUO0255 - Box Spring				0.7
TUO0257 - Westside E		0.7	0.2	0.8
TUO0258 - Westside W	0.5	0.0	0.0	
TUO0261 - U Camp 25				0.4
Total	**0.9**	**31.3**	**0.6**	**2.2**

*PACs not shown did not have project roads in them

The management requirement of re-closing all routes post-project that are currently designated closed is expected to minimize long-term habitat fragmentation and disturbance potential. Under this alternative, 0.5 miles of new permanent road construction would occur in PAC# TUO0258 and 0.4 miles of new permanent road construction would occur in PAC# TUO130. The management requirement of designating any new permanent road construction in PACs as blocked Maintenance Level 1 or Maintenance Level 2 gated year-round is expected to minimize long-term disturbance potential to affected sites. With the minimization of long-term disturbance potential, this disturbance effect is expected to be minor.

Table 3.15-7 Project road miles in HRCAs by road type, Alternative 1

Spotted Owl HRCA*	Miles			
	New permanent construction	Reconstruction	Skid zone	Temporary road
MPA0019		1.4		
MPA0082		1.2		0.2
TUO0010		1.6		0.1
TUO0011		6.5	0.1	
TUO0012		1.1	0.2	0.2
TUO0024		6.4		0.2
TUO0026		4.9		
TUO0027		4.9		
TUO0032		2.4	0.2	
TUO0034		1.1		
TUO0035				0.4
TUO0039		1.5	0.2	0.2
TUO0040		3.1		
TUO0053		3.7	0.6	0.3
TUO0054		1.5		
TUO0059		3.8		
TUO0061		4.0		
TUO0065		0.4	0.4	
TUO0078		3.8		
TUO0085		7.0		0.1
TUO0129		1.7	0.3	0.4
TUO0130	0.5	2.9		0.0
TUO0142		0.1		
TUO0148		4.2		
TUO0149		6.1	0.4	
TUO0151		3.3		
TUO0176		0.1		
TUO0187		3.6		
TUO0188		1.6	0.1	
TUO0205		1.0	0.0	
TUO0218		4.1		
TUO0219		2.0		
TUO0255		0.2		1.0
TUO0257		2.9	0.6	1.3
TUO0258	1.6	1.0	0.2	
TUO0261		0.0		1.6
Total	**2.1**	**95.3**	**3.4**	**6.2**

*HRCAs not shown did not have project roads in them

Table 3.15-7 for Alternative 1 shows a total of 107 miles of project road treatments would occur in HRCAs. The management requirement of re-closing all routes post-project that are currently designated closed pre-project, and the management requirement of designating any new permanent road construction in PACs as blocked Maintenance Level 1 or Maintenance Level 2 gated year-round are expected to minimize long-term habitat fragmentation and disturbance potential. The two HRCAs with new permanent road construction proposed are associated with the corresponding PAC and roads in the table.

Indicator 5. Alternative 1 has no material sources. Table 3.15-8 shows eight water sources and six landings in suitable PACs. Of the landings in suitable PACs, two are helicopter landings and four are tractor landings. One PAC contains two proposed landings, the remainder contain one each. The implementation of BMPs at project water sources is expected to minimize potential effects to spotted owls and their prey related to water availability. There is no provision in this alternative to mitigate habitat loss caused by landing construction by adding acreage to the PAC. This would result in a minimal amount of potential net loss of spotted owl habitat on 10 acres across 5 PACs.

Table 3.15-8 Water sources and landings within PACs, Alternative 1

Spotted Owl PAC	Water sources	Landings	
		Tractor	Helicopter
TUO0011 – Big Creek	0	1	0
TUO0039 – Ackerson Mountain	1	0	1
TUO0053 – Brushy Creek	0	1	0
TUO0061 – D51 Bear Spring Creek	1	0	0
TUO0078 – Crocker	2	0	0
TUO0129 – Upper 2 Mile Creek	1	0	0
TUO0148 – Upper 13 Mile Creek	1	0	0
TUO0151 – L. Cottonwood Creek	0	1	1
TUO0187 – Thompson Meadow	1	0	0
TUO0218 – L. Skunk Creek	1	0	0
TUO0257 – Westside E	0	1	0
Total	**8**	**4**	**2**

*PACs not shown did not have these features

Table 3.15-9 Biomass in critical winter deer range units, Alternative 1

Unit	Biomass Acres	Total Unit Acres	Percent
L03	31	30	100
L06	10	10	100
L07	5	5	100
L202	28	142	20
L203	265	265	100
L204	87	87	100
L205	140	140	100
L206	138	138	100
M201	35	50	70
O201	140	299	27
P201	185	185	100
Total	**1,064**	**1,352**	**79**

Indicator 6. Alternative 1 proposes 7,626 acres of biomass fuel treatment. Table 3.15-9 shows 1,064 biomass acres occur in critical winter deer range and have a cover/forage ratio emphasis for deer habitat. Treatments designed to achieve optimal deer cover/forage ratios would also break up fuel continuity within those units and contribute to fuels management goals. Fuels management goals are

important components of the fire and fuels strategy (Crook et al. 2013) and would assist in moving toward the desired condition of old forest habitat development.

Specifically, fuels management actions in the deer range units, which are located downslope of the old forest corridor and PAC TUO021, are likely to break up fuel continuity and prevent fire spread into the developing forest upslope, at least in the short-term. Based on location, these treatments would likely influence old forest development in at least three spotted owl territories. However, long-term effectiveness is highly speculative because future long-term management actions (e.g., prescribed burn schedules) are unknown at this time. This would likely play a critical role in contributing to the development of future old forest linking Yosemite National Park and the North Mountain Roadless Area to the Clavey River watershed. More details are in the Wildlife BE appendix).

CUMULATIVE EFFECTS

In making the determination for this alternative, 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 was considered, found in Appendix B, Cumulative Effects. Relevant risk factors potentially affecting California spotted owl abundance and distribution have been identified and primarily include nest site loss and disturbance, and loss of habitat and habitat elements, especially large snags and large down woody material (USDA 2001, R5 Sensitive species evaluation form 2012).

Based on relevant risk factors, the following present and reasonably foreseeable actions from Appendix B are the most relevant to spotted owl: green thinning sales, emergency fire salvage on private land, and the Rim HT project.

The green thinning sales are designed to reduce ladder fuels and retain and improve key habitat components such as retention of large trees, defect trees, snags, downed wood, and hardwoods. Based on the biological evaluations for each, spotted owl habitat is expected to improve in the long-term with implementation of these projects.

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acre is presently being salvage logged. These salvage activities generally remove all fire-killed and dying trees, important habitat elements to spotted owl habitat in the short and long-term. There is considerable uncertainty regarding the ecological effects of varying levels of salvage treatments to this species (Appendix D).

The Rim HT project removes snags along high-use, typically paved roads (Maintenance Level 3 to 5 roads). The hazard tree removal along Maintenance Level 3, 4 and 5 roads was considered when remapping Category 3 PACs for Alternatives 1, 3, and 4. For Category 2 PACs, hazard tree removal was considered in Alternative 3 and 4, but not Alternative 1 (Spotted Owl PAC evaluation/remapping narratives in the Wildlife BE Appendix).

Alternative 1 may contribute cumulatively to short and long-term effects on spotted owl. The combination of past Forest Service and private timber harvests has cumulatively reduced the amount of suitable habitat available across the analysis area, and the area has been identified as an area of concern (Verner et al. 1992). The cumulative contribution under this alternative may affect individual territories, but is not expected to affect the viability of this species.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur. The indirect effects of no action are primarily related to the influence no action may have on future wildfires and how future wildfires may impact spotted owl habitat.

Predicting the incremental effect no action would have on future wildfires and spotted owl habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (3.05 Fuels). However, potential fire behavior may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013). Additionally, a growing body of evidence indicates that spotted owls persist within fire affected landscapes (Bond et al. 2002, Roberts et al. 2011, and Lee et al. 2012).

CUMULATIVE EFFECTS

The cumulative effects discussion under Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, no direct cumulative effect is expected because no active management would occur. The cumulative contribution under this alternative may not complement the fuel reduction treatments that have occurred in the past, thus increasing the risk of loss of remaining suitable habitat to wildfire in the long-term. The short-term beneficial impacts to spotted owl such as retention of snags may be outweighed by the increased risk of additional habitat loss in the next wildfire. Because the indirect effects of future fires is highly speculative and uncertain, cumulative effects cannot be predicted. Thus, no action is not expected to result in any definitive direct or indirect cumulative effects.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Indicator 1. Potentially five known activity center nest trees intersect with roadside hazard salvage treatment units and 26 known activity center nest trees are within .25 mile of potentially disturbing activities. It is expected that the implementation of LOPs and protocol surveys as management requirements will minimize disturbance potential to these sites. Under Alternative 3, the management requirement to flag and avoid current and historic nest trees is expected to protect nest trees and ensure compliance with the Migratory Bird Treaty Act. The risk of nest tree loss is minimized and not expected to occur.

Indicator 2. Table 3.15-10 shows 2,015 acres of roadside hazard salvage treatments would occur within post-fire suitable PACs. Site-specifically, spotted owl sites would be potentially affected by habitat fragmentation at varying degrees ranging from 0 acres of overlap to approximately 40 percent of a PAC. The Alternative 3 overlap with roadside hazard treatments would be mitigated by adding acreage to the PAC equivalent to the treatment acres as per Forest Plan Direction (USDA 2010a p. 185). Under Alternative 3, 85 percent of affected PAC acres would be mitigated; six PACs would have unmitigated treatment overlap. For unmitigated acres, additional acres of suitable habitat were not available. PAC evaluation narratives and maps are in the Wildlife BE Appendix. Unmitigated habitat alteration and the potential influence on continued occupancy probabilities would be minimized to the greatest extent possible. Few studies are available for guidance on specific thresholds (Seamans and Gutierrez 2007). Although precise thresholds for the analysis area are not known, potential net loss is mitigated over the majority of acres in all but 2 PACs (Harden Flat and Hunter Creek).

Table 3.15-10 Treatment unit overlap within post-fire PACs, Alternative 3

Spotted Owl PAC Number	Roadside hazard salvage treatment acres	Percent mitigated
MPA0019 - McCauley Ranch	65	100
TUO0010 - Soldier Creek	42	100
TUO0011 - Big Creek	119	100
TUO0012 - Ackerson Creek	46	100
TUO0024 - SF Tuolumne	104	100
TUO0026 - Rush Creek	82	61
TUO0027 - N Bear Mountain	93	72
TUO0032 - Reynold's Creek	16	100
TUO0034 - D54 Niagara Creek	30	100
TUO0039 - Ackerson Mountain	31	100
TUO0040 - MF Tuolumne	84	73
TUO0053 - Brushy Creek	127	100
TUO0054 - Thompson Peak	0	N/A
TUO0059 - L 13 Mile Creek	39	100
TUO0061 - D51 Bear Spring Creek	108	51
TUO0065 - L Reynold's Creek	43	100
TUO0078 – Crocker	26	100
TUO0085 - Harden Flat NW	98	1
TUO0129 - U 2 Mile Creek	74	100
TUO0130 - Camp Clavey	94	100
TUO0146 - Hunter Creek	18	0
TUO0148 - U 13 Mile Creek	76	100
TUO0149 - Cottonwood Creek	91	100
TUO0151 - L Cottonwood Creek	64	100
TUO0176 - Clavey-Wolfin	92	100
TUO0187 - Thompson Meadow	24	100
TUO0188 - Loney Creek	59	100
TUO0205 - N Niagara	65	100
TUO0210 – Buchanan	3	100
TUO0218 - L Skunk Creek	75	76
TUO0219 - U Cherry Lake	33	100
TUO0255 - Box Spring	2	100
TUO0256 - Clavey River	0	N/A
TUO0257 - Westside E	68	100
TUO0258 - Westside W	5	100
TUO0261 - U Camp 25	19	100
Total	**2,015**	

Indicator 3. Table 3.15-11 shows Alternative 3 has 14,448 acres of salvage units managed for old forest condition would be managed for higher than average levels of large conifer snags and large down woody material. Large down woody material would be retained at the rate of 10 to 20 tons / acre with 20 tons per acre emphasized in units managed for old forest condition. Higher than average levels of large conifer snags and large down woody material is a management objective in areas managed for old forest condition. Areas managed for old forest condition include: OFEA, HRCA, and FCCC. Under Alternative 3, 2,089 acres would receive low intensity salvage treatment as part of a

PSW research project. The PSW research project is designed to address questions related to salvage logging intensities and spotted owl occupancy and use of post-fire environments. This research will provide information to better understand the effects of wildfire and salvage-logging on California spotted owl and serve as an empirical basis for informing future management decisions (Keane, pers.comm.). Thus, the PSW research is expected to benefit California spotted owl conservation by addressing the uncertainty related to thresholds of effect. Retaining higher than average levels of large conifer snags and large down woody material in areas managed for old forest condition would be consistent with the desired condition of habitat for this and other old forest associated species. The importance of higher than average levels of large conifer snags and large down woody material to habitat quality is described in the "habitat modification" section above. Generally, habitat managed for higher than average levels may be best qualified as developing into highly suitable habitat, while habitat managed at average levels may be best qualified as developing into low to moderate suitability.

Table 3.15-11 Snag retention level in basal area per acre, Alternative 3

	12 square feet BA per acre* General Forest matrix management average (USDA 2010 p.44).	30 square feet BA per acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).	100 to 120 square feet BA per acre Low-intensity salvage treatment units (PSW Research).
Unit acres	15,955	12,359	2,089

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 4. Table 3.15-12 shows Alternative 3 would have 0.2 miles of new permanent road construction, 29.1 miles of road reconstruction, 0.1 miles of "skid zones", and 0.6 miles of temp road occurring in suitable PACs. A total of 30 project road miles intersect PACs. Of the road reconstruction miles, 2.8 miles would occur in suitable PACs on routes currently decommissioned or not designated for motor vehicle travel. The remaining road reconstruction miles occur mainly on open Maintenance Level 2 roads. The management requirement of re-closing all routes post-project that are currently designated closed pre-project is expected to minimize long-term habitat fragmentation and disturbance potential. Under this alternative, 0.2 miles of new permanent road construction would occur in PAC TUO130. The management requirement of designating any new permanent road construction in PACs as blocked Maintenance Level 1 or Maintenance Level 2 gated year-round is expected to minimize long-term disturbance potential of affected sites.

Table 3.15-13 for Alternative 3 shows a total of 97.7 miles of project road treatments would occur in HRCAs. The management requirement of re-closing all routes post-project that are currently designated closed, and the management requirement of designating any new permanent road construction as blocked Maintenance Level 1 or Maintenance Level 2 gated year-round are expected to minimize long-term habitat fragmentation and disturbance potential. The one HRCA with new permanent road construction proposed is associated with the corresponding PAC and road in the "Project road miles in PACs" table above.

Table 3.15-12 Project road miles in PACs by road type, Alternative 3

Spotted Owl PAC*	Miles			
	New permanent construction	Reconstruction	Skid zone	Temporary road
MPA0019 - McCauley Ranch		1.4		
TUO0010 - Soldier Creek		0.4		0.0
TUO0011 - Big Creek		2.5	0.1	
TUO0012 - Ackerson Creek		0.8		
TUO0024 - SF Tuolumne		2.4		
TUO0026 - Rush Creek		1.8		
TUO0027 - N Bear Mountain		2.0		
TUO0032 - Reynold's Creek		0.0		
TUO0034 - D54 Niagara Creek		0.6		
TUO0039 - Ackerson Mountain		0.5		
TUO0040 - MF Tuolumne		1.2		
TUO0053 - Brushy Creek		1.5		
TUO0059 - L 13 Mile Creek		0.1		
TUO0061 - D51 Bear Spring Creek		2.3		
TUO0078 - Crocker		0.9		
TUO0085 - Harden Flat NW		2.1		0.1
TUO0129 - U 2 Mile Creek		1.2		
TUO0130 - Camp Clavey	0.2	1.3		
TUO0148 - U 13 Mile Creek		0.5		
TUO0149 - Cottonwood Creek		1.3		
TUO0151 - L Cottonwood Creek		1.1		
TUO0205 - N Niagara				0.1
TUO0218 - L Skunk Creek		1.1		0.3
TUO0219 - U Cherry Lake		0.1		
TUO0255 - Box Spring				0.1
TUO0257 - Westside E		1.2		
TUO0258 - Westside W		0.0		
TUO0261 - U Camp 25		0.4		
Totals	**0.2**	**29.1**	**0.1**	**0.6**

*PACs not shown did not have project roads in them

Table 3.15-13 Project road miles in HRCAs by road type, Alterative 3

Spotted Owl HRCA*	Miles			
	New permanent construction	Reconstruction	Skid zone	Temporary Road
MPA0019		2.3		
MPA0082		1.2		0.2
TUO0010		1.6		0.1
TUO0011		6.4	0.1	
TUO0012		1.5	0.2	
TUO0024		6.0		1.3
TUO0026		5.0		
TUO0027		4.9		0.2
TUO0032		2.0		
TUO0034		1.7		0.1
TUO0035		0.3		0.2
TUO0039		1.9	0.2	
TUO0040		2.8		0.3
TUO0053		3.3	0.2	
TUO0054		1.5		
TUO0059		2.9		
TUO0061		3.6		
TUO0065		0.4	0.4	
TUO0078		3.7		0.2
TUO0085		6.8		0.4
TUO0129		2.0	0.2	0.2
TUO0130	0.3	2.0		
TUO0142		0.1		0.0
TUO0148		3.7		
TUO0149		6.3	0.4	
TUO0151		3.1		
TUO0176		0.1		
TUO0187		2.8		
TUO0205				0.2
TUO0218		4.0		0.3
TUO0219		1.8		0.2
TUO0255		0.2		0.1
TUO0257		3.9		
TUO0258		0.9	0.0	
TUO0261		1.2		
Total	**0.3**	**91.7**	**1.8**	**3.9**

*HRCAs not shown did not have project roads in them

Indicator 5. Table 3.15-14 shows Alternative 3 has zero material sources, eight water sources, and two landings in suitable PACs. Two PACs contain one tractor landing each. The implementation of BMPs at project water sources is expected to minimize potential effects to spotted owls and their prey related to water availability. Under this alternative, habitat loss caused by landing construction was mitigated by adding equivalent acreage to the PAC. No net habitat loss is expected for this indicator.

Table 3.15-14 Water sources and landings within PACs, Alternative 3

Spotted Owl PAC*	Water sources	Landings	
		Tractor	Helicopter
TUO0011 - Big Creek	0	1	0
TUO0039 - Ackerson Mountain	1	0	0
TUO0061 - D51 Bear Spring Creek	1	0	0
TUO0078 - Crocker	2	0	0
TUO0129 - Upper 2 Mile Creek	1	0	0
TUO0148 - Upper 13 Mile Creek	1	0	0
TUO0151 - L. Cottonwood Creek	0	1	0
TUO0187 - Thompson Meadow	1	0	0
TUO0218 - L. Skunk Creek	1	0	0
Totals	**8**	**2**	**0**

*PACs not shown did not have these features

Table 3.15-15 Biomass in critical winter deer range units, Alternative 3

Unit	Biomass Acres	Total Unit Acres	Percent
L03	30	30	100
L04	25	79	32
L07	5	5	100
L201	92	92	100
L202	28	142	20
L203	250	695	36
L204	340	1519	22
L205	475	755	63
L206	15	81	19
M201	35	74	47
M202	20	138	14
M203	20	63	32
M204	79	282	28
O201A	80	156	51
O201B	60	121	50
P201	185	185	100
Total	**1,739**	**4,416**	**39**

Indicator 6. Alternative 3 has 8,379 acres of biomass fuels treatments. Table 3.15-15 shows 1,739 biomass acres occur in critical winter deer range and have a cover/forage ratio emphasis for deer habitat. Treatments designed to achieve optimal deer cover/forage ratios would also break up fuel continuity within those units and contribute to fuels management goals. Fuels management goals are important components of the fire and fuels strategy (Crook et al. 2013) and would assist in moving toward the desired condition of old forest habitat development. In particular, for critical winter deer range units located downslope of forest carnivore connectivity corridor units and PAC TUO0218, breaking up fuel continuity within the deer range units is likely to influence the development of future old forest linking Yosemite National Park and the North Mountain Roadless Area to the Clavey River watershed as shown in the Wildlife BE Appendix). Additional fuels treatments include 22,036 acres of pile and burn. Pile and burn treatments may be machine piled or hand piled with the objective of disposing of activity fuels. The 3,537 acres of watershed treatments involving mastication or "drop and lop" techniques would be used to provide soil cover in watershed sensitive areas would benefit

vegetation establishment and spotted owl habitat development. Alternative 3 treats 675 more biomass acres than Alternative 1 in critical areas and may potentially be more effective in managing fuels and future fire behavior downslope of an estimated 4 owl territories.

CUMULATIVE EFFECTS

The Cumulative effects discussion under Alternative 1 outlines those present and reasonably foreseeable future activities relevant to this alternative as well. The cumulative contribution of Alternative 3 would be less than Alternative 1 because management requirements minimize the potential for nest tree loss, habitat loss, and reduction in habitat quality of future old forest. In particular, snag retention would be higher within OFEA, HRCA, and FCCC units, and new permanent road construction would be greatly reduced. The cumulative contribution under this alternative may affect individual territories, but is not expected to affect the viability of this species.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Alternative 4 is the same as Alternative 3 except that it drops all new permanent road construction and the following eighteen units from treatment: A01B, A03, A04, A05A, A05B, D01A, D02, E01A, E01B, E02, O01, O02A, O02B, O04, O05, O12, R01A, and R02.

Indicator 1. Same as Alternative 3.

Indicator 2. Same as Alternative 3.

Table 3.15-16 Snag retention level in basal area per acre, Alternative 4

	12 square feet BA per acre* General Forest matrix management average (USDA 2010 p.44).	**30 square feet BA per acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).**	**100 to 120 square feet BA per acre Low intensity salvage treatment units (PSW Research).**	**Full retention**
Unit acres	13,427	12,315	2,089	2,571

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 3. Similar to Alternative 3, except Alternative 4, would drop 2,571 acres from salvage treatment specifically for species associated with post-fire environments (black-backed woodpecker section). Units designated for full snag retention incorporate 97 acres of retired PAC TUO030, 289 acres of retired PAC TUO0145, 57 acres of re-mapped PAC TUO078, and 148 acres of re-mapped PAC TUO0257. Although it was determined that these areas have little to no probability of continued occupancy for nesting or roosting as discussed in the PAC evaluation narratives and maps in the Wildlife BE Appendix, recent research indicates that the proposed retention may provide foraging habitat for spotted owls at least over the next decade (Bond et al. 2009). Retaining higher than average levels of large conifer snags and large down woody material in areas managed for old forest condition would improve habitat quality in the majority of territories in this project.

Indicator 4. Under Alternative 4, project road miles in PACs by road type would be the same as described in Alternative 3 above except that there would be no new permanent road construction within any PACs or HRCAs. Thus, in Alternative 4, long-term habitat fragmentation and disturbance potential from new permanent roads would not be an issue for the following two PACs and HRCAs: PAC# TUO0258 and PAC# TUO130.

Indicator 5. Same as Alternative 3.

Indicator 6. As in Alternative 3, Alternative 4 biomass and watershed treatments would occur except that biomass treatments and pile and burn treatments would not occur within the units dropped from salvage harvest. This totals 404 acres of dropped biomass treatments and 1,716 acres of dropped pile and burn treatments. As in Alternative 3, biomass treatments in critical winter deer range would still occur downslope of an estimated 4 owl territories.

CUMULATIVE EFFECTS

Same as Alternative 3, Alternative 4 would have the least habitat alteration with full retention of snags across 2,571 more acres than Alternative 3. Alternative 4 is not expected to affect the viability of spotted owl.

California Spotted Owl: Summary of Effects

Indicator 1. Table 3.15-17 shows the number of current and historic nest sites within suitable PACs in treatment units and the number of activity center nest sites within .25 mile of potentially disturbing activities are the same for all alternatives. LOPs are common to all action alternatives. However, Alternatives 3 and 4 include a management requirement to minimize the potential for effect and Alternative 1 does not.

Indicator 2. Table 3.15-17 shows acres of treatment unit overlap within suitable PACs is mitigated wherever possible in Alternatives 3 and 4 but not mitigated in Alternative 1.

Indicator 3. Table 3.15-17 shows Alternatives 3 and 4 have more acres managed for old forest objectives with higher than average levels of large snags and higher than average levels of large down woody material are highest in. In contrast, Alternative 1 manages no acres for higher than average levels of large snags. For retention of large down woody material, all action alternatives manage to a 10 to 20 tons per acre standard but Alternatives 3 and 4 emphasize retention at the higher end (i.e. 20 tons per acre) while Alternative 1 does not. Alternative 4 additionally manages 2,571 acres under full retention of snags and down woody material (1,414 acres from Alternative 3's 12 square feet BA per acre category and 1,157 acres from Alternative 3's 30 square feet BA per acre category are moved to the full retention category).

Indicator 4. Table 3.15-17 shows miles of new permanent road construction and other project road miles in PACs and HRCAs is highest in Alternative 1. Alternatives 1 and 3 include new permanent road construction in PACs and HRCAs. Alternative 4 proposes no new permanent road construction.

Indicator 5. Table 3.15-17 shows the number of water sources in PACs is the same in all action alternatives. Of the action alternatives, the number of landings in PACs is highest in Alternative 1 and lowest in Alternatives 3 and 4.

Indicator 6. Table 3.15-17 shows Alternatives 3 and 4 best address disposal of activity fuels and the need for soil cover treatments for watershed protection. Biomass treatments in critical areas are expected to be effective in managing fuels and future fire behavior downslope of developing owl habitat.

Determinations

Alternative 1 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 will not affect the California spotted owl. In making this determination, Bond et al. 2002, Roberts et al. 2011, and Lee et al. 2012 was considered.

Table 3.15-17 Summary of effects for California spotted owl

Indicator	Alternative			
	1	2	3	4
Indicator 1 – Nest sites				
Number of nest sites in treatment units	5	0	5	5
Number of nest sites within .25 mile of potentially disturbing activities	26	0	26	26
Management requirement to flag and avoid nest trees	no	N/A	Yes	Yes
Indicator 2 – Acres of treatment unit overlap within PACs				
Treatment overlap acres mitigated	0	N/A	1,715	1,715
Management requirement to add acreage to PAC	No	N/A	Yes	Yes
Indicator 3 – Old forest condition with large snags and large downed woody material				
12 sq. ft. BA / acre* General Forest matrix management average (USDA 2010 p.44)	28,326	0	15,955	13,427
30 sq. ft. BA / acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992)	0	0	12,359	12,315
100 to 120 sq. ft. BA / acre Low intensity salvage treatment units (PSW Research)	0	0	2,089	2,089
Full retention	0	30,402*	0	2,571
Indicator 4 – Road miles in PACs				
New construction	0.9	0	0.2	0
Reconstruction	31.3	0	29.1	29.1
Skid zone	0.6	0	0.1	0.1
Temporary road	2.2	0	0.6	0.6
Total miles in PACS	**35.0**	**0**	**30.0**	**28.8**
Indicator 4 – Road miles in HRCAs				
New construction	2.1	0	0.3	0
Reconstruction	95.3	0	91.7	91.7
Skid zone	3.4	0	1.8	1.8
Temporary road	6.2	0	3.9	3.9
Total miles in HRCAs	**107.0**	**0**	**97.7**	**97.4**
Indicator 5 – Number of water and material sources and landings in PACs				
Water sources	8	0	8	8
Material (Rock) sources	0	0	0	0
Tractor landings	4	0	2	2
Helicopter landings	2	0	0	0
Indicator 6 – Acres of fuels treatments by type				
Biomass	6,562	0	6,640	6,236
Biomass deer units	1,064	0	1,739	1,739
Pile and burn	0	0	22,036	20,320
Watershed soil cover treatments	0	0	3,537	3,537

*Represents the maximum number of potential unit acres.

Alternative 3 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is demonstrated.

Alternative 4 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the California spotted owl. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is best demonstrated by this action alternative. Specifically, this alternative would remove the risk factor of new permanent road construction within a suitable PAC, and retain the most foraging habitat of any action alternative.

Great Gray Owl: Affected Environment

Species and Habitat Account

The great gray owl (*Strix nebulosa*) is currently managed as a USDA Forest Service Sensitive species (Update to the Regional Forester's Sensitive species list, July 3, 2013). Habitat descriptions, species population trends, and the status of known or suspected limiting factors are summarized by Beck and Winter 2000, USDA 2001, 2004, and the R5 Sensitive species evaluation form of 2012 (USDA 2012d), and are incorporated here by reference.

Great gray owls are regarded as locally rare throughout their range in USFS Region 5 and no more than 100-200 individuals have been estimated in California since 1980, and only 80 were estimated in 2006 (R5 Sensitive Species Evaluation Form 2012). Although the great gray owl population in California is small, the Stanislaus National Forest contains more great gray owl sites than any other National Forest in Region 5, or any area outside of Yosemite National Park (Siegel 2001, 2002, NRIS Wildlife database, CNDDB database). Of the great gray owl sites on the Stanislaus National Forest, most are concentrated within the Rim Fire perimeter in areas that border Yosemite National Park (Rich, pers.obs.).

Hull et al. 2010 and Hull et al. 2014 found that great gray owls in the Yosemite area (i.e. including the Rim Fire area), are a genetically-unique population warranting subspecies status as ssp. *yosemitensis*. The genetic analysis completed by Hull et al. 2010 indicates that the *S.n. yosemitensis* population has experienced a recent genetic bottleneck and exhibits a small effective population size -- both of these latter factors are a significant conservation concern. The limited genetic diversity in this population may contribute to population instability because of the already low population levels, the low census numbers, the limited migration potential, and the potential for inbreeding depression (Hull et al. 2010).

Habitat requirements of great gray owls in the Sierra Nevada were summarized by Beck and Winter (2000), studied specifically by Greene (1995), Sears (2006), Powers et al. (2011), and Kalinowski et al. (in press), and are currently under additional investigations by PSW research (Keane, pers.comm.).

Great gray owls in the Sierra Nevada inhabit coniferous forest surrounding wet meadows (USDA 2001). Great gray owls typically breed in large flat-topped broken snags located in conifer stands with higher than average levels of large snags and woodland cover in the immediate vicinity of montane meadows (Bull and Duncan 1993, Beck and Winter 2000). Great gray owls may also utilize abandoned nests of other birds of prey, and mistletoe or other broom growths (Ibid).

Recent burns, where they exist in the Sierras, provide some structural similarity to a meadow ecosystem for a few years before the trees or brush shade out the grasses and forbs (Beck and Winter 2000). Such sites can provide foraging areas for nearby breeding great gray owls, but only on a short-term basis (Greene 1995, Beck pers.comm.). Meadows or meadow complexes at least 25 acres in size appear to be necessary for persistent occupancy and reproduction but meadows as small as 10 acres will support infrequent breeding (Beck and Winter 2000). Reproductive sites are associated with high vole abundance and high vole abundance is associated with meadow vegetation height (Beck 1985; Greene 1995; Sears 2006, Kalinowski et al., in press).

Mean home-range size in the Sierra Nevada during a radio-tagging study was estimated at 148 acres in females and 50 acres in males during the breeding season (generally March through August); great gray owls enlarge their home ranges substantially in winter (Van Riper and Van Wagtendonk 2006).

Great gray owl sites are identified through the use of protocol surveys (Beck and Winter 2000, Keane et al. 2011). Protocol surveys for great gray owl have been conducted throughout the Rim Fire area for the past two decades. Together these efforts have occurred at a level such that inventory information for the analysis area is considered essentially complete (USDA unpublished data, NRIS Wildlife database).

Great gray owl PACs are established and maintained to include the forested area and adjacent meadow around all known great gray owl nest stands. The PAC encompasses at least 50 acres of the highest quality nesting habitat (CWHR types 6, 5D, and 5M) available in the forested area surrounding the nest. The PAC also includes the meadow or meadow complex that supports the prey base for nesting owls (USDA 2010a p.187).

A post-fire PAC evaluation on NFS land in the Rim Fire area identified 13 historic great gray owl sites. This represents half of all great gray owl sites on the Stanislaus National Forest and a significant proportion of the estimated population size of 80 to 100 individuals for this subspecies (R5 Sensitive species evaluation form 2012, USDA 2010d). All of the great gray owl PACs in the Rim Fire burned at mixed severity. Approximately half of all PAC acres burned at high severity (greater than 75 percent basal area mortality) and although only preliminary ground assessment work has been completed, at least two known historic nest trees were lost in the fire. However, since great gray owls may nest in burned forest (Beck, pers.comm.), and since post-fire conditions may provide preferred foraging habitat in the short-term (Greene 1995), all great gray owl PAC boundaries were left intact except along roads where hazard tree removal was identified as a public safety need. Acreage was added to these PAC boundaries to offset unavoidable treatment overlap. Details on individual sites can be found in the Wildlife BE Appendix and in the effects analysis below. Based on early survey results this season using an Automatic Recording Unit (ARU), continued great gray owl use has been confirmed in one Rim Fire great gray owl PAC (USFS unpubl. data). The vocalizations obtained at this site involve courtship calls of a pair, suggesting an imminent nesting attempt. Occupation of additional great gray owl PACs post-fire is highly likely.

Management Direction

The Regional Forester for the Pacific Southwest Region has listed the great gray owl (GGOW) as a Sensitive Species. Current management direction is summarized by describing the desired future condition of land allocations (Robinson 1996). The desired condition for great gray owl PAC described in the Forest Plan Direction focuses on protecting nest sites with a minimum 50-acre buffer and managing meadow habitat for sufficiently large vole populations to provide a food source for great gray owls through the reproductive period (USDA 2010a p. 187).

Also, there is an emphasis to conduct additional surveys to established protocols to follow up reliable sightings of great gray owls (USDA 2010a p. 43).

Great Gray Owl: Environmental Consequences

The project alternatives could result in direct and indirect effects to the great gray owl through the following activities:

- Salvage harvest of fire-killed trees.
- Salvage harvest of roadside hazard trees.

- New permanent road construction, temporary road construction, and road reconstruction.
- Landing construction and use.
- Use of material sources and water sources.
- Biomass and similar fuels treatments.

These actions may have direct and indirect effects on great gray owls through the following:

- Project related death, injury, or disturbance.
- Project related modifications to habitat quantity and/or quality.

Death, injury or disturbance

Death, injury, and disturbance are potential direct effects to consider for great gray owl (USDA 2004). Project activities have the potential to cause death or injury by tree-falling or by the use of heavy equipment. There is the potential for death or injury if nest trees are felled while being used by nesting birds during the reproductive season. In addition, historic nest trees could be removed. The great gray owl is also susceptible to getting “roadkilled”. Collision with vehicles is a major cause of mortality (Keane et al. 2011); great gray owls tend to fly low over the ground in open areas especially adjacent to meadows (Bull and Duncan 1993). The management requirement of LOPs, mitigates the probability that death or injury would occur as a result of project activities. Flagging and avoiding current and historic nest trees provides a way to minimize nest tree loss or noncompliance with the Migratory Bird Treaty Act. Keeping screening vegetation intact within 500 feet of nests also helps to minimize disturbance potential and/or nest abandonment. Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, along project roads, and at landings, material sources, and water sources. Human presence in nest stands and loud noise in the vicinity of nest stands have the potential to change normal behavior and potentially impair essential behavior patterns of the great gray owl related to breeding, feeding, or sheltering. The potential for disturbance is minimized by the implementation of Limited Operating Periods (LOPs) as a management requirement.

The location of nest sites or activity centers are more uncertain following large-scale disturbance events (Keane, pers. comm.); conducting surveys to establish or confirm any new locations of nests or activity centers is a way to address this movement uncertainty (USDA 2004). Conducting protocol surveys is a management requirement common to all action alternatives.

Habitat modification

Post-fire salvage harvest is identified as a risk factor for great gray owl (Hull et al. 2010). Salvage harvest of fire-killed trees and salvage harvest of roadside hazard trees primarily removes snags and existing down woody material. Salvage harvest of roadside hazard trees may also remove existing living trees meeting certain criteria for hazard definition. There is considerable uncertainty with regards to treatment intensity in roadside hazard salvage units because treatment intensity is subject to a wide range of environmental conditions (e.g. drought and moisture stress) related to tree status. The removal of snags reduces future recruitment of down woody material. Snags and down logs are important habitat elements for great gray owls and their prey (USDA 2001, Bull and Henjum 1990). Sears (2006) found that sites with a higher density of large snags were more likely to be occupied by great gray owl. Salvage logging typically reduces snag densities especially large-diameter snags used for nesting, leaning trees used by juveniles for roosting before they can fly, and high stem density in stands used by juveniles for cover and protection (Bull and Henjum 1990). Bull and Henjum (1990) noted that roosts accessible to flightless young, such as leaning and deformed trees and perches high enough to avoid terrestrial predators, may increase reproductive success. Additionally, if perches are not left, great gray owls cannot readily hunt in those areas (Ibid). Because fledglings leave the nest before they can fly, screening cover around the nest is considered important for their survival (Hayward and Verner 1994).

New permanent road construction, temp road construction, road reconstruction, landing construction, and biomass removal also modify habitat. In particular, road construction and continued use can result in increased habitat fragmentation, disturbance, and lower habitat capability for great gray owl (Pyron et al. 2009). Basic road maintenance such as grading and cleaning culverts is probably not an issue provided vehicles are slow moving. In this project, landings and biomass removal are not proposed in great gray owl PACs. The use of water sources is probably not an issue given that great gray owls typically nest adjacent to wet meadow sites and wet meadow sites typically have high water availability. Further, the implementation of Best Management Practices (BMPs) at project water sources is expected to minimize potential effects to great gray owls and their prey related to water availability.

As great gray owls concentrate foraging around wet meadows and have relatively small breeding home ranges, the potential for habitat modification effects are expected to be most pronounced in the nesting habitat within PACs.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the great gray owl and to determine how well project alternatives comply with Forest Plan Direction and species conservation strategies:

1. Number of current and historic nest sites within PACs in treatment units or within .25 mile of potentially disturbing activities.
2. Acres of treatment unit overlap within suitable PACs.
3. Miles of new permanent road construction and other project road miles in PACs by road type.

Alternative 1 (Proposed Action)

Direct and Indirect Effects

Indicator 1. Potentially two known historic nest trees intersect with roadside hazard salvage treatment units and 22 known historic nest trees are within .25 mile of potentially disturbing activities. This represents approximately 70 percent of all known great gray owl nest trees on the Stanislaus National Forest. It is expected that the implementation of LOPs and protocol surveys as management requirements will minimize disturbance potential to these sites. However, there is no provision in Alternative 1 to flag and avoid current and historic nest trees and specify coordination triggers.

Table 3.15-18 Treatment unit overlap within great gray owl PACs, Alternative 1

Great gray owl PAC number	Roadside hazard tree treatment acres overlapping PAC	Percent of PAC affected*
Ackerson 11-15	0	0
Ackerson 16	17	23
Ackerson 1ABC	25	28
Ackerson 3	20	43
Ackerson 4	38	51
Ackerson 6	2	3
Ackerson South	0	0
Crocker Meadow	3	5
Drew Meadow	42	23
North Stone Meadow	2	4
Spinning Wheel	46	52
Wilson Meadow Lower	15	22
Wilson Meadow Upper	15	33

* Total great gray owl PAC acres vary. The Wildlife BE Appendix has narratives and maps of individual PACs.

Indicator 2. Under Alternative 1, 201 acres of roadside hazard salvage treatments within great gray owl PACs. Table 3.15-18 shows site-specifically, great gray owl sites would be potentially affected by habitat fragmentation at varying degrees ranging from 0 acres of overlap to approximately 50 percent overlap of a PAC. No provision in this alternative mitigates treatment overlap by adding equivalent acreage to the PAC.

Indicator 3. Table 3.15-19 shows the proposed activities within great gray owl PACs. The management requirement of re-closing all routes post-project, that are currently designated closed is expected to minimize long-term habitat fragmentation and disturbance potential. The management requirement of designating any new permanent road construction in PACs as blocked Maintenance Level 1 or Maintenance Level 2 gated year-round is expected to minimize long-term disturbance potential of affected sites, but not habitat fragmentation effects. For example, although locations are approximate, it appears that the placement of the new permanent road in the Drew Meadow PAC would partially go through a surviving group of green trees, potentially lowering capability of suitable roosting and nesting habitat for great gray owl.

Table 3.15-19 Project road miles in great gray owl PACs by road type, Alternative 1

Great gray owl PAC number*	New permanent road construction	Reconstruction	Temporary Roads	Total
Ackerson 16		0.09		0.09
Ackerson 3		0.17		0.17
Ackerson 4		0.39		0.39
Ackerson 6		0.03		0.03
Crocker Meadow		0.02		0.02
Drew Meadow	0.1	1.01	0.6	1.67
Spinning Wheel		0.89		0.89
Wilson Meadow Lower		0.10		0.10
Wilson Meadow Upper		0.40		0.40
Total	**0.1**	**3.1**	**0.6**	**3.8**

*PACs not shown did not have project roads in them

CUMULATIVE EFFECTS

In making the determination for this alternative, 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 was considered. A list of the actions considered can be found in Appendix B, Cumulative Effects.

Relevant risk factors potentially affecting great gray owl abundance and distribution have been identified and primarily include nest site loss and disturbance, roadkill, livestock grazing, and loss of habitat and habitat elements, especially large snags and large down woody material adjacent to wet meadows (USDA 2001, R5 Sensitive species evaluation form 2012, USDA 2012d).

Based on relevant risk factors and location, the following present and reasonably foreseeable actions from Appendix B are the most relevant to great gray owl: livestock grazing, meadow restoration, and the Rim HT project.

There are 13 grazing allotments either wholly or partially within the analysis area, resulting in a maximum number of 1,632 cow/calf pairs across the landscape. Livestock grazing may influence the abundance and availability of prey in wet meadows great gray owls use for foraging (Kalinowski et al., in press). Livestock grazing is subject to utilization and forest plan standards that are specifically designed to minimize grazing impacts on great gray owl prey. Meadow restoration projects are expected to improve foraging habitat for great gray owl. Based on the biological evaluations for each of these projects, short-term impacts are minimized and great gray owl habitat is expected to improve in the long-term with implementation of these projects.

Hazard tree removal along Maintenance Levels 3, 4 and 5 roads (i.e. typically paved) is occurring within great gray owl PAC, as shown in Table 3.15-20.

Cumulative effects of roadside hazard salvage treatments were mitigated in five PACs, partially mitigated in the Drew Meadow PAC, and could not be mitigated in two PACs. This would result in a net loss of habitat for three great gray owl territories, although precise thresholds of significance are unknown.

Alternative 1 may contribute cumulatively to short and long-term effects on great gray owl and there is at least a moderate level of uncertainty with thresholds of significance. The cumulative contribution under this alternative may affect individual territories, but is not expected to affect the viability of this species.

Table 3.15-20 Overlap acres of PACs with activities and acres mitigated

PAC	Acres of overlap	Acres mitigated*
Ackerson 11-15	0	N/A
Ackerson 16	13	13
Ackerson 1ABC	0	N/A
Ackerson 3	0	N/A
Ackerson 4	14	0**
Ackerson 6	28	28
Ackerson South	0	N/A
Crocker Meadow	17	17
Drew Meadow	93	55**
North Stone Meadow	4	4
Spinning Wheel	30	30
Wilson Meadow Lower	0	N/A
Wilson Meadow Upper	10	0**

*acres were mitigated by adding acreage to the PAC equivalent to the treated acres using adjacent acres of comparable quality wherever possible.
**no additional comparable habitat was available to offset total overlapping treatment acres.

Alternative 2 (No Action)

Direct and Indirect Effects

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur. The indirect effects of no action are primarily related to the influence no action may have on future wildfires and how future wildfires may impact great gray owl habitat.

Predicting the incremental effect no action would have on future wildfires and great gray owl habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, fire behavior may be expected to increase (3.05 Fuels). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

Cumulative Effects

The cumulative effects discussion under Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, no direct cumulative effect is expected because no active management would occur. Because the indirect effects of future fires is highly speculative and uncertain, cumulative effects cannot be predicted. Thus, no action is not expected to result in any definitive direct or indirect cumulative effects.

Alternative 3

Direct and Indirect Effects

Indicator 1. Similar to Alternative 1, but under Alternative 3, the management requirement to flag and avoid current and historic nest trees and screening vegetation is a mitigation measure expected to protect nest trees and ensure compliance with the Migratory Bird Treaty Act.

Indicator 2. Table 3.15-21 shows acres of roadside hazard salvage treatments overlapping great gray owl PAC. This indicator is similar to Alternative 1, but Alternative 3 has a management requirement that adds acreage to the PAC, equivalent to the treated acres using adjacent acres of comparable quality wherever possible. Two PACs would not be affected by overlapping treatment units. Treatments overlapping great gray owl PAC were almost entirely mitigated in four out of 11 cases. Treatments overlapping great gray owl PAC were partially mitigated in one case. The remaining six cases had no additional comparable habitat available to offset treatment acres proposed inside the respective PAC. Details on individual sites are in the Wildlife BE Appendix).

Indicator 3. Same as Alternative 1.

Table 3.15-21 Treatment unit overlap within great gray owl PACs, Alternative 3

Great gray owl PAC number	Roadside hazard tree treatment acres overlapping PAC	Percent of PAC affected*	Percent mitigated**
Ackerson 11-15	0	0	N/A
Ackerson 16	17	23	95
Ackerson 1ABC	25	28	100
Ackerson 3	20	43	100
Ackerson 4	38	51	0***
Ackerson 6	2	3	100
Ackerson South	0	0	N/A
Crocker Meadow	3	5	0***
Drew Meadow	42	23	0***
North Stone Meadow	2	4	100
Spinning Wheel	46	52	0***
Wilson Meadow Lower	15	22	0***
Wilson Meadow Upper	15	33	0***

* Total great gray owl PAC acres vary. The Wildlife BE Appendix has narratives and maps of individual PACs.
**Acres of roadside hazard salvage treatments overlapping great gray owl PAC were mitigated by adding acreage to the PAC equivalent to the treated acres using adjacent acres of comparable quality wherever possible. Maintenance Levels 3, 4, and 5 roadside hazard salvage were mitigated first as shown in the cumulative effects section followed by Maintenance Level 2 roadside hazard salvage.
*** No additional comparable habitat was available to offset treatment acres proposed inside this PAC.

Cumulative Effects

The Cumulative effects discussion under Alternative 1 outlines those present and reasonably foreseeable future activities relevant to this alternative as well. The cumulative contribution of Alternative 3 would be less than Alternative 1 because management requirements minimize the potential for nest tree and net habitat loss, and new permanent road construction would be greatly reduced. Alternative 3 is not expected to affect the viability of great gray owl.

Table 3.15-22 Project road miles in great gray owl PACs by road type, Alternative 3

PAC	Reconstruction	Temporary Road	Total
Ackerson 16	0.09	0	0.09
Ackerson 3	0.17	0	0.17
Ackerson 4	0.39	0	0.39
Ackerson 6	0.03	0	0.03
Crocker Meadow	0.02	0	0.02
Drew Meadow	1.37	0.30	1.67
Spinning Wheel	0.89	0	0.89
Wilson Meadow Lower	0.10	0	0.10
Wilson Meadow Upper	0.40	0	0.40
Total	**3.5**	**0.3**	**3.8**

*PACs not shown did not have project roads in them

Alternative 4

DIRECT AND INDIRECT EFFECTS

Alternative 4 is the same as Alternative 3 except that it drops the following eighteen units from treatment: A01B, A03, A04, A05A, A05B, D01A, D02, E01A, E01B, E02, O01, O02A, O02B, O04, O05, O12, R01A, and R02. Numerical values for indicators 1, 2, and 3 are the same in Alternative 4 as in Alternative 3. Under Alternative 4, the group O units are adjacent to great gray owl PACs Wilson Meadow Lower and Wilson Meadow Upper. Full retention in the O units under Alternative 4 would increase habitat capability for great gray owl in the Wilson Meadow area. Full retention would maintain the maximum number of snags for potential nests and hunting perches for great gray owl, reduce disturbance potential, and provide high stem densities great gray owls are likely to use for screening and cover.

CUMULATIVE EFFECTS

The incremental impact of Alterative 4 is very similar to Alternative 3 but overall, Alternative 4 would have the least amount of habitat alteration. As in Alternative 3, Alternative 4 is not expected to affect the viability of great gray owl.

Great Gray Owl: Summary of Effects

Indicator 1. Table 3.15-23 shows the number of current and historic nest sites within suitable PACs in treatment units and the number of activity center nest sites within .25 mile of potentially disturbing activities are the same for all alternatives. However, Alternatives 3 and 4 include a management requirement to minimize the potential for effect and Alternative 1 does not.

Indicator 2. Table 3.15-23 shows acres of treatment unit overlap within suitable PACs is mitigated wherever possible in Alternatives 3 and 4 but not mitigated in Alternative 1. For Alternatives 3 and 4, 30 percent of treatment overlap acres were mitigated; no additional comparable habitat was available to offset the remaining 70 percent. In Alternative 4, full retention of units in Group O may reduce treatment effect magnitude to two PACs (Wilson Meadow Lower and Wilson Meadow Upper).

Indicator 3. Table 3.15-23 shows miles of project road in great gray owl PACs is the same in all action alternatives.

Table 3.15-23 Summary of effects for great gray owl

Indicator	Alternative			
	1	2	3	4
Indicator 1 – Nest sites				
Number of nest sites in treatment units	2	0	2	2
Number of nest sites within .25 mile of potentially disturbing activities	22	0	22	22
Management requirement to flag and avoid nest trees	no	N/A	Yes	Yes
Indicator 2 – Acres of treatment unit overlap within PACs				
Treatment overlap acres mitigated	0	N/A	61	61
Management requirement to add acreage to PAC	No	N/A	Yes	Yes
Indicator 3 – Road miles in PACs				
New construction	0.1	0	0	0
Reconstruction	3.1	0	3.5	3.5
Temporary road	0.6	0	0.3	0.3
Total miles in PACS	**3.8**	**0**	**3.8**	**3.8**

Determinations

Alternative 1 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the great gray owl. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 will not affect the great gray owl.

Alternative 3 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the great gray owl. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is demonstrated.

Alternative 4 is the same as Alternative 3.

Northern Goshawk: Affected Environment

Species and Habitat Account

The northern goshawk (*Accipiter gentilis*) is currently managed as a USDA Forest Service Sensitive species (Update to the Regional Forester's Sensitive species list, July 3, 2013). Sensitive species are species identified by the Regional Forester where population viability is a concern because of 1) downward population trends and/or 2) diminished habitat capacity that would reduce species distribution. Habitat descriptions, species population trends, and the status of known or suspected limiting factors are summarized by USDA 2001 and the R5 Sensitive species evaluation form 2012, and are incorporated here by reference.

The northern goshawk has attracted substantial interest over the past two decades because management activities in forest environments have the potential to affect nesting habitat and, hence, population levels of this species (Woodbridge and Hargis 2006). Northern goshawks are associated with large trees, large snags, large downed logs, and use forests with a mix of dense tree cover interspersed with meadows, shrub patches, riparian areas, and other natural or artificial openings for foraging (Reynolds et al. 2008). In California, the occupancy rate of nest stands is positively correlated with stand size but smaller nest stands (less than 25 acre) are occasionally occupied (Woodbridge and Detrich 1994). Goshawk breeding area reoccupancy appears to be a function of the amount of potential nesting habitat available in the area surrounding the nest; goshawks tend to reoccupy breeding areas when greater than39 percent potential nesting habitat remains (Moser and Garton 2009). Stand replacing fire events have eliminated nesting territories but goshawks are known to nest in stands that have experienced understory fires that did not reduce canopy cover and numbers of large trees below suitable levels (USDA 2001).

Northern goshawk sites are identified through the use of protocol surveys (USDA 2000a). Protocol surveys for goshawk have been conducted throughout the Rim Fire area for the past two decades. These surveys are best described as opportunistic depending upon planned activities and funding levels but have occurred at a level such that inventory information for the analysis area is considered essentially complete (USDA, unpublished data, NRIS Wildlife database).

Northern goshawk sites receive special management consideration with protected activity centers (PACs). Goshawk PACs are delineated surrounding all known and newly discovered breeding territories detected on NFS lands. Northern goshawk PACs are designated based upon the latest documented nest site and location(s) of alternate nests. If the actual nest site is not located, the PAC is designated based on the location of territorial adult birds or recently fledged juvenile goshawks during the fledgling dependency period.

PACs are delineated to: (1) include known and suspected nest stands and (2) encompass the best available 200 acres of forested habitat in the largest contiguous patches possible, based on aerial photography. Where suitable nesting habitat occurs in small patches, PACs are defined as multiple blocks in the largest best available patches within 0.5 miles of one another. Best available forested stands for PACs have the following characteristics: (1) trees in the dominant and co-dominant crown classes average 24 inches dbh or greater; (2) in westside conifer and eastside mixed conifer forest types, stands have at least 70 percent tree canopy cover; and (3) in eastside pine forest types, stands have at least 60 percent tree canopy cover. Non-forest vegetation (such as brush and meadows) should not be counted as part of the 200 acres.

PACs may be removed from the network after a stand-replacing event if the habitat has been rendered unsuitable as a northern goshawk PAC and there are no opportunities for re-mapping the PAC in proximity to the affected PAC (USDA 2010a p. 184).

The post-fire PAC evaluation was completed with technical assistance from PSW scientists. For the analysis, each PAC was evaluated within the Rim Fire boundary using several criteria. The three main criteria used were 1) acres of post-fire suitable habitat defined as CWHR 4M, 4D, 5M, and 5D (including class 6) burned at less than 75 percent basal area mortality, 2) percent of PAC within a 496 acre circle burned at high severity (defined as greater than 75 percent basal area mortality), and 3) percent of pre-fire suitable habitat burned at high severity. Twenty-two northern goshawk sites are located within the Rim Fire perimeter. Figure 3.15-3 shows it is clear that sites cluster into three categories: 4 Category 1 (red), 15 Category 2 (green), and 3 Category 3 (orangeDetails on individual sites are provided in the Wildlife BE Appendix; categories may be summarized as follows:

Category 1 (red): These sites burned primarily at high severity across the 496-acre analysis area, had nearly all pre-fire suitable habitat burn at high severity, and have small amounts of post-fire suitable habitat. These sites lack attributes for suitable habitat (Laudenslayer and Parisi 2007). It is clear that these sites have very low to no probability of continued occupancy. Thus, we concluded that it is appropriate to remove these sites from the conservation network.

Category 2 (green): These are sites with lower amounts of high severity fire within the 200 ha analysis area, lower amounts of suitable habitat loss, and high amounts of remaining suitable habitat. Available literature suggests that these sites have high probabilities of continued occupancy. Thus, it is appropriate to consider these sites as suitable post-fire, and that it is appropriate to keep the boundaries intact as is.

Category 3 (orange): These are sites with intermediate values. There is some uncertainty as to the probability of occupancy for sites within this range of values. In order to reduce uncertainty in occupancy, it is appropriate to re-map the boundaries of these sites to encompass habitat of better quality where possible and to consider the re-mapped sites as suitable. It would be particularly important to monitor these sites so more can be learned about occupancy thresholds.

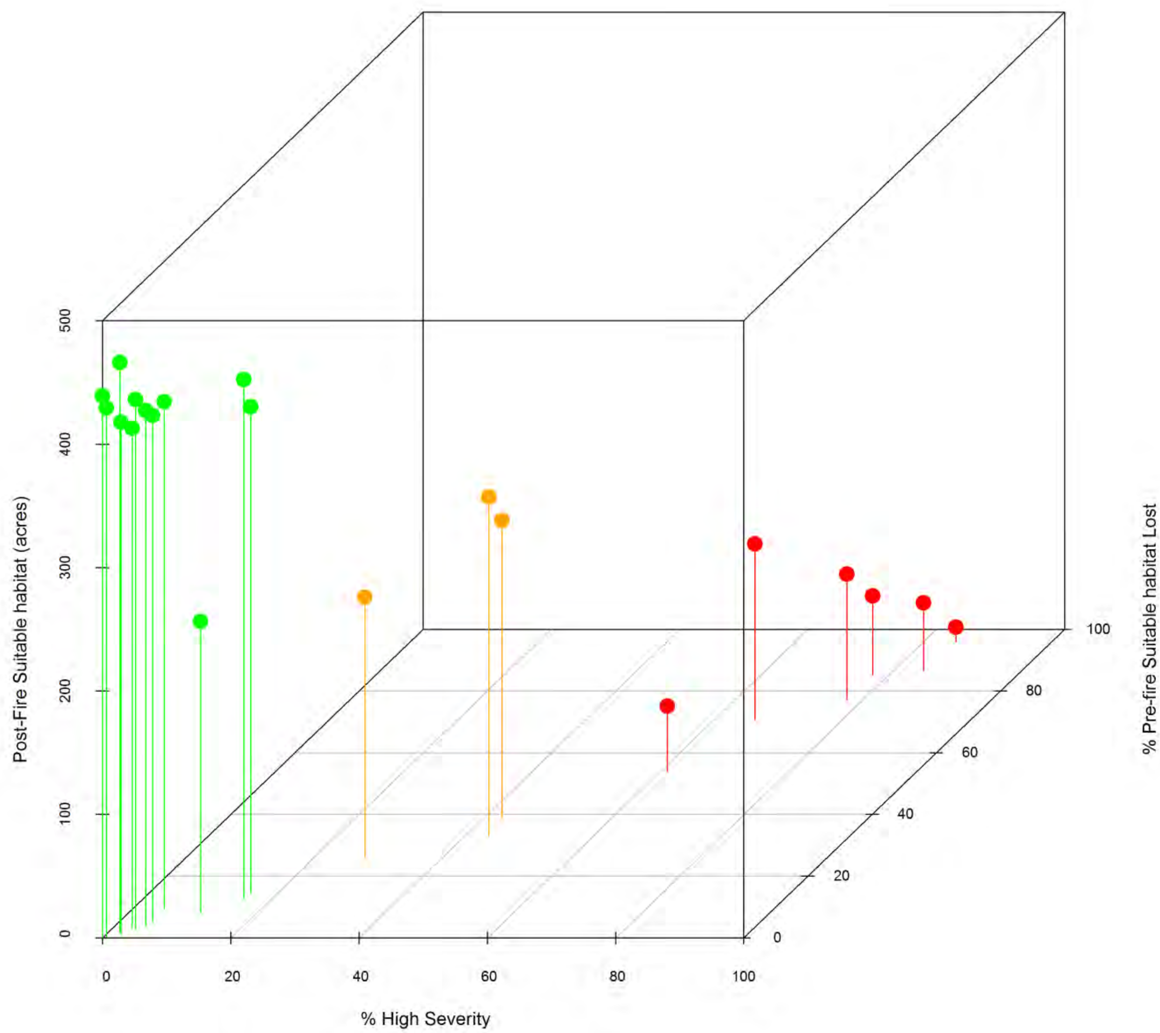

Figure 3.15-3 Pin graph showing post-fire northern goshawk PAC condition

Risk Factors

Risk factors potentially affecting northern goshawk abundance and distribution have been identified and primarily include nest site loss and disturbance, and loss of habitat and habitat elements, especially large snags and large down woody material (USDA 2001, R5 Sensitive species evaluation form 2012).

Management Direction

Current management direction is summarized by describing the desired future condition of land allocations (Robinson 1996). The northern goshawk is an at-risk species associated with old forest ecosystems (USDA 2004). The following land allocations pertain to goshawk and old forest ecosystems: Goshawk PACs, California spotted owl HRCA, OFEA, and FCCC). Although goshawks occupy a broad ecological niche and utilize a variety of habitats, the desired conditions in areas managed for old forest objectives provide suitable habitat for goshawk nesting, post-fledgling use, and are preferentially selected for foraging (USDA 2004).

The desired condition for a goshawk PAC is that stands in each PAC have: 1) at least two tree canopy layers; 2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; 3) at least 60 to70 percent canopy cover; 4) some very large snags (greater than 45 inches dbh); and 5) snag and down woody material levels that are higher than average.

Desired conditions in Home Range Core Area (HRCA) for California spotted owls also provide suitable habitat conditions for goshawk. The desired condition for HRCA is for large habitat blocks that have: 1) at least two tree canopy layers; 2) at least 24 inches dbh in dominant and co-dominant trees; 3) a number of very large (greater than 45 inches dbh) old trees; 4) at least 50 to 70 percent canopy cover; and 5) higher than average levels of snags and down woody material.

The desired condition for OFEA is to provide habitat conditions for mature forest associates (northern goshawk, California spotted owl, American marten, and Pacific fisher). Specifically, forest structure and function across old forest emphasis areas generally resemble pre-settlement conditions. High levels of horizontal and vertical diversity exist at the landscape-scale (roughly 10,000 acres). Stands are composed of roughly even-aged vegetation groups, varying in size, species composition, and structure. Individual vegetation groups range from less than 0.5 to more than 5 acres in size. Tree sizes range from seedlings to very large diameter trees. Species composition varies by elevation, site productivity, and related environmental factors. Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. Forest structure and function generally resemble pre-settlement conditions as shown in Figure 3.15-2.

Desired conditions in FCCC for fisher and marten also provide suitable habitat conditions for goshawk. The desired future condition of FCCC is to provide habitat connectivity for fisher and marten, linking Yosemite National Park and the North Mountain inventoried roadless area west to the Clavey River. For habitat connectivity, a future forested area is desired with a minimum of 50 percent of the forested area having at least 60 percent canopy cover. Higher than average levels of large snags and large down woody material is also desired (as in USDA 2004). Habitat structures are important to retain that may constitute rest sites as described in Lofroth et al. 2010 (e.g. see plate 7.8).

Northern Goshawk: Environmental Consequences

The project alternatives could result in direct and indirect effects to the northern goshawk through the following activities:

- Salvage harvest of fire-killed trees.
- Salvage harvest of roadside hazard trees.
- New permanent road construction, temporary road construction, and road reconstruction.
- Landing construction and use.
- Use of material sources and water sources.
- Biomass and similar fuels treatments.

These actions may have direct and indirect effects on northern goshawks through the following:

- Project related death, injury, or disturbance.
- Project related modifications to habitat quantity and/or quality.

Death, injury or disturbance

Death, injury, and disturbance are potential direct effects to consider for northern goshawk (USDA 2004). Project activities have the potential to cause death or injury by tree-falling or by the use of heavy equipment. There is the potential for death or injury if nest trees are felled while being used by nesting birds during the reproductive season. In addition, historic nest trees could be removed. The mobility of the species in question and the management requirement of LOPs, make it highly improbable that death or injury would occur as a result of project activities. Flagging and avoiding current and historic nest trees provides a way to minimize nest tree loss or noncompliance with the Migratory Bird Treaty Act. Keeping screening vegetation intact within 500 feet of nests also helps to minimize disturbance potential and/or nest abandonment.

Goshawks are highly susceptible to human disturbance (Squires and Reynolds 1997). During courtship and nest building, goshawks have been recorded to abandon nest areas following human intrusion alone (USDA 2000). In addition, incubating or brooding females may interrupt incubation or nestling care for extended periods to defend a nest (Ibid).

Logging activities near nests can cause failure, especially during incubation (Boal and Mannan 1994). Loading and skidding too close to active nests can cause abandonment, even with 20 day-old nestlings present (Squires and Reynolds 1997). Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, along project roads, and at landings, material sources, and water sources. Human presence, particularly loud noise, has the potential to change normal behavior and potentially impair essential behavior patterns of the northern goshawk related to breeding, feeding, or sheltering. The potential for disturbance is minimized by the implementation of Limited Operating Periods (LOPs) as a management requirement.

The location of nest sites or activity centers are more uncertain following large-scale disturbance events (Keane, pers. comm.); conducting surveys to establish or confirm any new locations of nests or activity centers is a way to address this movement uncertainty (USDA 2000). Conducting protocol surveys is a management requirement common to all action alternatives.

Habitat modification

Salvage harvest of fire-killed trees and salvage harvest of roadside hazard trees primarily removes snags and existing down woody material. Salvage harvest of roadside hazard trees may also remove existing living trees meeting certain criteria for hazard definition. The removal of snags reduces future recruitment of down woody material. Snags and down logs are important habitat elements for goshawks and their prey (USDA 2001).

Short-term, within the next ten years, snags and down woody material function as habitat elements important for goshawk prey. Snags also serve as potential hunting perch sites that may be utilized by goshawks. Goshawks feed on a variety of prey present in post-fire habitat mosaics. Primary prey groups include tree and ground squirrels, cottontails, jackrabbits, hares, and medium and large sized birds (Squires and Reynolds 1997). In the Sierra Nevada primary prey species are Douglas squirrel, golden-mantled ground squirrel, chipmunks, Steller's jay, northern flicker, and American robin (Keane 1999).

Long-term over several decades, large snags and large down woody material are considered biological legacies in the post-fire environment and play important roles in the structure of the future forest (Lindenmayer et al. 2008). Snag dynamics in the Sierra Nevada are complex and snags fall at different rates depending on many factors (Cluck and Smith 2007). The time elapsed since fire is closely correlated with habitat elements present and the composition of prey species (Ingles 1965, Quinn and Keeley 2006). Ground squirrels, northern flickers, and the American robin use a variety of open forests and shrub habitats with abundant insects and fruits (USDA 2001). Douglas squirrels use intermediate and mature stands containing large trees capable of providing cones and fungi, and Steller's jays prefer mature forest with open to moderate canopy cover and large, mature trees (Ibid). Thus, snags and down woody material serve different functional roles overtime for the goshawk, first providing cover for prey in the complex early seral stage of the forest, and ultimately decaying and playing a critical role in soil development of the future forest (Lindenmayer et al. 2008).

New permanent road construction, temp road construction, road reconstruction, and landing construction also modify habitat. In particular, road construction and continued use can result in increased habitat fragmentation, disturbance, and lower habitat capability for northern goshawk (Pyron et al. 2009). Woodbridge and Detrich (1994) found that northern goshawk territories associated with large contiguous forest patches were more consistently occupied compared to highly fragmented stands. Basic road maintenance such as grading and cleaning culverts is generally not an issue. The use of water sources may reduce water availability for northern goshawks and their prey, especially in drought years. Free water is important to the goshawk and in California, permanent water was generally closer to nesting ranges than to the centers of random circles (Hargis et al. 1994). Landing construction results in habitat fragmentation. Helicopter landings are typically between 1 and 3 acre in size and tractor landings are typically .25 to 1 acre in size.

The removal of snags and down woody material can be expected to reduce fuel loadings. However, the effectiveness of the various treatments proposed is difficult to predict and there is considerable uncertainty with how salvage logging influences future fire. A review of recent research on this topic and the associated controversy can be found in Long et al. (2013) Ch. 4.3 pp. 6-7.

The effect salvage logging has on the fire severity of a re-burn is likely to remain widely variable depending on numerous factors including how future prescribed fire management is planned and implemented. However, there is general consensus that the removal of smaller diameter material (activity fuels and biomass) is likely to be the most effective (3.05 Fuels) in reducing flame lengths and fire line intensities. Piling and burning activity fuels is an effective method for disposal and is expected to promote development of mature forest (Ibid). Also, preventing high fuel loadings along roadsides can reasonably be expected to play an important role in reducing fire severity to developing mature forest habitat, especially where roads are identified as critical fire management features Crook et al. 2013). Roadside hazard salvage treatments involve the removal of snags and live trees identified as hazards to public safety. There is considerable uncertainty with regards to treatment intensity in roadside hazard salvage units because treatment intensity is subject to a wide range of environmental conditions (e.g. drought and moisture stress) related to tree status.

The management of goshawk habitat is typically thought of in three spatial scales (Reynolds et al. 1992, Reynolds et al. 2008). The first is the nesting habitat scale, or the PAC which corresponds to 200 acres. The second addresses the post-fledgling area which corresponds to about 420 acres (USDA 2001), and the third addresses the whole foraging area or home range which corresponds to about 5,000 acres (Ibid). Goshawks in the Sierra Nevada are year-round residents, and expand their breeding ranges in the winter (Keane 1999). As northern goshawks focus their breeding activities around roost and nest sites within PACs, habitat modification effects are expected to be most pronounced in PACs.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the northern goshawk and to determine how well project alternatives comply with Forest Plan Direction and species conservation strategies:

1. Number of current and historic nest sites within suitable PACs in treatment units or within .25 mile of potentially disturbing activities.
2. Acres of treatment unit overlap within suitable PACs.
3. Acres of areas managed for old forest condition with higher than average levels of large snags and higher than average levels of large down woody material.
4. Miles of new permanent road construction and other project road miles in PACs by road type.
5. Number of material sources, water sources, and landings in PACs.
6. Acres of fuels treatments by type (biomass, pile and burn) including deer forage units and watershed soil cover treatments (mastication, drop and lop).

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Potentially ten known goshawk activity center nest trees intersect with roadside hazard salvage treatment units and 39 known activity center nest trees are within .25 mile of potentially disturbing activities. It is expected that the required implementation of LOPs and protocol surveys will minimize disturbance potential to these sites; however, Alternative 1 does not have the provision to flag and avoid current and historic nest trees or trigger special coordination measures designed to promote nest tree protection. Therefore, it is likely that approximately 56 percent of goshawk territories would be negatively affected by nest tree loss.

Indicator 2. Under Alternative 1, 653 acres of roadside hazard salvage treatments occurs within post-fire suitable PACs. Site-specifically, Table 3.15-24 shows northern goshawk sites would be potentially affected by habitat fragmentation at varying degrees ranging from 0 acres of overlap to approximately 40 percent of a PAC. There is no provision in this alternative to mitigate treatment overlap by adding equivalent acreage to the PAC. Although thresholds of significance for individual PACs are unknown, Alternative 1 would result in a potential net loss of 653 acres of goshawk habitat and potentially affect occupancy or reproduction in the majority of goshawk territories.

Table 3.15-24 Treatment unit overlap within post-fire goshawk PACs, Alternative 1

Goshawk PAC number	Roadside hazard tree treatment acres
R05F16D51T02	0
R05F16D51T03	39
R05F16D51T10	51
R05F16D51T11	10
R05F16D51T16	19
R05F16D51T24	76
R05F16D51T25	34
R05F16D54T02	18
R05F16D54T07	27
R05F16D54T08	82
R05F16D54T13	43
R05F16D54T21	59
R05F16D54T25	23
R05F16D54T40	41
R05F16D54T41	44
R05F16D54T42	20
R05F16D54T43	52
R05F16D54T44	15
Total	**653**

Indicator 3. Under Alternative 1, Table 3.15-25 shows salvage units managed for old forest condition would not be managed for higher than average levels of large conifer snags and large down woody material. Large down woody material would be retained at the average management rate of 10 to 20 tons per acre for all units. Higher than average levels of large conifer snags and large down woody material is a management objective in areas managed for old forest condition. Areas managed for old forest condition include OFEA, HRCA, and FCCC.

The importance of higher than average levels of large conifer snags and large down woody material to habitat quality is described in the "habitat modification" section above. Generally, habitat managed for higher than average levels may be best qualified as developing into highly suitable habitat, while habitat managed at average levels may be best qualified as developing into low to moderate suitability.

Table 3.15-25 Snag retention level in basal area per acre, Alternative 1

	12 square feet BA per acre* General Forest matrix management average (USDA 2010 p.44).	30 square feet BA per acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).	100 to 120 square feet BA per acre Low intensity salvage treatment units (PSW Research).
Unit acres	28,326	0	0

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 4. Under Alternative 1, Table 3.15-26 shows 10 road miles intersect goshawk PACs. There are no miles of new permanent road construction, 9.7 miles of road reconstruction, 0.1 miles of “skid zones”, and 0.05 miles of temporary road in PACs. Of the road reconstruction miles, 0.6 miles would occur in suitable PACs on routes currently decommissioned or not designated for motor vehicle travel. The remaining road reconstruction miles occur mainly on open Maintenance Level 2 roads. The management requirement of re-closing all routes post-project that are currently designated closed pre-project is expected to minimize long-term habitat fragmentation and disturbance potential.

Table 3.15-26 Project road miles in goshawk PACs by road type, Alternative 1

Goshawk PAC	Reconstruct	Skid Zone	Temporary Road
R05F16D51T03	0.99		
R05F16D51T10	1.09		
R05F16D51T11	0.09		
R05F16D51T24	0.45	0.11	
R05F16D51T25	0.10		
R05F16D54T08	1.12		
R05F16D54T13	1.71		
R05F16D54T21	1.14		
R05F16D54T40	0.73		
R05F16D54T41	0.96		
R05F16D54T42	0.20		
R05F16D54T43	1.07		0.05
R05F16D54T44	0.05		
Grand Total	**9.72**	**0.11**	**0.05**

*PACs not shown did not have project roads in them

Indicator 5. Table 3.15-27 shows Alternative 1 has zero material sources, four water sources, and two landings in suitable PACs. Of the landings in suitable PACs, one is a helicopter landing in PAC R05F16D54T13. The implementation of BMPs at project water sources is expected to minimize potential effects to northern goshawks and their prey related to water availability. There is no provision in this alternative to mitigate habitat loss caused by landing construction by adding acreage to the PAC. This would result in a potential net loss of four acres of goshawk habitat.

Table 3.15-27 Water sources and landings within goshawk PACs, Alternative 1

Goshawk PAC	Water sources	Landings	
		Tractor	Helicopter
R05F16D51T24		1	
R05F16D54T13			1
R05F16D54T21	1		
R05F16D54T40	2		
R05F16D54T44	1		
Totals	**4**	**1**	**1**

*PACs not shown did not have these features in them

Indicator 6. Under Alternative 1, 7,626 acres of fuels would be biomassed. Of the biomass acres, Table 3.15-28 shows 1,064 acres occur in critical winter deer range and have a cover/forage ratio emphasis for deer habitat. Treatments designed to achieve optimal deer cover/forage ratios would also break up fuel continuity within those units and contribute to fuels management goals. Fuels management goals are important components of the fire and fuels strategy (Crook et al. 2013) and would assist in moving toward the desired condition of old forest habitat development. In particular, for critical winter deer range units located downslope of forest carnivore connectivity corridor units and goshawk PAC R05F16D54T21, breaking up fuel continuity within the deer range units is likely to play a critical role in the development of future old forest, and goshawk nesting habitat, linking Yosemite National Park and the North Mountain Roadless Area to the Clavey River watershed. Specifically, fuels management actions in the deer range units, which are located downslope of the old forest corridor, are likely to prevent fire spread into the developing forest upslope, at least in the short-term. However, long-term effectiveness is highly speculative because future long-term management actions (e.g. prescribed burn schedules) are unknown at this time. The Wildlife BE Appendix has additional information.

Table 3.15-28 Biomass in critical winter deer range units, Alternative 1

Unit	Biomass Acres	Total Unit Acres	Percent
L03	31	30	100
L06	10	10	100
L07	5	5	100
L202	28	142	20
L203	265	265	100
L204	87	87	100
L205	140	140	100
L206	138	138	100
M201	35	50	70
O201	140	299	27
P201	185	185	100
Total	**1,064**	**1,352**	**79**

CUMULATIVE EFFECTS

In making the determination for this alternative, 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 was considered. A list of the actions considered can be found in Appendix B, Cumulative Effects.

Relevant risk factors potentially affecting northern goshawk abundance and distribution have been identified and primarily include nest site loss and disturbance, and loss of habitat and habitat elements, especially large snags and large down woody material (USDA 2001, R5 Sensitive species evaluation form 2012).

Based on relevant risk factors, the following present and reasonably foreseeable actions from Appendix B are the most relevant to northern goshawk: green thinning sales, emergency fire salvage on private land, and the Rim HT project.

The green thinning sales are designed to reduce ladder fuels and retain and improve key habitat components such as retention of large trees, defect trees, snags, downed wood, and hardwoods. Based on the biological evaluations for each, desired conditions in goshawk habitat are expected to improve in the long-term with implementation of these projects.

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acre is presently being salvage logged. These salvage activities generally remove all fire-killed and dying trees, important habitat elements to goshawk habitat in the short and long-term. There is considerable uncertainty regarding the ecological effects of varying levels of salvage treatments to this species (Appendix D).

The Rim HT project removes snags along high-use, typically paved roads (Maintenance Level 3 to 5 roads). Hazard tree removal along Maintenance Level 3-5 roads was considered when remapping Category 3 PACs for Alternatives 1, 3, and 4. For Category 2 PACs, hazard tree removal along Maintenance Level 3-5 roads was considered in Alternative 3 and 4, but not Alternative 1 (northern goshawk PAC evaluation/remapping narratives in the Wildlife BE Appendix).

Alternative 1 may contribute cumulatively to short and long-term effects on northern goshawk. The combination of past Forest Service and private timber harvests has cumulatively reduced the amount of suitable old forest habitat available across the analysis area. The cumulative contribution under this alternative may affect individual territories, but is not expected to affect the viability of this species.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur. The indirect effects of no action are primarily related to the influence no action may have on future wildfires and how future wildfires may impact northern goshawk habitat.

Predicting the incremental effect no action would have on future wildfires and goshawk habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (3.05 Fuels). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013). Goshawks occupy forest mosaics with heterogeneous habitat types (Squires and Reynolds 1997) but the optimal mosaic or mix of habitat is largely unknown. Presumably, occupancy rates would be highest under conditions that most closely approximate the environment goshawks evolved with, such as those described in North et al. 2009 and North 2012.

CUMULATIVE EFFECTS

The cumulative effects discussion under Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, no direct cumulative effect is expected because no active management would occur. Because the indirect effects of future fires is highly speculative and uncertain, cumulative effects cannot be predicted. Thus, no action is not expected to result in any definitive direct or indirect cumulative effects.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Indicator 1. Potentially nine known activity center nest trees intersect with roadside hazard salvage treatment units and 37 known activity center nest trees are within .25 mile of potentially disturbing activities. It is expected that the implementation of LOPs and protocol surveys as management requirements will minimize disturbance potential to these sites. Under Alternative 3, the management requirement to flag and avoid current and historic nest trees and screening vegetation is expected to protect nest trees and ensure compliance with the Migratory Bird Treaty Act. The risk of nest tree loss is minimized and not expected to occur.

Indicator 2. Table 3.15-29 shows 653 acres of roadside hazard salvage treatments would occur within post-fire suitable PACs. Site-specifically, northern goshawk sites would be potentially affected by habitat fragmentation at varying degrees ranging from 0 acres of overlap to approximately 40 percent of a PAC. Under this alternative, overlap with roadside hazard treatments was mitigated by adding acreage to the PAC equivalent to the treatment acres as per Forest Plan Direction (USDA 2010 p. 185). Under Alternative 3, 83 percent of affected PAC acres would be mitigated; two PACs had unmitigated treatment overlap. For unmitigated acres, additional acres of suitable habitat were not available. Nevertheless, in this alternative, unmitigated habitat alteration would be minimized to the greatest extent possible. Although thresholds of significance for individual PACs are unknown, Alternative 1 would minimize potential net loss of goshawk habitat to 102 acres and reduce the risk of non-occupancy in the majority of goshawk territories. Information on the PAC evaluation narratives and maps is in the Wildlife BE Appendix.

Table 3.15-29 Treatment unit overlap within post-fire goshawk PACs, Alternative 3

Goshawk PAC	Roadside hazard salvage treatment acres	Percent mitigated
R05F16D51T02	0	N/A
R05F16D51T03	39	100
R05F16D51T10	51	100
R05F16D51T11	10	100
R05F16D51T16	19	100
R05F16D51T24	76	100
R05F16D51T25	34	100
R05F16D54T02	18	100
R05F16D54T07	27	100
R05F16D54T08	82	100
R05F16D54T13	43	0
R05F16D54T21	59	0
R05F16D54T25	23	100
R05F16D54T40	41	100
R05F16D54T41	44	100
R05F16D54T42	20	100
R05F16D54T43	52	100
R05F16D54T44	15	100
Total	**653**	

Indicator 3. Table 3.15-30 shows under Alternative 3, 14,448 acres of salvage units managed for old forest condition would be managed for higher than average levels of large conifer snags and large down woody material. Large down woody material would be retained at the rate of 10 to 20 tons per

acre with 20 tons per acre emphasized in units managed for old forest condition. Higher than average levels of large conifer snags and large down woody material is a management objective in areas managed for old forest condition. Areas managed for old forest condition include OFEA, HRCA, and FCCC. Under Alternative 3, 2,089 acres would receive low intensity salvage treatment as part of a PSW research project. Goshawk occupancy will be monitored and studied in the PSW research project. This research will provide information to better understand the effects of wildfire and salvage-logging on northern goshawk occupancy and use, and serve as an empirical basis for informing future management decisions (Keane, pers.comm.). Thus, the PSW research is expected to address important management questions and benefit northern goshawk conservation. Retaining higher than average levels of large conifer snags and large down woody material in areas managed for old forest condition would be consistent with forest plan direction and improve habitat quality for the majority of territories in this project.

Table 3.15-30 Snag retention level in basal area per acre, Alternative 3

	12 square feet BA per acre* General Forest matrix management average (USDA 2010 p.44).	**30 square feet BA per acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).**	**100 to 120 square feet BA per acre Low intensity salvage treatment units (PSW Research).**
Unit acres	15,955	12,359	2,089

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 4. Under Alternative 3, a total of 8.6 project road miles intersect goshawk PACs. Table 3.15-31 shows no new permanent road construction, 8.3 miles of road reconstruction, 0.1 miles of “skid zones”, and 0.2 miles of temporary roads in suitable PACs. Of the road reconstruction miles, 0.6 miles would occur in suitable PACs on routes currently decommissioned or not designated for motor vehicle travel. The remaining road reconstruction miles occur mainly on open Maintenance Level 2 roads. The management requirement of re-closing all routes post-project that are currently designated closed pre-project is a mitigation measure that is expected to minimize long-term habitat fragmentation and disturbance potential.

Table 3.15-31 Road miles in PACs by road type, Alternative 3

Goshawk PAC	Reconstruction	Skid Zone	Temporary Road
R05F16D51T03	0.79		
R05F16D51T11	0.07		
R05F16D51T24	0.45	0.11	
R05F16D51T25	0.07		
R05F16D54T08	1.46		0.09
R05F16D54T13	1.39		
R05F16D54T21	1.14		0.07
R05F16D54T40	0.73		
R05F16D54T41	0.96		
R05F16D54T42	0.13		
R05F16D54T43	1.07		0.05
R05F16D54T44	0.05		
Grand Total	**8.33**	**0.11**	**0.21**

*PACs not shown did not have project roads in them

Indicator 5. Table 3.15-32 shows Alternative 3 has zero material sources, four water sources, and one landing in suitable PAC. Of the landings in suitable PACs, none are helicopter landings. The implementation of BMPs at project water sources is expected to minimize potential effects to northern goshawks and their prey related to water availability. Under this alternative, habitat loss caused by landing construction was mitigated by adding equivalent acreage to the PAC. No net habitat loss is expected for this indicator.

Table 3.15-32 Water sources and landings within PACs, Alternative 3

Goshawk PAC	Water sources	Landings	
		Tractor	Helicopter
R05F16D51T24		1	
R05F16D54T21	1		
R05F16D54T40	2		
R05F16D54T44	1		
Total	**4**	**1**	**0**

*PACs not shown did not have these features

Table 3.15-33 Biomass in critical winter deer range units, Alternative 3

Unit number	Biomass Acres	Total Unit Acres	Percent
L03	30	30	100
L04	25	79	32
L07	5	5	100
L201	92	92	100
L202	28	142	20
L203	250	695	36
L204	340	1519	22
L205	475	755	63
L206	15	81	19
M201	35	74	47
M202	20	138	14
M203	20	63	32
M204	79	282	28
O201A	80	156	51
O201B	60	121	50
P201	185	185	100
Total	**1,739**	**4,416**	**39**

Indicator 6. Under Alternative 3, there are 8,379 acres of biomass fuels treatments. Table 3.15-33 shows 1,739 acres of biomass occur in critical winter deer range and have a cover to forage ratio emphasis for deer habitat. Alternative 3 treats 675 more biomass acres than Alternative 1 in critical areas and so is expected to be more effective in managing fuels and future fire behavior downslope of developing goshawk habitat. Treatments designed to achieve optimal deer cover/forage ratios would also break up fuel continuity within those units and contribute to fuels management goals. Fuels management goals are important components of the fire and fuels strategy (Crook et al. 2013) and would assist in moving toward the desired condition of old forest habitat development. In particular, for critical winter deer range units located downslope of forest carnivore connectivity corridor units and goshawk PAC R05F16D54T21, breaking up fuel continuity within the deer range units is likely to play a critical role in the development of future old forest, and goshawk nesting habitat, linking Yosemite National Park and the North Mountain Roadless Area to the Clavey River watershed (illustrated in the Wildlife BE Appendix). The 22,036 acres of pile and burn fuels treatments and 3,537 acres of watershed treatments involving mastication or “drop and lop” techniques in watershed

sensitive areas are expected to benefit the establishment of vegetation and, thus, would benefit northern goshawk habitat development.

CUMULATIVE EFFECTS

The cumulative effects discussion under Alternative 1 outlines those present and reasonably foreseeable future activities relevant to Alternative 3 as well. The cumulative contribution of Alternative 3 would be less than Alternative 1 because management requirements minimize the potential for nest tree loss, habitat loss, and reduction in habitat quality of future old forest. In particular, snag retention would be higher within OFEA, HRCA, and FCCC units, and new permanent road construction would be reduced. Potentially effects are minimized by specific Management requirements. The cumulative contribution under this alternative may affect individual territories, but is not expected to affect the viability of this species.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Alternative 4 is the same as Alternative 3 except that it drops all new permanent road construction and the following eighteen units from treatment: A01B, A03, A04, A05A, A05B, D01A, D02, E01A, E01B, E02, O01, O02A, O02B, O04, O05, O12, R01A, and R02.

Indicator 1. Same as Alternative 3.

Indicator 2. Same as Alternative 3.

Indicator 3. Table 3.15-34 shows Alternative 4 has 16,975 acres of salvage units that would be managed for old forest condition would be managed for higher than average levels of large conifer snags and large down woody material. Large down woody material would be retained at the rate of 10 to 20 tons per acre with 20 tons per acre emphasized in units managed for old forest condition. Higher than average levels of large conifer snags and large down woody material is a management objective in areas managed for old forest condition. Areas managed for old forest condition include OFEA, HRCA, and FCCC. Low intensity salvage treatments would occur on 2,089 acres as part of a PSW research project as described in Alternative 3. Under Alternative 4, 2,571 acres would be dropped from salvage treatment specifically for species associated with post-fire environments (black-backed woodpecker section), except for roadside hazard salvage. Goshawks forage over large areas and the proposed retention may provide a greater variety of goshawk prey and perch sites for goshawks but little is known about goshawk use of post-fire environments.

Table 3.15-34 Snag retention level in basal area per acre, Alternative 4

	12 square feet BA per acre* General Forest matrix management average (USDA 2010 p.44).	30 square feet BA per acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992).	100 to 120 square feet BA per acre Low intensity salvage treatment units (PSW Research).	Full retention
Unit acres	13,427	12,315	2,089	2,571

*converted from 4 snags per acre for comparison purposes; assuming retention of 24 inches dbh snags.

Indicator 4. Under Alternative 4, project road miles in PACs by road type would be the same as described in Alternative 3 above except that there would be 0.8 miles less of road reconstruction in Alternative 4.

Indicator 5. Same as Alternative 3.

Indicator 6. As in Alternative 3 above, Alternative 4 treats 675 more biomass acres than Alternative 1 in critical areas and so is expected to be more effective in managing fuels and future fire behavior downslope of developing goshawk habitat. Biomass treatments and pile and burn treatments would not occur within the units dropped from salvage harvest. This totals 404 acres of dropped biomass treatments and 1,716 acres of dropped pile and burn treatments.

CUMULATIVE EFFECTS

The cumulative contribution of Alternative 4 would be similar to Alternative 3. Alternative 4 would have the least habitat alteration with full retention of snags across 2,571 more acres than Alternative 3. Alternative 4 is not expected to incrementally add to other actions and affect the viability of northern goshawk.

Northern Goshawk: Summary of Effects

Indicator 1. Table 3.15-35 shows the number of current and historic nest sites within suitable PACs in treatment units and the number of activity center nest sites within .25 mile of potentially disturbing activities are the same for all alternatives. However, Alternatives 3 and 4 include a management requirement to minimize the potential for effect and Alternative 1 does not.

Indicator 2. Table 3.15-35 shows acres of treatment unit overlap within suitable PACs is mitigated wherever possible in Alternatives 3 and 4 but not mitigated in Alternative 1.

Indicator 3. Table 3.15-35 shows the acres of areas managed for old forest objectives with higher than average levels of large snags and higher than average levels of large down woody material are highest in Alternatives 3 and 4. In contrast, Alternative 1 manages no acres for higher than average levels of large snags. For retention of large down woody material, all action alternatives manage to a 10 to 20 tons per acre standard but Alternatives 3 and 4 emphasize retention at the higher end (i.e. 20 tons per acre) while Alternative 1 does not. Alternative 4 additionally manages 2,571 acres under full retention of snags and down woody material (1,414 acres from Alternative 3's 12 square feet BA per acre category and 1,157 acres from Alternative 3's 30 square feet BA per acre category are moved to the full retention category).

Indicator 4. Table 3.15-35 shows miles of project road miles in goshawk PACs is highest in Alternative 1. There is 0.1 miles of additional temporary road under Alternatives 3 and 4 because the PACs are larger (following the Forest Plan Direction for mitigating treatment overlap) and one happens to incorporate a short piece of temporary road. Of the action alternatives, Alternative 4 has the least overall amount of project road activity overlapping suitable goshawk PAC.

Indicator 5. Table 3.15-35 shows the number of water sources in PACs is the same in all action alternatives. Of the action alternatives, Alternative 1 has a helicopter landing in suitable goshawk PAC and Alternatives 3 and 4 do not.

Indicator 6. Alternatives 3 and 4 best address disposal of activity fuels and the need for soil cover treatments for watershed protection.

Determinations

Alternative 1 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the northern goshawk. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 will not affect the northern goshawk.

Alternative 3 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the northern goshawk. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is demonstrated.

Alternative 4 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the northern goshawk. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing conservation strategies and forest plan direction is demonstrated.

Table 3.15-35 Summary of effects for northern goshawk

Indicator	Alternative			
	1	2	3	4
Indicator 1 – Nest sites				
Number of nest sites in treatment units	10	0	9	9
Number of nest sites within .25 mile of potentially disturbing activities	39	0	37	37
Management requirement to flag and avoid historic nest trees	no	N/A	Yes	Yes
Indicator 2 – Acres of treatment unit overlap within PACs				
Treatment overlap acres mitigated	0	N/A	653	653
Management requirement to add acreage to PAC	No	N/A	Yes	Yes
Indicator 3 – Old forest condition with large snags and large downed woody material				
12 sq. ft. BA / acre* General Forest matrix management average (USDA 2010 p.44)	28,326	0	15,955	13,427
30 sq. ft. BA / acre OFEA, HRCA, FCCC above average level management objective (Verner et al. 1992)	0	0	12,359	12,315
100 to 120 sq. ft. BA / acre Low intensity salvage treatment units (PSW Research)	0	0	2,089	2,089
Full retention	0	30,402	0	2,571
Indicator 4 – Road miles in PACs				
New construction	0	0	0	0
Reconstruction	9.7	0	8.3	7.5
Skid zone	0.1	0	0.1	0.1
Temporary road	0.1	0	0.1	0.1
Indicator 5 – Number of water and material sources and landings in PACs				
Water sources	4	0	4	4
Material (Rock) sources	0	0	0	0
Tractor landings	1	0	1	1
Helicopter landings	1	0	0	0
Indicator 6 – Acres of fuels treatments by type				
Biomass	6,808	0	6,825	6,421
Biomass deer units	1,064	0	1,739	1,739
Pile and burn	0	0	22,036	20,320
Watershed soil cover treatments	0	0	3,537	3,537

American Marten: Affected Environment

Species and Habitat Account

The marten (*Martes americana* sierrae) is a Region 5 Forest Service Sensitive species and is also a Sierra Nevada Management Indicator Species (MIS), as described in the Rim Recovery MIS report available in the project record. Marten occur throughout much of their historic range from Trinity and Siskyou counties east to Mount Shasta, south through the Cascades and Sierra Nevada mountain ranges to Tulare county. They are considered rare when compared to other forest carnivore species (USDA 2001). Their core elevation range is 5,500 to 10,000 feet. Marten have been documented on the Stanislaus National Forest as low as 5,200 feet in elevation.

Population estimates and trends are not available for marten in California. Although classified as a furbearer, there has been no open trapping season for this species since 1954 (USDA 2001). Declines in marten population size in the early twentieth century have been attributed to habitat modifications, trapping, and predator control. Based on surveys conducted from 1989-2002, the American marten appears to occupy much of its historic range in California (Zielinski et al. 1995, Slauson et al. 2007).

Carnivore camera stations have been employed within suitable habitat in and near the project area in 2005-2013 following the protocol designed by Zielinski and Kucera (1995a). No marten detections were made as a result of these survey efforts (NRIS Wildlife database).

The project is within the current distribution of marten across the Sierra Nevada Bioregion. The nearest documented occurrence of marten was in 2006 less than two miles north of the project area near Reynolds Creek and south of the project area in Yosemite National Park. Their presence within the analysis area is unknown; however, presence is assumed where suitable habitat exists. Because there are no documented den sites, LOPs for this species are not required for this project.

Marten are considered one of the most habitat-specific mammals in North America. Habitat quality is likened to the structural diversity consistent with late seral, mesic coniferous forests, interspersed with riparian areas and meadows. Preferred forest vegetation types include red fir, red fir/white fir mix, lodgepole pine, and Sierra mixed conifer (Freel 1991). Marten home ranges are very large relative to their body size. Mean home ranges in the central Sierra Nevada are 960 acres for males and 801 acres for females (USDA 2001). The analysis area still contains relatively high quality habitat for marten in areas that burned at low or low-moderate intensity such as Twomile, Bourland, and Reynolds Creek, Pilot Ridge and the Crocker Meadow area. Post-fire, the analysis area contains about 17,695 acres of moderate and high capability habitat on NFS lands only. Table 3.15-36 displays pre- and post-fire acres by CWHR vegetation type, size class, and density on NFS lands. There are about 46,135 acres of moderate and high capability habitat within the cumulative effects analysis area post-fire, including all ownerships.

Moderate to High Capability habitat is defined as that in which a CWHR suitability rating is greater than or equal to 0.55. Two of three categories (reproduction, cover, food) must have a medium rating to achieve the minimum rating. See CWHR version 8.2 user’s manual for further explanation on suitability ratings.

A road density of less than 1 mile of road per square mile has been recommended for high quality habitat for marten (USDA 1991). A road density of 1 to 2 miles of road per square mile is recommended for medium capability habitat (Ibid). The road density including all routes open to motor vehicles in the analysis area is 3.0 miles per square mile on NFS lands and is more than twice the acceptable density found in high quality habitat and more than 1 mile per square mile above that found in moderate capability habitat.

Marten natal dens are typically found in cavities in large trees, snags, stumps, logs, shrubs, burrows, caves, rocks, or crevices in rocky areas (USDA 1991 and Zielinski et al. 1997). Dens are lined with vegetation and are found in structurally complex, late succession forests (Buskirk and Powell 1994). Breeding occurs from late June to early August, followed by embryonic diapause, and birth in March-April (Ibid).

Table 3.15-36 Pre- and post-fire moderate to high capability habitat for marten

CWHR Vegetation Type[1]	Size Class and Density	Pre-Fire CWHR Veg Type (acres)	Post-Fire CWHR Veg Type (acres)
LPN, MHC, RFR,	4P	22	33
JPN, LPN, MHC, PPN, RFR, SMC, WFR	4M	4,040	2,705
JPN, LPN, MHC, PPN, RFR, SMC, WFR	4D	12,282	8,765
JPN, MHC, SMC, WFR	5M	177	147
JPN, MHC, PPN, RFR, SMC, WFR	5D	7,207	6,045
TOTAL		**23,728**	**17,695**

1CWHR habitat types: JPN equals Jeffrey pine, LPN equals Lodgepole Pine, MHC equals montane hardwood conifer, PPN equals ponderosa pine, SMC equals sierra mixed conifer, WFR equals white fir. Acres include National Forest system lands only.
CWHR Size Classes: 4 equals 12-24 inches dbh, 5 equals 24-40 inches dbh and CWHR Density Classes (Canopy Closure): P equals 25-39 percent, M equals 40-59 percent, D equals greater than 60 percent

Freel (1991) and Spencer et al. (1983) characterized suitable habitat for denning and resting marten as follows:

- Canopy cover ≥ 70 percent.
- Largest live conifers are ≥ 24 inches dbh and occur at a density of at least 9 per acre.
- Live tree basal area ranges from 163-326 square feet per acre.
- Largest snags average 5 per acre and are ≥ 24 inches dbh (16 square feet per acre).
- Coarse woody debris is present at 5-10 tons per acre in decay classes 1-2.

Marten diet varies geographically and seasonally with local prey availability. In the Central Sierra, marten diets are comprised primarily of voles, while in the southern Sierra it is squirrels and voles, insects, hypogeous fungi and secondarily (less than 20 percent of diet) reptiles and birds (Zielinski et al. 1983, Zielinski and Duncan 2004). Zielinski and others (1983) noted Douglas squirrels, snowshoe hare, northern flying squirrels and deer mice were the prey species used almost exclusively during the winter, while ground squirrels formed the largest component of the diet from late spring through fall.

Coarse woody debris is an important component of marten habitat, especially in winter, when it provides structure that intercepts snowfall and creates subnivean (below snow) tunnels, interstitial spaces, and access holes. Zielinski and others (1983) suggested that marten activity varied to take advantage of subnivean dens utilized by their prey. Sherburne and Bissonette (1994) found that when coarse woody debris covered a greater percent of the ground, marten use also increased. Older growth forests appeared to provide accumulated coarse woody debris necessary to enable marten to forage effectively during the winter.

Freel (1991) and Spencer et al. (1983) characterized suitable habitat for travel and foraging marten as follows:

- Canopy cover ≥ 40 percent.
- Largest live conifers are ≥ 24 inches dbh and occur at a density of at least 6 per acre.
- Largest snags average 2.5 per acre and are ≥ 24 inches dbh (8 square feet per acre).
- Coarse woody debris is present at 5-10 tons per acre in decay classes 1-3.

Reports of long-distance movements, likely representing dispersal, are largely anecdotal. Movement patterns in marten, dispersal and migration, have not been intensively studied for this species because of the difficulty and high cost of studying long-distance movements in small bodied mammals

(Buskirk and Powell 1994, Ruggiero et al. 1994). Martens exhibit seasonal variation in habitat selection within stable home ranges, with little evidence to suggest shifts in home range boundaries.

Risk Factors

Hargis et al. (1999) and USDA (2001) summarize several risk factors potentially influencing marten abundance and distribution:

- Habitat fragmentation – Fragmentation can limit occupancy and dispersal of marten across the landscape. Marten were negatively associated with low levels of habitat fragmentation. When the average nearest neighbor distance between non-forested patches was less than 100 m, it created more edge and less interior forested habitat preferred by marten.
- Meadow habitat degradation – Grazing can reduce the amount of shrub and herbaceous cover available and can increase soil compaction for prey species such as voles.
- Fire suppression – Fire suppression has contributed to degraded conditions in meadows and riparian habitats by allowing encroachment of trees which reduces the availability of understory vegetation required by prey.
- Lack of, or removal of coarse woody debris – Removal of coarse woody debris (piles of several smaller logs, or single large logs) can also reduce access and abundance of prey during the important winter months, and may also reduce resting site availability for marten.

Management Direction

Current management direction is summarized by describing the desired future condition of land allocations (Robinson 1996). The marten is a Region 5 Forest Service Sensitive species that is associated with old forest ecosystems (USDA 2004). The following land allocations pertain to marten and old forest ecosystems: PACs, HRCA, OFEA, and FCCC.

The desired condition for PAC is to have 1) at least two tree canopy layers; (2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; (3) at least 60 to70 percent canopy cover; (4) some very large snags (greater than 45 inches dbh); and (5) snag and down woody material levels that are higher than average.

The desired condition for California spotted owl HRCA is to encompass the best available habitat in the closest proximity to the owl activity center (USFS 2004 ROD pp. 39-40). HRCAs consist of large habitat blocks that have: 1) at least two tree canopy layers; 2) at least 24 inches dbh in dominant and co-dominant trees; 3) a number of very large (greater than 45 inches dbh) old trees; 4) at least 50 to 70 percent canopy cover; and 5) higher than average levels of snags and down woody material.

The desired condition for OFEA is to provide habitat conditions for mature forest associates (spotted owl, northern goshawk, American marten, and Pacific fisher). Specifically, forest structure and function across old forest emphasis areas generally resemble pre-settlement conditions. High levels of horizontal and vertical diversity exist at the landscape-scale (roughly 10,000 acres). Stands are composed of roughly even-aged vegetation groups, varying in size, species composition, and structure. Individual vegetation groups range from less than 0.5 to more than 5 acres in size. Tree sizes range from seedlings to very large diameter trees. Species composition varies by elevation, site productivity, and related environmental factors. Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. Forest structure and function generally resemble pre-settlement conditions.

The desired future condition of forest carnivore connectivity corridor FCCC is to provide habitat connectivity for forest carnivores, linking Yosemite National Park and the North Mountain inventoried roadless area west to the Clavey River. For habitat connectivity, a future forested area is desired with a minimum of 50 percent of the forested area having at least 60 percent canopy cover. Higher than average levels of large snags and large down woody material is also desired (as in USDA

2004). Habitat structures are important to retain that may constitute rest sites as described in Freel 1991 and Lofroth et al. 2010 (plate 7.7).

American Marten: Environmental Consequences

The project alternatives could result in direct and indirect effects to the marten through the following activities:

- Salvage of fire-killed trees.
- Salvage of roadside hazard trees.
- New permanent and temporary road construction and road reconstruction.
- Fuels treatments.
- Use of material sources and water sources.

These activities may have direct and indirect effects on marten through the following:

- Project related death, injury or disturbance.
- Project related modifications to habitat quantity or quality.

Death, injury, or disturbance

Death or injury from project related activities would be unlikely to occur given the mobility of this species. However, there is the potential for death or injury if a den or rest tree were felled while being used by martens.

Project activities, especially loud noise, could result in disturbance that may impair essential behavior patterns of the marten related to denning, resting, or foraging. Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. The location of marten within the analysis area is uncertain following the Rim Fire, a large-scale disturbance event; conducting surveys to identify areas being used is a way to address this uncertainty. Temporary avoidance of the project site or displacement of individuals is expected during project implementation. Any displacement or avoidance would be of short duration and would subside shortly after project implementation activities. LOPs in place for spotted owls, goshawks, great gray owls, and bald eagles would afford protection to individual marten in these areas during parturition, kit rearing, and subsequent breeding (March-August). The potential risk to individual marten is considered low because of the lack of documented marten occurrence within or near the analysis area and length of exposure expected given the accelerated timeframe of this project and implementation.

Habitat Modification

Salvage logging and the removal of hazard trees along level 2 roads would modify suitable marten habitat by reducing its quality in both the short-term (10 to 20 years) and in the long-term (20 to 50 years).

Short-term retention of snags within and near suitable marten habitat would provide denning and resting sites, as well as habitat for prey species (Freel 1991). Marten are known to use a wide range of structures for denning and resting including cavities in large trees, snags, stumps, logs, burrows, caves, rocks, or crevices in rocky areas (USDA 1991, Zielinski et al. 1997). The number of snags and downed logs available across a marten's home range affects the quality of that habitat for foraging and breeding. They require at least five snags per acre that are greater than 24 inches dbh (Freel 1991). In moderate and high capability traveling and foraging habitat, at least two to three snags greater than or equal to 24 inches dbh are required (Ibid). Marten may travel across small open areas, but generally avoid open areas.

Prey species that tolerate disturbance or open conditions are known to be abundant in post fire environments, such as mice, rats, chipmunks, and squirrels (Amacher et al. 2008 and Diffendorfer et al. 2012). Structural elements such as snags and downed logs, when combined with the flush of shrubs, forbs and grasses expected post-fire, will provide habitat suitable for prey and foraging habitat for marten within a few years post fire.

Long-term, large snags and large downed logs are considered biological legacies in a post fire environment and play important roles in the structure of future forest (Lindenmayer et al. 2008). Large snags and downed logs may take hundreds of years to develop, emphasizing the need to retain these elements across the landscape. Because large snags and large downed logs are important habitat elements found in high capability marten habitat, it is not only important to retain these structural elements during project implementation, but it is imperative that recruitment of snags and downed logs occur over time to maintain habitat suitability in the long-term.

Snags remain standing for decades depending upon the species of tree and other environmental factors (Cluck and Smith 2007 and Ritchie et al. 2013). For example, Ritchie and others (2013) found that snag fall rates and decay rates vary considerably by species. When snags eventually fall, they are incorporated as large downed logs, another critical structural element important for marten and prey species (Freel 1991, Zielinski et al. 2004a).

Roads can modify marten habitat by directly removing it or indirectly reducing its quality, resulting in both short and long-term effects. Gaines and others (2003) studied the response of several focal species, including marten, related to roads and trails. Martens in this study were displaced, shifting use of habitat away from human activities on or near roads or trails. Robitaille and Aubrey (2000), found that marten use of habitat within 984 and 1,312 feet meters of roads was significantly less than habitat use 2,296 or 2,624 feet distant; however, in a study conducted in northern California, Zielinski et al. (2008) found that marten occupancy or probability of detection did not change in relation to the presence or absence of motorized routes and OHV use when the routes (plus a 164-foot buffer) did not exceed about 20 percent of a 31 square mile area, and traffic did not exceed one vehicle every 2 hours. Zielinski and others (2008) did not study or measure behavioral changes or changes in use patterns. Andren (1994) suggested that, as landscapes become fragmented, the combination of increasing isolation and decreasing patch size of suitable habitat is negatively synergistic, compounding the effects of simple habitat loss. In particular, species associated with old forest habitats may be impacted by such effects. Reductions in interior forest patch size results in loss of habitat and greater distances between suitable interior forest patches for sensitive species like the American marten. New construction, temporary road construction and reconstruction would result in increased habitat fragmentation as well as a reduction in potential resting and denning structures.

Additional habitat modification occurs as an indirect effect new road construction, temporary road construction, and reconstruction. Trees posing a potential safety hazard (“hazard trees”) are removed along these new, temporary, and reconstructed roads. These trees are typically snags that are within a tree-height distance from the road. This safety policy results in a “snag free” zone of about 200 feet from a road’s edge, also affecting the recruitment of large downed wood within this zone. Habitat quality is reduced within this corridor.

Reducing fuel loads across the analysis area was identified as an essential first step in longer term fire and fuels management within the Rim Fire area (Crook et al. 2013). Removal of smaller material, less than 20 inches dbh, would not directly affect habitat suitability for marten. However, it may indirectly contribute to a more resilient landscape and less risk of further loss of remaining suitable habitat in the face of the next wildfire.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the marten and to determine how well project alternatives comply with Forest Plan Direction.

1. Amount of moderate and high capability habitat altered.

2. Habitat connectivity
3. Amount of large legacy snags and downed logs in OFEA, HRCA, and FCCC units.
4. Road density (miles/square mile) in moderate and high capability and dispersal habitat

These criteria were chosen based on the best available scientific literature which focuses on various aspects of marten ecology and life history requirements. These criteria focus on those life history aspects, or habitat elements, considered most limiting to marten persistence across their range and where project effects are expected.

Effects Common to All Action Alternatives

Direct and Indirect Effects

Indicator 1. Because there is small difference in the amount of acres proposed for treatment in moderate and high quality suitable habitat under all action alternatives, the effects are expected to be similar and are therefore analyzed together. Under the action alternatives, habitat quality would be reduced across a portion of the remaining moderate and high capability habitat within the analysis area as a result of removing snags and hazard trees. Between 76 percent and 78 percent of the remaining suitable habitat is not proposed for treatment. Proposed treatments would not result in creating barriers to movement based on the configuration of remaining suitable habitat. Snag retention requirements vary by alternative and would serve to mitigate some of the negative effects expected to result from implementation of the action alternatives and is discussed in more detail under each alternative. Table 3.15-37 displays the proposed types of treatments and the proportion of suitable habitat affected under each action alternative for comparison.

Table 3.15-37 Proposed treatments in marten moderate and high capability habitat

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total (acres)	Percent of Suitable Habitat Treated
1	1,557	2,667	4,224	24
3	1,576	2,634	4,210	24
4	1,215	2,677	3,892	22

Although a reduction in quality is expected, treated areas would continue to offer foraging habitat. Trees that are in decline and not subject for removal under this project would, over time, be incorporated as potential resting or denning structures and habitat for prey species. Marten are known to reuse rest sites slightly more often than fisher and they also use downed logs, shrubs, and rocks and are not dependent solely on snags (Zielinski et al. 1997). Effects may result in impacts to an individual’s fitness, but because there are no documented occurrences within the analysis area this risk is considered low. Furthermore, because no established populations occur in the analysis area, no population impacts are expected.

Indicator 2. Habitat connectivity across the landscape is important to marten as it provides a means for dispersal, linkages between suitable habitat patches or core habitat areas, and genetic exchange. Spencer and Rustigan-Romsos (2012) provide recommendations for the conservation of rare carnivores such as the marten in California. Marten use higher elevation habitats during the summer and snow free periods and may use lower elevation forested habitat during the winter. It is thought that the summer range is more restrictive and limiting for marten and their persistence within a given landscape. Thus, Spencer and Rustigan-Romsos (2012) used the higher elevation summer range to base this modeling effort. They used spatially explicit, empirical models to identify large areas of suitable habitat and dispersal corridors connecting those areas. Suitable marten habitat cores were identified as a part of this effort and occur in the north, east, southeast portions of the analysis area on the Stanislaus National Forest, at elevations above 7,000 feet. The forest carnivore connectivity corridor described in the analysis for Pacific fisher is at an elevation below 5,000 feet and it is unlikely that marten would venture this low during the summer. Since documented occurrences of marten on the Stanislaus National Forest are usually above 5,000 feet, it is unlikely that the corridor would be as critical for marten relative to fisher. Additionally, habitat connectivity is still largely intact at the preferred elevation of marten – the approximate elevation band at which the Rim Fire was contained. Thus, implementation of the action alternatives is not expected to create barriers to movement for marten.

Indicator 4. To analyze effects of road density, it is necessary to include more than the current suitable marten habitat because roads can be somewhat permanent features on the landscape and will affect the habitat suitability for marten not only in the short-term, but long-term as well. Thus, land allocations that are managed for old forest associated species (OFEA and HRCA) and suitable habitat at or above 5,000 feet elevation were used to calculate road density for marten within the analysis area. Small disjunct patches of habitat not contributing to this core area or connected to suitable habitat on adjacent ownerships such as Yosemite National Park were omitted. This area is about 44,842 acres and can support marten in part today and into the future based on the desired conditions outlined in the Stanislaus National Forest Plan (USDA 2010). Therefore, this is considered a logical approach to analyze project related road density and effects to marten. This is discussed further under each alternative.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Discussed under effects common to all action alternatives.

Indicator 3. Under Alternative 1, the snag retention rate is considered the management standard or average snag retention. Table 3.15-38 displays the acres affected by the snag retention requirements within potential marten habitat proposed under Alternative 1. Potential marten habitat is defined as land allocations that are managed for old forest associated species (OFEA and HRCA) and potential suitable habitat at or above 5,000-foot elevation.

Table 3.15-38 Snags retained in salvage units within potential marten habitat, Alternative 1

12ft² per acre* General Forest Average	30ft² per acre (OFEA, HRCA, FCCC) Above Average	100-120ft² per acre (PSW Research) Above Average
6,060	0	0

* Converted from 4 snags per acre for comparison; assuming retention of 24 inches dbh snags.

Retaining snags at a rate of 12 square feet per acre across the 6,060 acres proposed for treatment in moderate and high capability habitat would provide fewer snags than has been documented to occur in occupied marten habitats. Occupied marten habitat contains at least 16 square feet per acre of snags greater than or equal to 24 inches dbh (Freel 1991, Spencer 1983). Habitat quality would be reduced on 34 percent of moderate and high capability breeding habitat under Alternative 1; however, retained snags would provide some potential resting and denning sites for marten. The proposed retention rate would be adequate for foraging habitat utilized by marten. Although a reduction in breeding habitat quality is expected, the treated areas would continue to offer moderate and high capability foraging habitat for marten.

Under Alternative 1, retaining snags at 12 square feet per acre would result in the lowest retention of snags to contribute to the structural complexity and diversity within recovering forested stands. Marten readily move through habitats with understory vegetation, snags, and downed woody debris within 100 meters of forested habitat (Koehler and Hornocker 1977). The units under this alternative would create some openings larger than those known to be traversed by marten. As vegetative cover returns, the edges of these units that occur adjacent to forested stands would provide habitat that marten would readily use for foraging. Minor beneficial effects on habitat quality for marten are expected in the short-term. Because so much of their home range contains older forest conditions, most treated areas aren’t expected to offer suitable breeding conditions for many decades (Freel 1991, Koehler and Hornocker 1977, Spencer 1983).

Hardwoods occur irregularly across the analysis area and have not been mapped. Hardwoods are utilized by marten and they provide structure for many prey species sought by them (Freel 1991, Koehler and Hornocker 1977, Spencer 1983). Because all hardwood snags would be retained under Alternative 1, no change in the number of hardwood snags available is expected as a result of implementation.

Considering that marten utilize habitat that contains higher rates of large snags and large downed woody debris, the rate of snag retention proposed under this alternative is not adequate to maintain habitat quality for breeding and resting within the treated areas. Snags retained are expected to contribute and provide suitable habitat, although of lower quality in the short-term. In the long-term these snags would be incorporated as large downed woody material, critical structural elements needed within a recovering forest.

Downed woody debris retention at 10 to 20 tons per acre, if available in larger size classes, would provide habitat important for marten and their prey. In most areas, sufficient large downed woody material is lacking, making snag retention and eventual recruitment as downed logs even more critical. Fuels treatments that result in the removal of smaller downed woody material may result in a more diverse understory including more herbaceous and shrub vegetation that would benefit marten and their prey.

Table 3.15-39 Miles of road treatments, Alternative 1

New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project use During Implementation (mi/mi^2)	Total Road Density Existing plus Additional for Project (mi/mi^2)
2.8	57.6	10.3	6.7	0.3	3.3

Indicator 4. Table 3.15-39 displays the miles of each type of road related treatment and the resulting miles per square mile under Alternative 1. The new road construction and temporary road construction proposed under this alternative would result in an increase of 0.3 miles per square mile of road, effectively increasing the road density from 3.0 miles per square mile to 3.3 miles per square mile during project implementation. Minor negative effects to habitat quality are expected under Alternative 1. This alternative may slightly increase the potential for road related mortality during project implementation while the roads are open and being used regularly. New permanent road construction would be designated as blocked Maintenance Level 1 or 2 gated year round. This would alleviate the risk of road related mortality after project implementation because the roads would only be used intermittently for management purposes. The new permanent road construction would result in habitat fragmentation in the long-term because habitat would be removed as a result of the road construction and the road would additionally be subject to hazard tree removal within 200 feet of the roads edge in the long-term reducing the quality of habitat adjacent to those new roads. All temporary roads would be obliterated and blocked and over time vegetation would become reestablished and all roads that were non-motorized before project implementation would be returned to the pre-project specifications.

CUMULATIVE EFFECTS

In making the determination for this alternative, 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 was considered (found in Appendix B, Cumulative Effects). Some, but not all of these actions have or may contribute cumulatively to effects on martens.

Risk factors potentially affecting marten abundance and distribution have been identified and include habitat fragmentation and lack of or removal of coarse woody debris. The following evaluation criterion was used as a relative measure of cumulative effects from this alternative to marten: habitat modification.

Habitat Modification

Federal Lands

Past, present, and foreseeable future timber harvests and hazard tree removal sales on public lands have and will likely affect habitat suitability for marten through the removal of large trees, reduction in canopy cover, and potential loss of snags and downed woody debris from prescribed fire operations. Present actions within the analysis area include: The Twomile Ecological Restoration Vegetation Management Groovy and Funky timber sales and the Soldier Creek timber sale are scheduled to treat about 2,045 acres through commercial thinning, biomass removal, mastication, and prescribed fire treatments. GTR 220 was used as a guide when designing these projects including maintaining elements important to marten (large trees, snags, downed wood, areas of dense canopy cover). In addition, Yosemite National Park is currently removing hazard trees on about 816 acres, which would have negligible effects on marten and their habitat.

Foreseeable future actions on federal lands include: Reynolds Creek Ecological Restoration involving meadow and aspen restoration. These types of projects generally include the removal of encroaching trees and will improve habitat quality for marten. Twomile-Campy, Looney, and Thommy timber sales and Reynolds Creek timber sale are scheduled to occur over the next few years and will result in treatment of about 3,798 acres through commercial thinning, biomass removal, mastication, and prescribed fire. Additionally, the Rim HT removal project proposed to remove hazard trees along 10,262 acres of level 3, 4, and 5 roads and is scheduled for implementation in the summer of 2014.

The ecological restoration projects will reduce habitat quality in the short-term for marten, but are designed to have long-term benefits such as improved forest health and reduced future fire intensity. Hazard tree removal will reduce habitat quality in the short and long-term because the objective and priority in these areas, especially on Maintenance Level 3, 4, and 5 roads, is public safety.

Roads and trails modify habitat suitability for marten by reducing habitat or degrading quality through fragmentation. Roads and trails also improve human access, and potentially result in the displacement of individuals. Twomile Transportation, a foreseeable future action, will result in a slight reduction in motorized routes, essentially removing 11.4 miles by gating, decommissioning, or closing to Maintenance Level 1 roads used only for administrative purposes. Reynolds Creek Motorized Routes project will decommission 3.5 miles of unauthorized routes in the near future as well. The Mi-Wok OHV Restoration project proposes to block and restore 11.6 miles of unauthorized OHV routes. This reduction of about 26.5 miles of motorized roads and trails across the analysis area would improve habitat quality by reducing fragmentation and human access while increasing the amount of interior habitat available.

Private Lands

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acre is presently being salvage logged. These salvage activities tend to take more and larger snags and reduce more fuels than Forest Service projects. Post salvage, the areas may provide short-term foraging habitat for marten as understory vegetation becomes established; however, these benefits are expected to be limited in space and time based on typical reforestation efforts.

Wildfire

Wildfires can affect habitat in varying degrees, depending on the intensity of the fire. Wildfires can create snags, which may be used as den, rest, or forage structures by marten. Wildfires that burn at high severity such as the Rim Fire result in eliminating habitat. Treatments in green forest (past, present, future) are designed to reduce fire intensity and spread, thus reducing the risk of habitat loss. It is expected that wildfire will continue to occur on the landscape.

Alternative 1 Contribution/Summary

Alternative 1 is expected to contribute cumulatively to short and long-term effects on marten. Disturbance and potential displacement of individuals may occur during project implementation and would likely be temporary. No recent occurrences of marten within the analysis area are documented; however, the analysis area is in close proximity to occupied habitat on both the Stanislaus National Forest and Yosemite National Park. Reduction in the quality of moderate and high capability habitat on about 4,224 acres (9 percent of the remaining suitable habitat within the analysis area) is expected from implementation of this alternative. Snag retention requirements under this alternative are less than under the other action alternatives. Habitat quality would be reduced based on the reduction of denning and resting sites. There are also 2.8 miles of new permanent road construction proposed within potential marten habitat under this alternative, which would have negative effects on marten and their habitat. Treatments would likely occur over the next two to three years and may coincide with other projects, particularly Groovy, Funky, and Soldier Creek. The combination of past Forest Service and private timber harvests, and wildfire has cumulatively reduced the amount of late succession habitat available across the analysis area. This and other Forest Service projects were and continue to be designed to prevent additional, large scale loss of mature forest from wildfires such as the Rim. These projects are designed to retain and improve key habitat components such as retention of large trees, defect trees, snags, downed wood, while focusing on releasing black oaks and pines. Habitat suitability within the analysis area is predicted to improve in the long-term for marten. The cumulative contribution under this alternative is not expected to affect the viability of this species.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur.

Under Alternative 2, no indirect effects are expected because no active management would occur; however, there may be consequences under this alternative primarily related to the influence no action may have on future wildfires and how future wildfires may impact marten habitat. Predicting the effect no action would have on future wildfires and marten habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (Rim EIS Fuels Report). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

Indicator 1. Under the Alternative 2, habitat quality within currently suitable moderate and high capability habitat would not be altered.

Within the areas that burned at high severity, herbaceous and shrub vegetation is expected to be established within 3 to 5 years (Gray et al. 2005 and Moghaddas et al. 2008) and would be suitable for marten movement and potentially as foraging habitat. These beneficial effects would be expected in the short-term. Because the ability of forests to regenerate after stand replacing fire is highly dependent on seed sources, forested conditions are likely to re-establish only within mixed severity burn patches and the edges of high severity patches. It is likely that areas that burned at high severity would be dominated by herbaceous and shrub vegetation and shade tolerant conifer species such as white fir and incense cedar in the future. A consequence of shrub dominance is the reduced likelihood that forested conditions would return naturally for many decades. Not removing fire-killed trees would result in additional difficulties related to future management, such as planting conifers that could help accelerate the establishment of forest conditions. Thus, suitable denning and resting habitat would be delayed under this alternative resulting in long-term negative effects to marten.

When wildfire returns to this landscape, the remaining moderate and high capability habitat adjacent to or near areas that burned at high severity may be at increased risk of loss. Within 10 years, the fuel loading is predicted to be four to eight times higher (78 tons per acre) than the desired condition (3.05 Fuels). This would significantly increase the risk of fire suppression activities when wildfire occurs in the future. The negative long-term effects on habitat for marten from this alternative outweigh the short-term beneficial effects.

Indicator 2. Under the no action alternative, no forest carnivore connectivity corridor would be proposed. As discussed above under effects common to all action alternatives, since it is unlikely that the corridor is critical for marten relative to fisher based on preferred elevation range, no effects are expected under this alternative.

Indicator 3. Under the Alternative 2, all snags and downed logs would be retained. In the short-term marten and their prey would benefit from the availability of more snags and downed logs within an adjacent to remaining suitable habitat, as discussed under the action alternatives. Remaining suitable habitat would be at higher risk of loss in the long-term when wildfire returns to this landscape, see Indicator 1 above. The potential for recovery of forested conditions across areas that burned at high severity would also be delayed, see Indicator 1 above.

Indicator 4. Under the no action alternative, no new permanent road construction, temporary road construction, reconstruction, or maintenance would occur. This alternative would provide the greatest benefit to marten because there would be no increase in road density across the analysis area and no potential increase of road related mortality in the short or long-term.

CUMULATIVE EFFECTS

The Cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under the No Action alternative, there would be no direct cumulative effect expected because no active management would occur.

No Action Alternative Contribution/Summary: The cumulative contribution under this alternative would not complement the treatments that have occurred in the past, thus increasing the risk of loss of remaining suitable habitat to wildfire in the long-term. The short-term beneficial impacts to marten such as retention of snags for denning and resting sites would be outweighed by the increased risk of additional habitat loss in the next wildfire.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Under Alternative 3 the Stanislaus National Forest Land and Resource Management Plan would be amended to establish the connectivity corridor as a land allocation (old forest emphasis area) prioritizing future management objectives, not just those objectives associated with this project, within this connectivity corridor to benefit old forest associated species, particularly forest carnivores. The effects to marten under this alternative are the same as discussed for Indicator 2 under the effects common to all action alternatives, but would be realized in the long-term because the proposed corridor, approximately 10,000 acres, would be changed from General Forest to Old Forest Emphasis Area. This land allocation change would prioritize management emphasis in this corridor to benefit old forest associated species into the future.

Indicator 3. Under Alternative 3, the snag retention rate in OFEA, HRCA, and FCCC is considered greater than the management standard and above average snag retention, while the snag retention rate in general forest is considered the management standard or average snag retention.

Table 3.15-40 displays the acres affected by the snag retention requirements within potential marten habitat proposed under this alternative. Potential marten habitat is defined as land allocations that are managed for old forest associated species (OFEA and HRCA) and potential suitable habitat at or above 5,000 feet elevation.

Table 3.15-40 Snags retained in salvage units within potential marten habitat, Alternative 3

12ft² per acre* General Forest Average	30ft² per acre (OFEA, HRCA, FCCC) Above Average	100-120ft² per acre (PSW Research) Above Average
3,443	2,103	262

* Converted from 4snags per acre for comparison; assuming retention of 24 inches dbh snags.

Retaining snags at a rate of 12 square feet per acre across the 3,443 acres proposed for treatment in moderate and high capability habitat would provide less than has been documented to occur in occupied marten habitats. Retaining snags at the rate of 30 square feet per acre would provide a supply of snags found in occupied marten habitat. Snags retained at the rate of 100 to 120 square feet per acre would provide several times the snags documented to occur in occupied marten habitat. Occupied marten habitat has at least 16 square feet per acre of snags greater than or equal to 24 inches dbh (Freel 1991, Spencer 1983). Habitat quality would be reduced on 19 percent of moderate and high capability breeding habitat under this alternative; however, retained snags would provide some potential resting and denning sites for marten. Habitat quality would be maintained on 14 percent of moderate and high capability habitat where snag retention is 30 or 100 to 120 square feet per acre under this alternative. Marten readily move through habitats with understory vegetation, snags, and downed woody debris within 328 feet of forested habitat (Koehler and Hornocker 1977). The units under Alternative 3 would create some openings larger than those known to be traversed by marten. Minor beneficial effects on habitat quality for marten are expected in the short-term. Because so much of their home range contains older forest conditions, most treated areas aren’t expected to offer suitable breeding conditions for many decades (Freel 1991, Koehler and Hornocker 1977, Spencer 1983).

Areas with above average snag retention would provide the most snags to contribute to structural complexity and diversity within recovering forested stands. As vegetative cover returns, the edges of these units that occur adjacent to forested stands would provide habitat that marten would readily use for foraging, while providing protection from predators.

Hardwoods occur irregularly across the analysis area and have not been mapped. Hardwoods are utilized by marten and they provide structure for many prey species sought by them (Freel 1991, Koehler and Hornocker 1977, Spencer 1983). Because all hardwood snags would be retained under Alternative 3, no change in the number of hardwood snags available is expected as a result of implementation

Snag retention at the rate of 30 or 100-120 square feet per acre proposed under Alternative 3 is adequate to maintain moderate and high capability habitat that marten would likely occupy. These snags are expected to provide denning and resting structure in the short-term and also in the long-term as large downed woody debris.

Downed woody debris retention at 15-20 tons per acre, if available in larger size classes, would provide habitat important for marten and their prey. In most areas, sufficient large downed woody material is lacking, making snag retention and eventual recruitment as downed logs even more critical. Fuels treatments that result in the removal of smaller downed woody material would have a minor effect on marten.

Indicator 4. Table 3.15-41 displays the miles of each type of road related treatment and the resulting miles per square mile under Alternative 3. These effects would be similar to Alternative 1, although more minor because there are less miles of new permanent road proposed under Alternative 3.

Table 3.15-41 Miles of road treatments, Alternative 3

New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project Use During Implementation (mi/mi²)	Total Road Density- Existing Plus Additional for Project (mi/mi²)
1.0	52.7	13.2	7.9	0.3	3.3

CUMULATIVE EFFECTS

The Cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands, refer to this discussion. The cumulative contribution of Alternative 3 would be the same as those described under Alternative 1 because there is only a difference of 14 acres proposed for treatment within moderate and high capability habitat. However, effects under Alternative 3 are less than Alternative 1 regarding the following: snag retention would be higher within OFEA, HRCA, and FCCC units under this alternative and there would only be 1.0 miles of new permanent road construction under this alternative. The cumulative contribution under this alternative would affect marten and their habitat in the short and long-term but is not expected to affect the viability of this species.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Same as Alternative 3.

Indicator 3. Under Alternative 4, the snag retention guidelines are the same as outlined under Alternative 3; however, the spatial extent of proposed treatments is less under this alternative. Table 3.15-42 displays the acres affected by the snag retention requirements within potential marten habitat proposed under this alternative. Potential marten habitat is defined as land allocations that are managed for old forest associated species (OFEA and HRCA) and potential suitable habitat at or above 5,000 feet elevation. Effects are very similar as those discussed under Alternative 3. Alternative 4 is expected to have less severe effects due to the smaller spatial extent of treated area.

Table 3.15-42 Snags retained in salvage units within potential marten habitat, Alternative 4

12ft² per acre* General Forest Average	30ft² per acre (OFEA, HRCA, FCCC) Above Average	100-120ft² per acre (PSW Research) Above Average
2,168	1,399	262

* Converted from 4snags per acre for comparison; assuming retention of 24 inches dbh snags.

Indicator 4. Table 3.15-43 displays the miles of each type of road related treatment and the resulting miles per square mile under Alternative 4. The temporary road construction proposed under this alternative would result in an increase of 0.3 miles per square mile of road, effectively increasing the road density from 3.0 miles per square mile to 3.3 miles per square mile during project implementation. Alternative 4 is similar to Alternative 3; however, because there is no new permanent road construction proposed under this alternative, long-term negative effects from road treatments such as fragmentation and hazard tree removal would not occur.

Table 3.15-43 Miles of road treatments, Alternative 4

New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project Use During Implementation (mi/mi²)	Total Road Density-Existing Plus Additional for Project (mi/mi²)
0	46.1	13.8	6.1	+ 0.3	3.3

CUMULATIVE EFFECTS

The cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands, refer to this discussion. The cumulative contribution of Alternative 4 would be the least of all the action alternatives as described under Alternatives 1 and 3 because there are the least amount of acres proposed for treatment within moderate and high capability habitat, snag retention would be higher within OFEA, HRCA, and FCCC units, and there would be no new permanent road construction under this alternative. The cumulative contribution under Alternative 4 would affect marten and their habitat in the short and long-term, but is not expected to affect the viability of this species.

American Marten: Summary of Effects

Indicator 1. Table 3.15-44 shows the amount of moderate and high capability marten habitat proposed for treatment is very similar for all alternatives. Alternative 1 would affect the most suitable habitat, while Alternative 4 would affect the least amount of habitat. Alternative 2 would not affect suitable habitat.

Indicator 2. None of the alternatives would result in habitat fragmentation within potential marten habitat areas. All action alternatives incorporate the forest carnivore connectivity corridor; however, a Forest Plan Amendment is only proposed under Alternatives 3 and 4. Under Alternative 2, no connectivity corridor or Forest Plan Amendment would be proposed.

Indicator 3. As shown in Table 3.15-44, the acres of areas managed for old forest objectives with higher than average levels of large snags and higher than average levels of large down woody material are highest in Alternatives 3 and 4. In contrast, Alternative 1 manages no acres for higher than average levels of large snags. For retention of large down woody material, all action alternatives manage to a 10 to 20 tons per acre standard, but Alternatives 3 and 4 emphasize retention at the higher end (i.e. 20 tons per acre) while Alternative 1 does not. Alternative 4 manages for an additional 2,571 acres under full retention of snags and down woody material.

Indicator 4. Of the action alternatives, proposed miles of new permanent road construction is highest under Alternative 1 and lowest under Alternative 4. Increases to road density are the same among all action alternatives, but long-term effects related to road density are greatest under Alternative 1 because of the amount of new permanent road construction.

Table 3.15-44 Summary of effects for marten

Indicator	Alternative			
	1	2	3	4
Indicator 1 – Moderate and high capability habitat treated				
Salvage acres	1,557	0	1,576	1,215
Hazard Tree removal acres	2,667	0	2,634	2,677
Total acres	4,224	0	4,210	3,892
Percent of suitable habitat treated	24%	0%	24%	22%
Indicator 3 – Large snags and large downed woody material				
12 sq. ft. BA / acre General Forest Average	6,060	0	3,443	2,168
30 sq. ft. BA / acre OFEA, HRCA, FCCC, above average	0	0	2,103	1,399
100 to 120 sq. ft. BA / acre PSW Research, above average	0	0	262	262
Full retention, no action	0	29,103*	0	2,571
Indicator 4 – Road treatments in miles				
New construction	2.8	0	1.0	0
Reconstruction- currently designated for motor vehicle travel	57.6	0	52.7	46.1
Reconstruction- currently NOT designated for motor vehicle travel	10.3	0	13.2	13.8
Temporary road construction	6.7	0	7.9	6.1
Roads added for project use during implementation (mi/mi^2)	+0.3	0	+0.3	+0.3
Total road density existing plus additional for project (mi/mi^2)	3.3	3.0	3.3	3.3

*Represents maximum number of potential unit acres in land allocations with old forest observations.

Determinations

Alternative 1 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the American marten. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the American marten. In making this determination, I considered (Freel 1991 and Crook et al. 2013).

Alternative 3 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the American marten. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 4 may affect individuals but is not likely to result in a trend toward Federal listing or loss of viability for the American marten. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is best demonstrated under this alternative. Specifically, no new permanent road construction is proposed and the least amount of suitable habitat would be modified under this alternative.

Pacific Fisher: Affected Environment

Species and Habitat Account

The Pacific fisher (*Martes pennanti*) is a Region 5 Forest Service Sensitive species and a candidate for listing under the ESA. In 2004, the U.S. Fish and Wildlife Service (FWS) completed a 12-month status review of the fisher and determined that the West Coast Distinct Population Segment (DPS) warranted protection under the Endangered Species Act of 1976 et seq. but was precluded from listing by higher priority actions (Federal Register 2004), making this fisher DPS a Candidate for listing. The West Coast Fisher DPS (USDI 2004) includes all potential fisher habitats in Washington, Oregon and California from the east side of the Cascade Mountains and Sierra Nevada to the Pacific coast. A status review was initiated as part of a multidistrict litigation settlement agreement under which the Service agreed to submit a proposed rule or a not-warranted finding to the Federal Register for the West Coast DPS of the fisher no later than the end of Fiscal Year 2014 (Federal Register 2013a). If the USFWS pursues listing, they will concurrently designate critical habitat for that DPS. The Forest Service has the option of requesting technical assistance from the USFWS due to Candidate for ESA listing status.

Fishers have been listed with the State of California as a Species of Special Concern since at least 1986 (Williams 1986). In March 2009, the California Fish and Game Commission recommended that the fisher be assessed for listing as Threatened or Endangered under the California State Endangered Species Act. Based on the recommendation CDFW conducted a 12-month review and concluded that the fisher did not merit protection under the State Endangered Species Act in March 2010. Although they accepted additional comments regarding the status of fisher, they did not change their finding.

Fishers historically occurred in the Lassen, Plumas, Tahoe, Lake Tahoe Basin, Eldorado, Stanislaus, Sierra, and Sequoia National Forests. As of 1995, Zielinski et al. determined that fishers remain extant in just two areas comprising less than half of the historic distribution: northwestern California and the southern Sierra Nevada from Yosemite National Park southward, separated by a distance of approximately 250 miles.

A number of southern Sierra Nevada population estimates and simulations have been conducted for fisher populations occurring across the Sequoia and Sierra National Forests, Mountain Home State Park, tribal lands, Yosemite and Sequoia/Kings Canyon National Parks. These estimates range from 100 to 600 adults (Lamberson et al. 2000, Spencer et al. 2008, and Self et al. 2008).

Status and trend monitoring for fisher and American marten was initiated in 2002; the monitoring objective is to be able to detect a 20 percent decline in population abundance and habitat (USDA 2006). This monitoring includes intensive sampling to detect population trends on the Sierra and Sequoia national forests, where the fisher currently occurs, and is supplemented by less intensive sampling in suitable habitat in the central and northern Sierra Nevada specifically designed to detect population expansion. From 2002 – 2008, 439 sites were surveyed throughout the Sierra Nevada on 1,286 sampling occasions, with the bulk of the sampling effort occurring within the Southern Sierra fisher population monitoring study area (USDA 2009).

Preliminary results indicate that fishers are well-distributed in portions of the Sequoia and Sierra National Forests; annual occupancy rates are consistently higher on the Sequoia (33.3 percent to 41.1 percent) than the Sierra (14.5 percent to 22.7 percent) (USDA 2005). Comparisons to southern Sierra Nevada survey data from the 1990's suggest that the areal extent of occurrence for fisher may have expanded during the past 10 years (USDA 2005). Thus there has been no conspicuous difference in occupancy rates among years, and no seasonal effects on detection probabilities within the June to October sampling periods (Truex et al. 2009).

Carnivore camera stations have been employed within suitable habitat in and near the analysis area in 2005-2013 following the protocol designed by Zielinski and Kucera (1995). No fisher detections were made as a result of these survey efforts (NRIS Wildlife database).

From 2002 thru 2006, 916 primary sample units were completed, consisting of greater than 4,500 individual survey stations for over 45,000 survey nights (USDA 2006). In the seven southern Sierra Nevada monitoring seasons to date (2002 – 2008), fishers were detected at a total of 112 of 251 sample units, or 44.6 percent of sites (USDA 2009). These surveys have not resulted in detections of fishers on the Stanislaus National Forest.

The project is within the historic distribution of fisher across the Sierra Nevada Bioregion. Fisher have been documented both in Yosemite National Park and south of the Merced River on the Sierra National Forest. Although their presence within the analysis area is undocumented, their presence is assumed where suitable habitat exists. Because there are no documented den sites, LOPs for this species are not required for this project.

Habitat Account

In the Sierra Nevada, fishers occur in mid-elevation forests (Grinnell et at. 1937, Zielinski et al. 1997) largely on NFS lands, below the elevations of most national parks and wilderness areas. In the southern Sierra Nevada, fishers occur sympatrically with martens at elevations of 5,000 to 8,500 feet in mixed conifer forests (Zielinski et al. 1995). The Sierra Nevada status and trend monitoring project has detected fishers as low as 3,110 feet and as high as 9,000 feet in the southern Sierra Nevada, which are considered to be extremes of the elevation range for this species (USDA 2006).

The following California Wildlife Habitat Relationships (CWHR) types are considered important to fishers: generally structure classes 4M, 4D, 5M, 5D and 6 (stands with trees 11 inches diameter at breast height or greater and greater than 40 percent cover) in ponderosa pine, montane hardwood-conifer, Sierran mixed conifer, montane riparian, aspen, redwood, red fir, Jeffrey pine, lodgepole pine, subalpine conifer, and eastside pine (California Department of Fish and Game, California Interagency Wildlife Task Group. 2008). CWHR assigns habitat values according to expert panel ratings. CWHR2 is a derivative of the CWHR fisher habitat relationship model constructed by Davis et al. (2007). They used best available science to revise the statewide model and eliminate some forest types that appeared to contribute little to fisher habitat: aspen, eastside pine, lodgepole pine, montane riparian, red fir, and subalpine conifer. As Table 3.15-45 shows, this can be further refined to reflect only those forest types present in the southern Sierra Nevada: Jeffrey pine, montane hardwood-conifer, ponderosa pine, Sierran mixed-conifer and white fir, terming it CWHR2.1.

Table 3.15-45 High and moderate capability habitat for pacific fisher

Habitats*	Canopy Cover and Substrate Classes
Jeffrey pine	4P, 4M, 4D, 5M, 5D
Montane hardwood-conifer	4P, 4M, 4D, 5P, 5M, 5D, 6
Ponderosa pine	4P, 4M, 4D, 5P, 5M, 5D
Sierran mixed conifer	4P, 4M, 4D, 5P, 5M, 5D, 6
White fir	4P, 4M, 4D, 5P, 5M, 5D, 6

*CWHR 2008 as Modified by Davis et al. 2007 [CWHR2] and Applied to Southern Sierra Nevada Forest Types [CWHR2.1].

In addition to habitat fragmentation within the analysis area resulting from the Rim Fire, habitat connectivity across this landscape was compromised by the 1996 Ackerson and Rogge Fires, and the 2003 Kibbie Fire. Prior to the Rim Fire, the analysis area contained about 73,081 acres of moderate and high capability habitat. The analysis area still contains relatively high quality habitat for fisher in areas that burned at low or low-moderate intensity such as Twomile, Bourland, Reynold's Creek, Pilot Ridge and the Crocker Meadow area. Post-fire, the analysis area contains about 44,876 acres of moderate and high capability habitat on NFS lands only. Table 3.15-46 displays pre- and post-fire acres by CWHR vegetation type, size class, and density. Suitable habitat has been greatly reduced in the heart of the analysis area and connectivity between large tracts of habitat on the forest and currently occupied areas in Yosemite has been further reduced. This habitat fragmentation has reduced the likelihood of fisher moving through or dispersing into the area until natural vegetation recovery or forest management practices, such as planting, effectively re-establishes connectivity.

There are about 84,142 acres of moderate and high capability habitat within the cumulative effects analysis area post-fire, including all ownerships.

Table 3.15-46 Pre- and post-fire high and moderate capability habitat for fisher

CWHR Vegetation Type*	Size Class and Density	Pre-Fire CWHR Veg Type* (acres)	Post-Fire CWHR Veg Type* (acres)
JPN, MHC, PPN, SMC, WFR	4P	1,107	4,128
JPN, MHC, PPN, SMC, WFR	4M	8,035	4,700
JPN, MHC, PPN, SMC, WFR	4D	44,872	21,898
JPN, MHC, PPN, SMC, WFR	5P	8	827
JPN, MHC, PPN, SMC, WFR	5M	200	251
JPN, MHC, PPN, SMC, WFR	5D	18,859	13,072
TOTAL		**73,081**	**44,876**

*CWHR vegetation types: JPN: Jeffrey pine, MHC: montane hardwood conifer, PPN: ponderosa pine, SMC: sierra mixed conifer, WFR: white fir. Acres include public lands only.
CWHR Size Classes: 4 = 12-24 inches dbh, 5 = 24-40 inches dbh CWHR Density Classes (Canopy Closure): P = 25-39 percent, M = 40-59 percent, D equal to or greater than 60 percent

A road density of 0 to 0.5 miles per square mile is associated with high capability habitat for fishers USDA 1991). A road density of 0.5 to 2.0 miles per square mile is associated with medium capability habitat (Ibid). The road density including all routes open to motor vehicles in the analysis area is 3.0 miles per square mile on NFS lands and is more than six times the acceptable density found in high quality habitat and more than 1 mile per square mile above that found in moderate capability habitat.

Breeding occurs from late February through May, just a few days after parturition. Breeding is followed by embryonic diapause until late winter to early spring. Den site structural elements must exist in the proper juxtaposition within specific habitats in order to provide a secure environment for birth and rearing of fisher kits. Natal dens, where kits are born, are most commonly in tree cavities at heights of greater than 20 feet (Lewis and Stinson 1998). Maternal dens, where kits are raised, may be in cavities closer to the ground so active kits can avoid injury in the event of a fall from the den (Ibid).

Truex et al. 1998, Zielinski et al. 2004, Purcell et al. 2009 characterize suitable habitat for denning/resting as follows:

- Canopy cover greater than 60 percent.
- Large live and dead conifers and hardwoods 21-51 inches dbh; showing preference for largest tree or snag in area.
- Live and snag tree basal area ranges from 100 to 500 square feet per acre.

Fishers are considered prey generalists and their diet varies widely with local prey available in the diverse habitats they occupy (Zielinski et al. 2006). Prey items include squirrels, voles, porcupine, snowshoe hares and reptiles (Zielinski and Duncan 2004a). They also readily consume hypogenous fungi, fruit and deer carrion (Ibid). While information is lacking regarding fishers use of meadows, they are known to eat meadow voles and it is likely that they forage along meadow edges as marten do.

Freel 1991 characterized highly suitable habitat for foraging as follows:

- Canopy cover greater than 40 percent with a shrub component in the understory.
- Largest snags average 4 to 5 per acre and are greater than 20 inches dbh.
- Downed logs average 4 per acre and are greater than 30 inches dbh.

Dispersal ability is low in the western population and Arthur and others (1993) suggest that short dispersal distances (up to 6-12 miles from natal home range) may be problematic in the maintenance of fisher populations in areas where suitable habitat is fragmented. The current disjunct distribution pattern may also be partially attributed to movement and dispersal constraints imposed by the elongated and peninsular distribution of montane forests in the Pacific states (Wisely et al. 2004). The synergistic effect of road and rodenticide related mortalities documented in the southern Sierra populations, the apparent reluctance of fishers to cross open areas, and the more limited mobility of this terrestrial mammal relative to birds, it is more difficult for fishers to locate and occupy distant, but suitable, habitat.

Risk Factors

- Climate Change. Climate change is a concern for fishers because of the widespread ecological effects. There is the potential that climate change could increase habitat quality for this species, but various models and studies appear to support the idea that the core habitat for fisher in the middle elevation would suffer from fires and disease.
- Uncharacteristically Severe Wildfire. While wildfires are affected by climate change; fishers are also affected by historic and ongoing vegetation management, including timber harvesting and fire suppression, which have left the forests of the western Sierra Nevada un-naturally dense with understory vegetation, including shrubs and smaller trees.
- Vegetation Manipulation to Reduce Risk of Uncharacteristically Severe Wildfire. Aggressive stand thinning for forest health and reduced fire risk may remove important cover, snags, and vegetative diversity for fisher. These treatments may prevent more adverse effects associated with drought and wildfire, but may nonetheless result in habitat with reduced value for fisher or even render it unsuitable.
- Habitat Fragmentation or Loss of Connectivity. Habitat connectivity is a key to maintaining fishers within a landscape. Activities under Forest Service control that result in habitat fragmentation or population isolation pose a risk to the persistence of fishers. Timber harvest, fuels reduction treatments, road presence and construction, and recreational activities may result in the loss of habitat connectivity resulting in a negative impact on fisher distribution and abundance.

Management Direction

Current management direction is summarized by describing the desired future condition of land allocations (Robinson 1996). The Pacific fisher is a candidate for listing under the ESA, is a Region 5 Forest Service Sensitive species that is associated with old forest ecosystems (USDA 2004). The following land allocations pertain to fisher and old forest ecosystems: PACs, HRCA, OFEA, and FCCC.

The desired condition for PAC is to have 1) at least two tree canopy layers; 2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; 3) at least 60 to70 percent canopy cover; 4) some very large snags (greater than 45 inches dbh); and 5) snag and down woody material levels that are higher than average.

The desired condition for Spotted Owl HRCA is to encompass the best available habitat in the closest proximity to the owl activity center (USFS 2004 ROD pp. 39-40). HRCAs consist of large habitat blocks that have: 1) at least two tree canopy layers; 2) at least 24 inches dbh in dominant and co-dominant trees; 3) a number of very large (greater than 45 inches dbh) old trees; 4) at least 50 to 70 percent canopy cover; and 5) higher than average levels of snags and down woody material.

The desired condition for OFEA is to provide habitat conditions for mature forest associates (spotted owl, northern goshawk, American marten, and Pacific fisher). Specifically, forest structure and function across old forest emphasis areas generally resemble pre-settlement conditions. High levels of horizontal and vertical diversity exist at the landscape-scale (roughly 10,000 acres). Stands are composed of roughly even-aged vegetation groups, varying in size, species composition, and structure. Individual vegetation groups range from less than 0.5 to more than 5 acres in size. Tree sizes range from seedlings to very large diameter trees. Species composition varies by elevation, site productivity, and related environmental factors. Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. Forest structure and function generally resemble pre-settlement conditions.

The desired future condition of FCCC is to provide habitat connectivity for forest carnivores, linking Yosemite National Park and the North Mountain inventoried roadless area west to the Clavey River. For habitat connectivity, a future forested area is desired with a minimum of 50 percent of the forested area having at least 60 percent canopy cover. Higher than average levels of large snags and large down woody material is also desired (as in USDA 2004). Habitat structures are important to retain that may constitute rest sites as described in Freel 1991 and Lofroth et al. 2010 (plate 7.7).

Pacific Fisher: Environmental Consequences

The project alternatives could result in direct and indirect effects to the fisher through the following activities:

- Salvage of fire-killed trees.
- Salvage of roadside hazard trees.
- New permanent and temporary road construction, road reconstruction and maintenance
- Fuels treatments.
- Use of material sources and water sources.

These activities may have direct and indirect effects on fisher through the following:

- Project related death, injury or disturbance.
- Project related modifications to habitat quantity or quality.

Death, injury, or disturbance

Death or injury from project related activities would be unlikely to occur given the mobility of this species. However, there is the potential for death or injury if a den or rest tree were felled while being used by fisher.

Project activities, especially loud noise, could result in disturbance that may impair essential behavior patterns of the fisher related to denning, resting, or foraging. Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. The location of fisher within the analysis area is uncertain following the Rim Fire, a large-scale disturbance event; conducting surveys to identify areas being used is a way to address this uncertainty. Temporary avoidance of the project site or displacement of individuals during is expected during project implementation. Any displacement or avoidance would be of short duration and would subside shortly after project implementation activities. LOPs in place for spotted owls, goshawks, great gray owls, and bald eagles would afford protection to individual fisher in these areas during parturition, kit rearing, and subsequent breeding (March-August). The potential risk to individual fisher is considered low because of the lack of documented fisher occurrence within or near the analysis area and length of exposure expected given the accelerated timeframe of this project and implementation.

Habitat Modification

Salvage logging and the removal of roadside hazard trees would modify suitable fisher habitat by reducing its quality in both the short-term (10 to 20 years) and in the long-term (20-50 years).

Short-term, retaining snags within and near suitable fisher habitat would provide denning and resting sites (Freel 1991, Thompson et al. 2011, Zielinski et al. 2004). The number of snags and downed logs available across a fisher's home range affects the quality of that habitat for foraging and breeding. Resting and denning structures are likely the most limiting habitat elements within fisher home ranges (Zielinski et al. 2004). While there is no research available regarding fisher use of high severity burn areas in the first few years after fire, male fishers may venture several hundreds of yards into openings while female fishers would be much more cautious (Thompson pers. comm.). Therefore, snags retained away from forest cover are not likely to benefit fisher while vegetation becomes re-established.

Prey species that tolerate disturbance or open conditions are known to be abundant in post fire environments, such as mice, rats, chipmunks, and squirrels (Amacher et al. 2008 and Diffendorfer et al. 2012). Structural elements such as snags and downed logs, when combined with the flush of shrubs, forbs and grasses expected post-fire, will provide habitat suitable for prey and foraging habitat for fisher within a few years post-fire.

Long-term, large snags and large downed logs are considered biological legacies in a post fire environment and play important roles in the structure of future forest (Lindenmayer et al. 2008). Large snags and downed logs may take hundreds of years to develop, emphasizing the need to retain these elements across the landscape. Because large snags and large downed logs are regularly used by fisher it is not only important to retain these structural elements during project implementation, but it is imperative that recruitment of large snags and large downed logs occur over time to maintain habitat suitability in the long-term.

Snags remain standing for decades depending upon the species of tree and other environmental factors (Cluck and Smith 2007 and Ritchie et al. 2013). For example, Ritchie and others (2013) found that snag fall rates and decay rates vary considerably by species. When snags eventually fall, they are incorporated as large downed logs, another critical structural element important for marten and prey species (Freel 1991, Zielinski et al. 2004a).

Roads modify fisher habitat by directly removing it or indirectly reducing its quality, resulting in both short and long-term effects. Gaines and others (2003) studied the response of several focal species, including fisher, related to roads and trails. Fishers in this study were displaced, shifting use of habitat away from human activities on or near roads or trails. Andren (1994) suggested that, as landscapes become fragmented, the combination of increasing isolation and decreasing patch size of suitable habitat is negatively synergistic, compounding the effects of simple habitat loss. In particular, species associated with old forest habitats may be impacted by such effects. Reductions in interior forest patch size results in loss of habitat and greater distances between suitable interior forest patches for sensitive species like the Pacific fisher. New construction, temporary road construction and reconstruction would result in increased habitat fragmentation as well as a reduction in potential resting and denning structures.

Additional habitat modification occurs as an indirect effect of new road construction, temporary road construction, and reconstruction. Trees posing a potential safety hazard ("hazard trees") are removed along these new, temporary, and reconstructed roads. These trees are typically snags that are within a tree-height distance from the road. This safety policy results in a "snag free" zone of about 200 feet from each side of a road's edge, also affecting the recruitment of large downed wood within this zone. Habitat quality is reduced within this corridor.

Reducing fuel loads across the analysis area was identified as an essential first step in longer term fire and fuels management within the Rim Fire area (Crook et al. 2013). Removal of smaller material, less than 20 inches dbh, would not directly affect habitat suitability for fisher. However, it may indirectly contribute to a more resilient landscape and less risk of further loss of remaining suitable habitat in the face of the next wildfire.

Indicators

The following indicators were chosen to provide a relative measure of the direct and indirect effects to the fisher and to determine how well project alternatives comply with Forest Plan Direction and the species' conservation strategies.

1. Amount of moderate and high capability habitat altered.
2. Habitat connectivity
3. Amount of large legacy snags and downed logs in OFEA, HRCA, and FCCC units.
4. Road density (miles/square mile) in moderate and high capability and dispersal habitat

These criteria were chosen based on the best available scientific literature which focuses on various aspects of fisher ecology and life history requirements. These criteria focus on those life history aspects, or habitat elements, considered most limiting to fisher persistence across their range and where project effects are expected.

Effects Common to all Action Alternatives

DIRECT AND INDIRECT EFFECTS

Indicator 1. Because there are small differences in the amount of acres proposed for treatment in moderate and high quality suitable habitat under all action alternatives, the effects are expected to be similar and are therefore analyzed together.

Under the action alternatives, habitat quality would be reduced across a portion of the remaining moderate and high capability habitat within the analysis area as a result of removing snags and hazard trees. Between 71 percent and 72 percent of the remaining suitable habitat is not proposed for treatment. Proposed treatments would not exacerbate the lack of connectivity between large contiguous blocks of suitable habitat in the analysis area already created by the fire. Snag retention requirements vary by alternative and would serve to mitigate some of the negative effects expected to result from implementation of the action alternatives and is discussed in more detail under each alternative. Table 3.15-47 displays the proposed types of treatments and the proportion of moderate and high capability habitat affected under each action alternative for comparison.

Table 3.15-47 Proposed treatments in fisher moderate and high capability habitat

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total (acres)	Percent of Suitable Habitat Treated
1	6,221	6,677	12,898	29
3	6,266	6,562	12,828	29
4	5,724	6,632	12,356	28

Although a reduction in quality is expected, treated areas would continue to offer denning, resting, and foraging habitat. Trees that are in decline and not subject for removal under this project would, over time, be incorporated as potential resting or denning structures and habitat for prey species. Effects may result in impacts to an individual's fitness, but because there are no documented occurrences within the analysis area this risk is considered low.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Habitat connectivity across the landscape is important to fisher as it provides a means for dispersal, linkages between suitable habitat patches or core habitat areas, and genetic exchange. Spencer and Rustigan-Romsos (2012) provide recommendations for the conservation of rare carnivores such as the fisher in California. They used spatially explicit, empirical models to identify large areas of suitable habitat and dispersal corridors connecting those areas. Suitable fisher habitat cores were identified as a part of this effort and occurred in the north, east, southeast portions of the analysis area on the Stanislaus National Forest before the Rim Fire in 2013. Because the fire resulted in the removal of some of the core habitats identified, connectivity between occupied habitat in Yosemite National Park and suitable habitat on the Stanislaus National Forest has been further reduced.

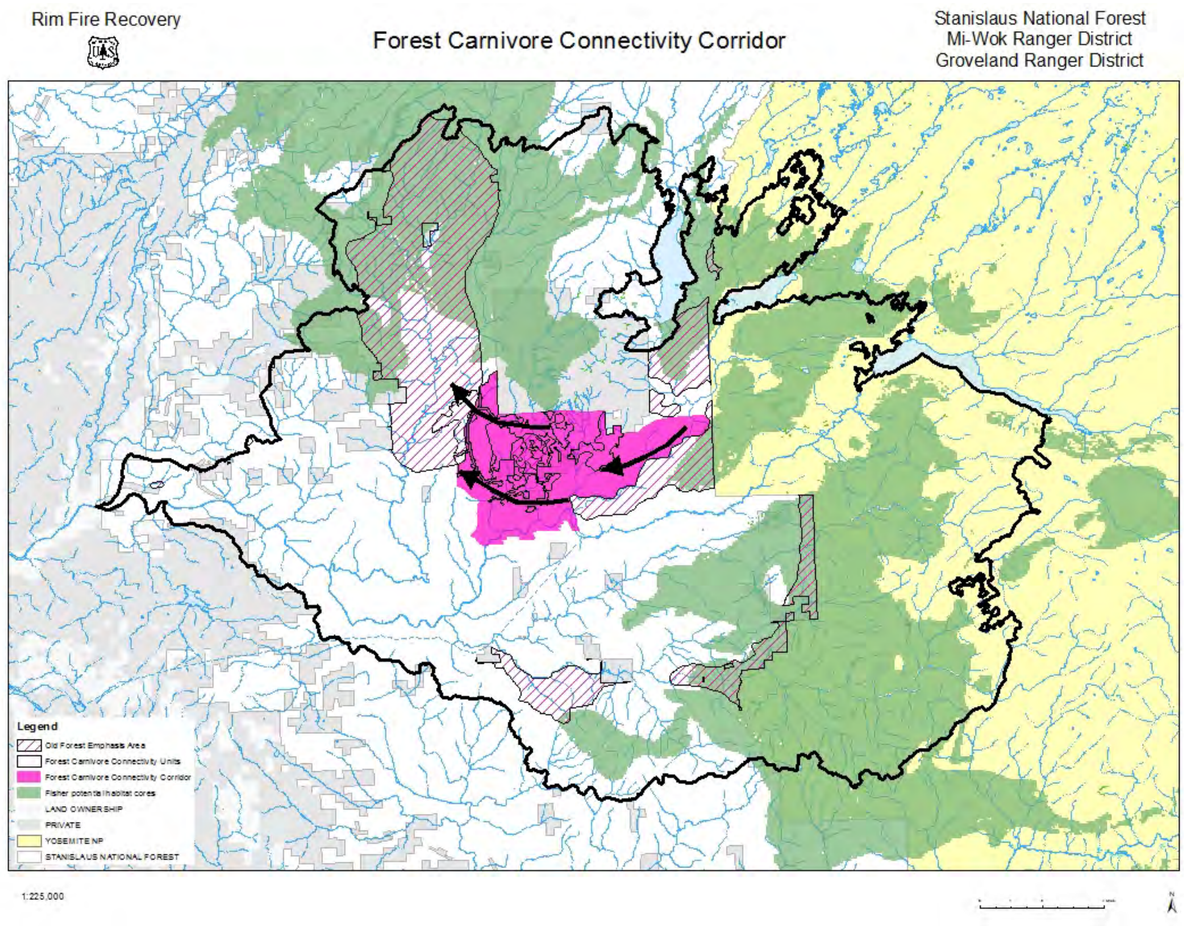

Figure 3.15-4 Proposed Forest Carnivore Connectivity Corridor

A forest carnivore connectivity corridor is proposed to focus management activities associated with this project on re-establishing that connectivity so that fisher can disperse into and utilize the available suitable habitat on the Stanislaus National Forest. Portions of this corridor would also overlap important critical winter deer range. This corridor spans from Yosemite National Park and the North Mountain roadless area, encompassing the Tuolumne River canyon west toward the Clavey River canyon. The corridor, shown in Figure 3.15-4, includes the following proposed salvage units managed for old forest emphasis: L02, L05, M1 through M10, M12, M13, M15, M16, M18, M19, and N1. This corridor was identified based on the following: modeling and recommendations presented in Spencer and Rustigan-Romsos (2012), potential natural vegetation, on-the-ground knowledge of habitat suitable for fisher, ownership, and other management priorities.

Objectives for this corridor include salvaging to provide for future management opportunities that may include re-establishing forested conditions suitable for fisher and other old forest associated species by planting. Management objectives in this corridor would complement OFEA and HRCAs management objectives at the larger landscape scale.

Desired conditions for this area include managing this corridor for a range of vegetative conditions, including a minimum of 50 percent of forested areas having at least 60 percent canopy cover. This would allow for fisher movement through, and use of, this habitat. Because a portion of this corridor is within a designated fuels SPLAT, it is necessary to manage for heterogeneity, combining some denser forested conditions with less dense vegetation to allow for effective fuels and fire management. Additional biomass removal proposed in critical winter deer range would contribute to breaking up fuel continuity across the analysis area, increasing the defensibility of forest carnivore connectivity units in the long-term. This corridor would benefit fisher and other old forest associated species such as the California spotted owl and northern goshawk over the long-term as forested conditions return.

Indicator 3. Under Alternative 1, Table 3.15-48 displays the acres affected by the snag retention requirements within potential fisher habitat proposed under this alternative. Potential fisher habitat is defined as land allocations that are managed for old forest associated species (OFEA, HRCA, and FCCC) and potential suitable habitat between 3,000 and 9,000 feet in elevation.

Retaining snags at a rate of 12 square feet per acre across the 28,140 acres proposed for treatment would provide less than half of that documented to occur in occupied fisher habitat. For example, occupied fisher habitat within the Kings River Fisher Project area contains an average of 24 square feet per acre basal area of snags in a variety of size classes (Thompson pers.comm.). Zielinski et al. (2004) reports an average of 44square feet per acre basal area of snags present in the immediate vicinity of fisher resting sites. Although retaining snags at this level is not optimal for fisher, those retained would provide some potential resting and denning sites as well as habitat for prey sought by fishers.

Table 3.15-48 Snags retained in salvage units within potential fisher habitat, Alternative 1

12ft² per acre* General Forest Average	30ft² per acre (OFEA, HRCA, FCCC) Above Average	100-120ft² per acre (PSW Research) Above Average
28,140	0	0

* Converted from 4snags per acre for comparison; assuming retention of 24 inches dbh snags.

Retaining snags at 12 square feet per acre would result in the lowest retention of snags to contribute to the structural complexity and diversity within recovering forested stands. As vegetative cover returns, only minor beneficial effects on habitat quality for fisher are expected.

Hardwoods occur irregularly across the analysis area and have not been mapped. Hardwoods are critically important structures and are selected by fisher for resting and denning sites (R. Sweitzer unpublished data, Thompson et al. 2011, and Truex et al. 1998). Because all hardwood snags would be retained under Alternative 1, no change in the number of hardwood snags available is expected as a result of implementation.

Over time, retained snags would decay and fall and become incorporated as large downed logs. Large downed woody debris provides important habitat elements utilized by fisher and their prey. Considering fisher utilize habitat that contains higher rates of large snags and large downed woody debris, the rate of snag retention proposed under Alternative 1 is not adequate to maintain the highest habitat capability within the treated areas. However, snags retained are expected to contribute and provide suitable habitat, although of lower quality in the short-term. In the long-term these snags would be incorporated as large downed woody material, critical structural elements needed within a recovering forest.

Downed woody debris retention at 10 to 20 tons per acre, if available in larger size classes, would provide habitat structure important for fisher and their prey. In most areas, there is a lack of sufficient large downed woody material, making snag retention and eventual recruitment as downed logs even more critical. Fuels treatments that result in the removal of smaller downed woody material may result in a more diverse understory including more herbaceous and shrub vegetation that would benefit fisher and their prey.

Indicator 4. To analyze effects of road density, it is necessary to include more than the current suitable fisher habitat because roads can be somewhat permanent features on the landscape and will affect the habitat suitability for fisher not only in the short-term, but long-term as well. Thus, land allocations that are managed for old forest associated species (OFEA and HRCA), the proposed forest carnivore connectivity corridor, and pre-fire moderate and high capability habitat were used to calculate road density for fisher within the analysis area. Small disjunct patches of habitat not contributing to the core area as defined here were omitted. This potential fisher habitat area is about 88,000 acres and can support fisher, in part today and into the future, based on the desired conditions outlined in the Forest Plan (USDA 2010a). Therefore, this is considered a logical approacreh to analyze project related road density and effects to fisher.

Under Alternative 1, new permanent road construction, temporary road construction, and road reconstruction are proposed as described in Chapter 2. Table 3.15-49 displays the miles of each type of road-related treatment and the resulting miles per square mile under this alternative.

Table 3.15-49 Miles of road treatments within potential fisher habitat, Alternative 1

New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project use During Implementation (mi/mi²)	Total Road Density Existing plus Additional for Project (mi/mi²)
5.4	215.8	30.9	18.2	0.3	1.9

The new road construction and temporary road construction proposed under this alternative would result in an increase of 0.3 miles per square mile of road, effectively increasing the road density from 1.6 miles per square mile to 1.9 miles per square mile during project implementation. Minor negative effects to habitat quality are expected under Alternative 1. This may slightly increase the potential for road related mortality during project implementation while the roads are open and being used regularly. Because there are no documented occurrences within the analysis area this risk is considered low. The new permanent road designation as blocked maintenance Level 1 or Level 2 gated year round would alleviate the risk of road related mortality after project implementation because the roads would only be used intermittently for management purposes. The new permanent road construction would result in habitat fragmentation in the long-term due to habitat removal as a result of the road construction and future hazard tree removal within 200 feet of the roads edge in the long-term. This would reduce the quality of habitat adjacent to those new roads. All temporary roads would be obliterated and blocked and over time. Vegetation would become reestablished and all roads that were non-motorized before project implementation would be returned to the pre-project specifications.

CUMULATIVE EFFECTS

In making the determination for Alternative 1, the cumulative impact on the environment resulting from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, was considered. A list of the actions considered can be found in Appendix

B. Some, but not all of these foreseeable future actions have or may contribute cumulatively to effects on fishers.

Risk factors potentially affecting fisher abundance and distribution have been identified and include habitat fragmentation and lack of or removal of coarse woody debris. The following evaluation criterion was used as a relative measure of cumulative effects from this alternative to fisher: habitat modification.

Habitat Modification

Federal Land

Past, present, and foreseeable future timber harvests and hazard tree removal sales on public lands have and will likely affect habitat suitability for fisher through the removal of large trees, reduction in canopy cover, and potential loss of snags and downed woody debris from prescribed fire operations. Truex and Zielinski (2005) suggest that a reduction in habitat suitability does not necessarily equate to loss of suitability. Present actions within the analysis area include: The Twomile Ecological Restoration Vegetation Management Groovy and Funky timber sales and the Soldier Creek timber sale are scheduled to treat about 2,045 acres through commercial thinning, biomass removal, mastication, and prescribed fire treatments. GTR 220 (North et al. 2009) was used as a guide when designing these projects including maintaining elements important to fisher (large trees, snags, downed wood, areas of dense canopy cover). In addition, Yosemite National Park is currently removing hazard trees on about 816 acres, which would have negligible effects on fisher and their habitat.

Foreseeable future actions on federal lands include: Reynolds Creek Ecological Restoration involving meadow and aspen restoration. These types of projects generally include the removal of encroaching trees. Two mile-Campy, Looney, and Thommy timber sales and Reynolds Creek timber sale are scheduled to occur over the next few years resulting in treatment of about 3,798 acres through commercial thinning, biomass removal, mastication, and prescribed fire. As a result of the Rim Fire, the Rim HT removal project proposed to remove hazard trees along 10,262 acres of Maintenance Level 3, 4, and 5 roads is scheduled for implementation in the summer of 2014. The ecological restoration projects will reduce habitat quality in the short-term for fisher, but are designed to have long-term benefits. Hazard tree removal will reduce habitat quality in the short and long-term because the objective and priority on Maintenance Level 3, 4, and 5 roads is public safety.

Roads and trails modify habitat suitability for fishers by reducing habitat or degrading quality through fragmentation. Roads and trails also improve human access, and potentially result in the displacement of individuals. Twomile Transportation, a foreseeable future action, will result in a slight reduction in motorized routes, essentially removing 11.4 miles by gating, decommissioning, or closing to Maintenance Level 1 roads used only for administrative purposes. Reynolds Creek Motorized Routes project will decommission 3.5 miles of unauthorized routes in the near future as well. The Mi-Wok OHV Restoration project proposes to block and restore 11.6 miles of unauthorized OHV routes. This reduction of about 26.5 miles of motorized roads and trails across the analysis area would improve habitat quality by reducing fragmentation and human access while increasing the amount of interior habitat available.

Private Lands

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acres is presently being salvage logged. Post salvage, the areas may provide short-term foraging habitat for fisher as understory vegetation becomes established; however, these benefits are expected to be limited in space and time based on typical reforestation efforts.

Wildfire

Wildfires can affect habitat in varying degrees, depending on the intensity of the fire. Wildfires can create snags, which may be used as den or rest sites by fisher. Wildfires that burn at high severity, such as the Rim Fire, result in eliminating habitat. Treatments in green forest (past, present, future) are designed to reduce fire intensity and spread, thus reducing the risk of habitat loss. It is expected that wildfire will continue to occur on the landscape.

Alternative 1 Contribution/Summary

The proposed action is expected to contribute cumulatively to short and long-term effects on fisher. Disturbance and potential displacement of individuals may occur during project implementation and would likely be temporary. No recent occurrences of fishers within the analysis area are documented; however, the analysis area is in close proximity to the nearest known populations occurring on the Sierra National Forest and Yosemite National Park. Reduction in the quality of moderate and high capability habitat on about 12,898 acres (15 percent of the remaining suitable habitat within the analysis area) is expected from implementation of Alternative 1. Snag retention requirements under Alternative 1 are less than under the other action alternatives. Habitat quality would be reduced based on the reduction of denning and resting sites. There are also 5.4 miles of new permanent road construction proposed within potential fisher habitat under Alternative 1, which would have negative effects on fisher and their habitat. Treatments would likely occur over the next two to three years and may coincide with other projects, particularly Groovy, Funky, and Soldier Creek. The combination of past Forest Service and private timber harvests, and wildfire has cumulatively reduced the amount of late-succession habitat available across the analysis area. This and other Forest Service projects were and continue to be designed to prevent additional, large scale loss of mature forest from wildfires such as the Rim Fire. The Forest Service projects are designed to retain and improve key habitat components such as retention of large trees, defect trees, snags, downed wood, while focusing on releasing black oaks and pines. Habitat suitability within the analysis area is predicted to improve in the long-term for fisher. The cumulative contribution under Alternative 1 is not expected to affect the viability of this species.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur.

Under Alternative 2, no indirect effects are expected because no active management would occur; however, there may be consequences under this alternative primarily related to the influence no action may have on future wildfires and how future wildfires may impact fisher habitat. Wildfire has been documented as one of the biggest risks to fisher persistence across their range (USDA 2001). Predicting the effect no action would have on future wildfire and fisher habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (3.05 Fuels). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

Indicator 1. Under Alternative 2, habitat quality within currently suitable moderate and high capability habitat would not be altered.

Within the areas that burned at high severity, herbaceous and shrub vegetation is expected to be established within 3-5 years (Gray et al. 2005 and Moghaddas et al. 2008) and would be suitable for fisher movement and potentially as foraging habitat. These beneficial effects would be expected in the short-term. Because the ability of forests to regenerate after stand replacing fire is highly dependent on seed sources, forested conditions are likely to re-establish only within mixed severity burn patches and the edges of high severity patches (Rim EIS Vegetation Report). It is likely that areas that burned at high severity would be dominated by herbaceous and shrub vegetation and shade tolerant conifer species such as white fir and incense cedar in the future (Rim EIS Vegetation Report). A consequence of shrub dominance is the reduced likelihood that forested conditions would return naturally for many decades. Not removing fire-killed trees would result in additional difficulties related to future management, such as planting conifers that could help accelerate the establishment of forest conditions. Thus, suitable denning and resting habitat would be delayed under this alternative resulting in long-term negative effects to fishers.

When wildfire returns to this landscape, the remaining moderate and high capability habitat adjacent to or near areas that burned at high severity may be at increased risk of loss. Within 10 years, the fuel loading is predicted to be four to eight times higher (78 tons per acre) than the desired condition (Rim EIS Fuels Report). This would significantly increase the risk of fire suppression activities when wildfire occurs in the future. The negative long-term effects on habitat for fisher from this alternative outweigh the short-term beneficial effects.

Indicator 2. Under Alternative 2, no forest carnivore connectivity corridor would be proposed. The connectivity would not be re-established between large areas of suitable habitat lacking connectivity after the Rim Fire. Benefits described under the action alternatives would not be realized under this alternative.

Indicator 3. Under Alternative 2, all snags and downed logs would be retained. In the short-term fisher and their prey would benefit from the availability of more snags and downed logs within an adjacent to remaining suitable habitat, as discussed under the action alternatives. Remaining suitable habitat would be at higher risk of loss in the long-term when wildfire returns to this landscape, see Indicator 1 above. The potential for recovery of forested conditions across areas that burned at high severity would also be delayed, see Indicator 1 above.

Indicator 4. Under the Alternative 2, no new permanent road construction, temporary road construction, reconstruction, or maintenance would occur. This alternative would provide the greatest benefit to fisher because there would be no increase in road density across the analysis area and no potential increase of road related mortality in the short or long-term.

CUMULATIVE EFFECTS

Habitat modification

The Cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, there would be no direct cumulative effect expected because no active management would occur.

Alternative 2 Contribution/Summary

The cumulative contribution under this alternative would not complement the treatments that have occurred in the past, thus increasing the risk of loss of remaining suitable habitat to wildfire in the long-term. The short-term beneficial impacts to fisher such as retention of snags for denning and resting sites would be outweighed by the increased risk of additional habitat loss in the next wildfire.

Alternative 3

DIRECT AND INDIRECT EFFECTS

Under Alternative 3, no cumulative effects are expected.

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Under Alternative 3, the Stanislaus National Forest Land and Resource Management Plan would be amended to establish the connectivity corridor as a land allocation (old forest emphasis area) prioritizing future management objectives, not just those objectives associated with this project, within this connectivity corridor to benefit old forest associated species, particularly forest carnivores. The effects to fishers under Alternative 3 are the same as discussed under Alternative 1, but would be realized in the long-term because the proposed corridor, approximately 10,000 acres, would be changed from General Forest to Old Forest Emphasis Area. This land allocation change would prioritize management emphasis in this corridor to benefit old forest associated species into the future.

Indicator 3. Under Alternative 3, the snag retention rate in OFEA, HRCA, and FCCC is considered greater than the management standard and above average snag retention, while the snag retention rate in general forest is considered the management standard or average snag retention.

In addition, under this alternative in OFEA, HRCA, FCCC, and in roadside hazard units within Protected Activity Centers (PACs), retain the largest size classes of down woody material. Table 3.15-50 displays the acres affected by the snag retention requirements within potential fisher habitat proposed under this alternative. Potential fisher habitat is defined as land allocations that are managed for old forest associated species (OFEA, HRCA, and FCCC) and potential suitable habitat between 3,000 and 9,000 feet in elevation.

Table 3.15-50 Snags retained in salvage units within potential fisher habitat, Alternative 3

12ft² per acre* General Forest Average	30ft² per acre (OFEA, HRCA, FCCC) Above Average	100-120ft² per acre (PSW Research) Above Average
14,691	13,436	2,089

* Converted from 4snags per acre for comparison; assuming retention of 24 inches dbh snags.

Under Alternative 3, all snag retention areas occur within suitable or potential future fisher habitat. Snags retained at a rate of 12 square feet per acre would provide less than half of the snags documented to occur in occupied fisher habitat. Snags retained at the rate of 100 to 120 square feet per acre would provide almost three times the snags documented to occur in occupied fisher habitat. Snag retention at the rate of 30 square feet per acre would provide a supply of snags within the range found in occupied fisher habitat. Occupied fisher habitats within the Kings River Fisher Project area contain an average of 24square feet per acre basal area of snags in a variety of size classes (Thompson pers. comm.). Zielinski et al (2004) reports an average of 44 square feet per acre basal area of snags present in the immediate vicinity of fisher rest sites. Units with snag retention at the rate of 30 or 100 to 120 square feet per acre would provide higher quality habitat for fisher post treatment than those with only 12 square feet per acre.

Areas with above average snag retention would provide the most snags to contribute to structural complexity and diversity within recovering forested stands. Areas that occur within a few hundred yards from suitable fisher habitat not proposed for treatment are expected to be used by fisher in the near future as vegetative cover returns, providing fisher protection from predators. Areas with average snag retention would provide some elements to contribute to the structural complexity and diversity within recovering forested stands.

As in Alternative 1, all hardwood snags would be retained under Alternative 3 and no change in habitat quality is expected as a result of implementation.

The rate of snag retention proposed under this alternative is adequate to maintain the moderate and high capability habitat or fisher on about 50 percent of the area proposed for treatment under this alternative. The remaining 50 percent would have fewer snags than is documented in occupied fisher habitat; however, the snags retained are expected to provide some habitat elements for resting, denning and prey in the short-term, and in the long-term as large downed woody debris.

Downed woody debris retention at 15-20 tons per acre, if available in larger size classes, would provide habitat important for fisher and their prey. In most areas, there is a lack of sufficient large downed woody material, making snag retention and eventual recruitment as downed logs even more critical. Fuels treatments that result in the removal of smaller downed woody material may result in a more diverse understory including more herbaceous and shrub vegetation that would benefit fisher and their prey.

Indicator 4. Under Alternative 3, new permanent road construction, temporary road construction, and road reconstruction are described in Chapter 2. Table 3.15-51 displays the miles of each type of road-related treatment and the resulting miles per square mile under this alternative.

Table 3.15-51 Miles of road treatments within potential fisher habitat, Alternative 3

New Permanent Road Construction (miles)	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project Use During Implementation (mi/mi²)	Total Road Density-Existing Plus Additional for Project (mi/mi²)
1.0	216.6	31.0	28.9	0.4	2.0

The new road construction and temporary road construction proposed under this alternative would result in an increase of 0.4 miles per square mile of road, effectively increasing the road density from 1.6 miles per square mile to 2.0 miles per square mile during project implementation. This would have a slightly greater negative effect on habitat quality in the short-term than under Alternative 1, but effects are still expected to be minor. This may slightly increase the potential for road related mortality during project implementation while the roads are open and being used regularly. Because there are no documented occurrences within the analysis area this risk is considered low. The new permanent road designation as blocked Maintenance Level 1 or Level 2 gated year round, would alleviate the risk of road related mortality because the roads would only be used intermittently for management purposes. They would however result in habitat fragmentation in the long-term due to habitat removal as a result of the road construction, and future hazard tree removal within 200 feet of the roads edge in the long-term. This would reduce the quality of habitat adjacent to those new roads. All temporary roads would be obliterated and blocked and over time vegetation would become reestablished and all roads that were non-motorized before project implementation would be returned to the pre-project specifications. These effects would be less than under the proposed action because there are 4.4 fewer miles of new permanent road proposed under this alternative.

CUMULATIVE EFFECTS

Refer to the cumulative effects discussion under Alternative 1 outlining those present and foreseeable future activities scheduled on public and private lands. The cumulative contribution of Alternative 3 would be less than those described under Alternative 1, due to slightly fewer acres proposed for treatment within moderate and high capability habitat, higher snag retention within OFEA, HRCA, and FCCC units, and 4.4 miles less new permanent road construction. The cumulative contribution under Alternative 3 would affect fishers and their habitat in the short and long-term, but is not expected to affect the viability of this species.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Indicator 1. Discussed under effects common to all action alternatives.

Indicator 2. Same as Alternative 3.

Indicator 3. Under Alternative 4, the snag retention guidelines are the same as outlined under Alternative 3, only the amount of area proposed for treatment has changed. Table 3.15-52 displays the acres affected by the snag retention requirements proposed under this alternative. While percentages vary slightly between Alternatives 3 and 4, effects from Alternative 4 are expected to be the same as discussed under Alternative 3.

Table 3.15-52 Snags retained in salvage units within potential fisher habitat, Alternative 4

12 feet² per acre* General Forest Average	30 feet² per acre (OFEA, HRCA, FCCC) Above Average	100-120 feet² per acre (PSW Research) Above Average
13,278	12,279	2,089

* Converted from 4snags per acre for comparison; assuming retention of 24 inches dbh snags.

Indicator 4. Under Alternative 4, temporary road construction, and road reconstruction are described in Chapter 2. Table 3.15-53 displays the miles of each type of road-related treatment and the resulting miles per square mile under this alternative.

The new road construction and temporary road construction proposed under Alternative 4 would result in an increase of 0.4 miles per square mile of road, effectively increasing the road density from 1.6 miles per square mile to 2.0 miles per square mile during project implementation. Although the road density is slightly above Alternative 1, no new permanent road construction is proposed. Thus, no long-term habitat fragmentation is expected under Alternative 4. This may slightly increase the potential for road related mortality during project implementation while the roads are open and being used regularly. All temporary roads would be obliterated and blocked and over time vegetation would become reestablished and all roads that were non-motorized before project implementation would be returned to the pre-project specifications. Because there are no documented occurrences within the analysis area this risk is considered low.

Table 3.15-53 Miles of road treatments within potential fisher habitat, Alternative 4

New Permanent Road Construction (miles)	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project Use During Implementation (mi/mi²)	Total Road Density-Existing Plus Additional for Project (mi/mi²)
0	211.2	30.9	27.3	0.4	2.0

CUMULATIVE EFFECTS

Refer to the cumulative effects discussion under the Alternative 1 outlining those present and foreseeable future activities scheduled on public and private lands. The cumulative contribution of Alternative 4 would be the least of all the action alternatives as described under Alternatives 1 and 3 due to having the least amount of acres proposed for treatment within moderate and high capability habitat, highest snag retention within OFEA, HRCA, and FCCC units, and no new permanent road construction. The cumulative contribution under Alternative 4 would affect fishers and their habitat in the short and long-term but is not expected to affect the viability of this species.

Pacific Fisher: Summary of Effects

Indicator 1. Table 3.15-54 shows the amount of moderate and high capability fisher habitat proposed for treatment is very similar for all alternatives. Alternative 1 would affect the most habitat and Alternative 4 would affect the least amount of habitat. Alternative 2 would not affect suitable habitat.

Table 3.15-54 Summary of effects for fisher

Indicator	Alternative			
	1	2	3	4
Indicator 1 – Moderate and high capability habitat treated				
Salvage acres	6,221	0	6,266	5,724
Hazard Tree removal acres	6,677	0	6,562	6,632
Total acres	12,898	0	12,828	12,356
Percent of suitable habitat treated	29	0	29	28
Indicator 3 – Large snags and large downed woody material				
12 sq. ft. BA / acre General Forest Average	28,140	0	14,691	13,278
30 sq. ft. BA / acre OFEA, HRCA, FCCC, above average	0	0	13,436	12,279
100 to 120 sq. ft. BA / acre PSW Research, above average	0	0	2,089	2,089
Full retention, no action	0	29,103*	0	2,571
Indicator 4 – Road treatments in miles				
New construction	5.4	0	1.0	0
Reconstruction- currently designated for motor vehicle travel	215.8	0	216.6	211.2
Reconstruction- currently NOT designated for motor vehicle travel	30.9	0	31.0	30.9
Temporary road construction	18.2	0	28.9	27.3
Roads added for project use during implementation (mi/mi^2)	0.3	0	0.4	0.4
Total road density existing plus additional for project (mi/mi^2)	1.9	1.6	2.0	2.0

*Represents maximum number of potential unit acres in land allocations with old forest observations.

Indicator 2. All action alternatives incorporate the forest carnivore connectivity corridor; however, a Forest Plan Amendment is only proposed under Alternatives 3 and 4. Under Alternative 2, no connectivity corridor or Forest Plan Amendment would be proposed.

Indicator 3. Table 3.15-54 shows the acres of areas managed for old forest objectives with higher than average levels of large snags and higher than average levels of large down woody material are highest in Alternatives 3 and 4. In contrast, Alternative 1 manages no acres for higher than average levels of large snags. For retention of large down woody material, all action alternatives manage to a standard of 10 to 20 tons per acre but Alternatives 3 and 4 emphasize retention at the higher end (i.e. 20 tons per acre) and Alternative 1 does not. Alternative 4 manages for an additional 2,571 acres under full retention of snags and down woody material.

Indicator 4. Of the action alternatives, proposed miles of new permanent road construction is highest under Alternative 1 and lowest under Alternative 4. Increases to road density are similar among all action alternatives, but long-term effects related to road density are greatest under Alternative 1 because of the amount of new permanent road construction.

Determinations

Alternative 1 may affect individuals, but is not likely to contribute to the need for Federal listing or result in loss of viability for the Pacific fisher in the analysis area. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 may affect individuals, but is not likely to contribute to the need for Federal listing or result in loss of viability for the Pacific fisher in the analysis area. The Rim EIS Fuels Report 2014 and Crook et al. 2013 were considered.

Alternative 3 may affect individuals, but is not likely to contribute to the need for Federal listing or result in loss of viability for the Pacific fisher in the analysis area. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 4 may affect individuals, but is not likely to contribute to the need for Federal listing or result in loss of viability for the Pacific fisher in the analysis area. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is best demonstrated under this alternative. Specifically, no new permanent road construction is proposed and the least amount of suitable habitat would be modified under this alternative.

Pallid Bat and Fringed Myotis: Affected Environment

Species and Habitat Accounts

The pallid bat (*Antrozous pallidus*) is a Region 5 Forest Service Sensitive species and is designated as a Species of Special Concern by CDFW. They occur in arid regions of western North America from British Columbia to Mexico and east to Wyoming (Hermanson and O'Shea 1983). They are usually found in low to mid elevation habitats below 6,000 feet; however, they have been documented up to 10,000 feet in the Sierra Nevada (USDA 2001). Considered yearlong residents, they inhabit vegetation types such as Blue Oak Woodland, Mixed Chaparral, and coniferous forests (CDFG 2008, Stanislaus National Forest survey records).

The fringed myotis bat (*Myotis thysanodes*) is a Region 5 Forest Service Sensitive species and is designated as a Species of Special Concern by CDFW. The fringed myotis bat occurs from southern British Columbia south through the western United States and most of Mexico (O'Shea and Bogan 2003). In California, it occurs from near sea level at the coast to elevations of at least 6,400 feet in the Sierra Nevada and in a variety of habitats from low desert scrub to high-elevation conifer forest (Philpott 1997). The fringed myotis is a widely distributed species, but it is considered rare (Ibid). Although this species occurs in netting and night roost surveys in a number of localities, it is always one of the rarest taxa (Pierson et al. 1996).

North American pallid bat populations have declined over the past 50 years (O'Shea and Bogan 2003), and limited data from California suggest population declines associated with desert and oak woodland habitat loss due to urban expansion (USDA 2001).

Population estimates and trends for fringed myotis are unavailable, but the limited available data suggests the population is declining (Macfarlane and Angerer *draft*). Not only have historic maternity colonies disappeared, but those remaining appear to contain fewer individuals.

Bat surveys have been conducted in and near the analysis area. Pallid bats have been documented on the North Fork Merced River and along Cottonwood Creek (Gellman 1994, Stanislaus National Forest survey records). Fringed myotis have been documented at Fahey Pond and the Hetch Hetchy adit at the end of road 1N45 (Stanislaus National Forest survey records, CNDDB). They have also been documented just outside the analysis area in the lower Tuolumne River and a bridge over the South Fork Tuolumne River. Suitable roosting and foraging habitat is present for both species throughout the project area and their presence is assumed.

Pallid bats are common in open, dry habitats including grasslands, shrublands, woodlands, and coniferous forests. They roost in a variety of locations such as bridges, buildings, caves, rock crevices, mines, and trees (Hermanson and O'Shea 1983). This species can be found singly, but it is gregarious and can often be found roosting in groups. They are sensitive to roost site disturbance which may lead to roost abandonment. Suitable habitat is present throughout the project area. There are no barriers precluding movement (dispersal, seasonal, etc.) of this species both within and in close proximity to the project area.

In California, the fringed myotis occurs in valley foothill hardwood, hardwood conifer, and coniferous forested habitats. In mist netting surveys, they are found on secondary streams and ponds (Stanislaus National Forest survey records). They roost in caves, buildings, mineshafts, rock crevices and bridges (O'Farrell and Studier 1980). Studies conducted in California, Oregon, and Arizona, have documented that fringed myotis roosts in tree hollows, particularly in large conifer snags (Chung-MacCoubrey 1996, Rabe et al. 1998, Weller and Zabel 2001, Pierson et al. 2006). Most of the tree roosts were located within the tallest or second tallest snags in the stand and were surrounded by reduced canopy closure (Ibid). They are gregarious and can be found roosting with other bat species, such as the long eared myotis (M. Baumbach pers. obs.). They exhibit high roost site fidelity, sometimes in different trees but within a small area (O'Farrell and Studier 1980, Weller and Zabel 2001). Fringed myotis are highly sensitive to roost site disturbance (Ibid).

Pallid bats breed in the fall with delayed implantation occurring in the spring. Females form maternity colonies in April that may contain up to 100 individuals (Zeiner et al. 1990b). Males sometimes roost in or near to maternity colonies. Horizontally-oriented rock crevices are preferred diurnal roost sites in the summer, which coincides with maternity colony selection and use (Hermanson and O'Shea 1983).

Fringed myotis also breed in the fall, with delayed implantation occurring in the spring. Females give birth to one young per year typically from May to July (Philpott 1997; Harvey et al 1999). Maternity colonies may contain up to several hundred individuals. In California in recent years smaller colonies of 25-50 are more typical.

Pallid bats forage in open canopied woodlands, riparian areas, and grassland or meadow habitat. They are maneuverable on the ground and commonly forage between one and five feet above the ground for prey such as Jerusalem crickets, longhorn beetles, scorpions, and occasionally large moths and grasshoppers (USDA 2001, Zeiner et al. 1990). They readily use roads, meadows, oak woodlands and other open areas to hunt.

Individual fringed myotis emerge from roost sites to forage approximately 1-2 hours after sunset. They forage in and among vegetation along forest edges and in the overstory canopy. They feed on a variety of insect prey, including small beetles, moths, and fly larvae caught in flight or gleened from vegetation (Ibid). Fringed myotis often forage in meadows and along secondary streams, in fairly cluttered habitat. (Pierson et al. 2001). They are known to fly during colder temperatures and precipitation (Hirshfeld and O'Farrell 1976). Even snow does not appear to affect emergence (O'Farrell and Studier 1975, M. Baumbach pers. obs.). Keinath (2004) found that travel distances from roosting to foraging areas may be up to five miles.

Dispersal patterns in pallid bats aren't known. Pallid bats are not known to migrate long distances. They are relatively inactive and either hibernate or enter extended periods of torpor during the winter (Hermanson and O'Shea 1983).

Dispersal patterns are also unknown for fringed myotis. Although known to migrate, little is known regarding the species movement (O'Farrell and Studier 1980). Fringed myotis are year-round residents in California and are known to hibernate but are also capable of periodic winter activity (Philpott 1997).

Risk Factors

- White Nose Syndrome. The largest emerging threat to all cave-roosting species is the fungal disease white-nose syndrome (WNS). Massive die-offs result once a colony is infected. Because pallid bats and fringed myotis readily uses caves for roosting, they are considered highly susceptible to contracting WNS. Although not yet documented in California, the disease is moving to the west.

- Timber Harvest and loss of snags as roosting sites. The loss of large diameter snags and live trees for roosts due to fire or harvest activities can affect roost availability. In some forested settings, the fringed myotis appears to rely heavily on tree cavities and crevices as roost sites (Weller and Zable 2001), and may be threatened by certain timber harvest practices that result in the removal of snags. Retention of existing large trees and management of forested habitat will provide short and long-term habitat.
- Fire Suppression. Pallid bats are at risk from loss of open foraging habitat from fire suppression and may reduce foraging habitat in the long-term.
- Mining. The resurgence of gold mining in the West potentially threatens mine dwelling bat species such as pallid bats and fringed myotis (Macfarlane and Angerer draft). Mining exploration has resulted in an increase in roost disturbance and abandonment. Closure of old mines for hazard abatement or safety can reduce habitat availability if mines aren't closed using bat friendly gates.
- Rangeland management. Pallid bats frequently forage in open areas such as oak woodlands. Fringed myotis frequently forage along riparian corridors or over meadows. Overgrazing and trampling may alter meadow hydrology or riparian ecosystems, resulting in reduced insect diversity, productivity, and reducing foraging success (Macfarlane and Angerer draft, Ferguson and Azerrad 2004).

Management Direction

The pallid bat and fringed myotis are both Region 5 Forest Service Sensitive species. The Forest Plan does not contain specific direction for the management of these species; however, it provides general guidance for management of Forest Service Sensitive species. This includes managing to ensure conservation or enhancement of these species' populations and habitats to prevent a trend towards Federal listing or a loss of viability. In addition, general direction in the Forest Plan to retain dead trees (snags) protects potential roosting and breeding habitat components, particularly for bats.

Pallid Bat and Fringed Myotis: Environmental Consequences

The project action alternatives could result in direct and indirect effects to the pallid bats or fringed myotis through the following activities:

- Salvage of fire-killed trees.
- Salvage of roadside hazard trees.
- Fuels treatments.
- Use of water sources.

These activities may have direct and indirect effects on pallid bats or fringed myotis through the following:

- Project related death, injury or disturbance.
- Project related modifications to habitat quantity or quality.

Death, injury, or disturbance

Death or injury from project related activities would be unlikely to occur given the mobility of this species. However, there is the potential for death or injury if a day roost tree were felled while being used by pallid bats or fringed myotis .

Project activities, especially loud noise, could result in disturbance to day roosting pallid bats and fringed myotis. Loud noise from equipment such as chain saws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. Smoke from pile burning may also impact bats that are roosting in close proximity to burning activities. The location of pallid bats and fringed myotis within the analysis area is uncertain. While both species are susceptible to disturbance at roost sites that may lead to roost abandonment, it is unlikely that females would abandon their young due to their ability to carry pups from roost to roost during normal roost-switching behavior. The tendency for bats to switch roosts under normal circumstances would preclude this from causing negative effects to reproduction. If a maternity roost is discovered, an LOP from April 1 through August 1 would be applied within 300 feet surrounding the site. LOPs in place for spotted owls, goshawks, great gray owls, and bald eagles would afford protection to bats roosting in these areas during pup rearing in the spring and summer months. Foraging behavior would not be affected due to their nocturnal foraging behavior.

Habitat Modification

Salvage logging and the removal of roadside hazard trees would result in reduced habitat quality for both pallid bats and fringed myotis. There would be a reduction in the number of potential roosting sites for pallid bats and fringed myotis in both the short-term (10 to 20 years) and in the long-term (20-50 years). However, many snags including all hardwood snags would be retained across the treatment units and would continue to provide roosting sites.

Indicators

The following indicator was chosen to provide a relative measure of the direct and indirect effects to the pallid bats and fringed myotis and to determine how well project alternatives comply with Forest Plan Direction.

1. Amount of habitat altered.

This criterion was chosen based on the best available scientific literature focusing on various aspects of pallid and fringed myotis ecology and life history requirements. This criterion focuses on those life history aspects, or habitat elements, considered most limiting to pallid bats and fringed myotis persistence across their range and where project effects are expected.

Effects Common to all Action Alternatives

DIRECT AND INDIRECT EFFECTS

Indicator 1. Because there is a small difference in the amount of acres proposed for treatment within suitable habitat for pallid bats and fringed myotis under all action alternatives, the effects are expected to be similar and are therefore analyzed together.

Trees or snags with existing cavities or furrowed bark provide roosting habitat for pallid bats and fringed myotis (Pierson 1996 and Pierson et al. 2006). Trees with existing cavities, that aren’t deemed hazardous, are less likely to be removed because there is little to no economic value associated with them. The large coniferous snags with deep furrowed bark preferred by fringed myotis may have economic value associated with them. The removal of snag and hazard trees within treatment units and along roads would result in a reduction in roost site availability. An estimated 8 snags per acre greater than or equal to 24 inches dbh are within coniferous habitat that burned at low to moderate severity (less than 50 percent basal area mortality). An estimated 21 snags per acre greater than or equal to 24 inches dbh are within coniferous habitat that burned at moderate to high severity (greater than 50 percent basal area mortality). Most treatment units are within the higher-severity burned areas and these snags would have less value as roosting sites. Hazard tree removal would occur across all burn severities and would have a greater effect on suitable coniferous habitats that burned at lower severities.

Table 3.15-55 displays the estimated number of snags per acre greater than or equal to 24 inches dbh and the minimum number of snags that would be retained within suitable forested conifer habitat under the action alternatives.

Snag densities were estimated using common stand exam data downloaded from the Natural Resources Management Natural Resource Information System (NRM NRIS) Field Sampled Vegetation Database (FSVeg). All data were collected between 2005 and 2013 (prior to the 2013 Rim Fire). A total of 1,183 plots were processed using the Western Sierras variant of the Forest Vegetation Simulator (FVS) (Dixon 2002). Plots are assumed to be representative of the CWHR classes within the Rim Fire perimeter. Post-fire information was achieved by simulating fire with the following basal area mortalities: 0 percent (representing pre-fire conditions and/or post-fire conditions with no mortality), 10 percent, 25 percent, 50 percent, 75 percent, 90 percent, and 100 percent. Though models are never 100 percent accurate, the simulation results are the best available information for this project. Snag densities were averaged for each basal area loss category less than or equal to 50 percent basal area mortality.

Table 3.15-55 Snags retained in treatment units and within suitable forest habitat

Alternative	Total Acres Proposed For Treatment in Suitable Habitat (Salvage and Hazard Tree*)	Estimate of Snags per Acre ≥24 inches DBH in Low to Moderate Burn Severity Suitable Habitat (Pre-Treatment)	Minimum Snags per Acre Retained Within Treatment Units Within Suitable Habitat** (Post-Treatment)
1	10,732	35,624	17,812
3	10,690	36,464	18,232
4	10,346	33,344	16,672

* No snags would be retained within the roadside hazard tree removal area.
**Based on the minimum requirement of 4 snags per acre retained across all treatment units and the assumption that snags retained would be at least 24 inches dbh.

While there would be a short-term reduction in snags available within treated areas, many would be retained and would continue to offer potential roosting sites. Trees that are declining and not subject to removal under this project would provide for long-term snag recruitment, being most pronounced in areas that burned at low to moderate severity. Areas outside treatment units would also continue to offer potential roosting structures. It is unknown how many snags in a given area are used or required by pallid bats and fringed myotis, but it is assumed that the snags retained would maintain habitat quality for use by these species. About 77 percent of mid-to-late seral coniferous forest within the analysis area would remain untreated on NFS land. Because all hardwood snags would be retained under all alternatives unless deemed hazardous, no significant change in the number of hardwood snags available is expected as a result of implementation.

The treatments would result in more open conditions within which herbaceous and shrub vegetation would regrow quickly providing more foraging habitat for pallid bats. Forest edges, where the low to moderate burned forest meets the high severity burned forest, may be modified by treatments but they would still be present throughout the analysis area and would continue to provide suitable foraging conditions for fringed myotis. The action alternatives would have negligible effects on foraging habitat and foraging success for these bats.

CUMULATIVE EFFECTS

In making the determination for the action alternatives, the cumulative effect on the environment, resulting from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions was considered. A list of the actions considered can be found in Appendix B. Some, but not all of these foreseeable future actions have or may contribute cumulatively to effects on pallid bats and fringed myotis.

Risk factors potentially affecting the abundance and distribution of pallid bats and fringed myotis has been identified and include loss of snags as roosting sites and human disturbance at roost sites. The following evaluation criterion was used as a relative measure of cumulative effects from the action alternatives to pallid bats and fringed myotis: Habitat modification resulting in loss of roost sites and Human disturbance at roost sites.

Habitat Modification

Federal Lands

Past, present, and foreseeable future timber harvests and hazard tree removal sales on public lands have and will result in a decrease in roosting habitat availability. Present actions within the analysis area include: The Twomile Ecological Restoration Vegetation Management Groovy and Funky timber sales and the Soldier Creek timber sale are scheduled to treat about 2,045 acres through commercial thinning, biomass removal, mastication, and prescribed fire treatments. While management requirements are in place to retain all or most snags greater than or equal to 15 inches dbh, some inevitably will be removed for safety and operability, reducing available roosting sites for bats. In addition, Yosemite National Park is currently removing hazard trees on 816 acres, which will result in a decrease in roosting sites for bats.

Foreseeable future actions on federal lands include: Reynolds Creek Ecological Restoration involving meadow and aspen restoration. These types of projects generally include the removal of encroaching trees. Twomile-Campy, Looney, and Thommy timber sales and Reynolds Creek timber sale are scheduled to occur over the next few years and will result in treatment of about 3,798 acres through commercial thinning, biomass removal, mastication, and prescribed fire. As a result of the Rim Fire, the Rim HT removal project proposed to remove hazard trees along 10,262 acres of level 3, 4, and 5 roads and is scheduled for implementation beginning in the summer of 2014. These foreseeable future projects will reduce roosting site availability.

Private Lands

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acre is presently being salvage logged. These salvage activities will reduce roost site availability to bats.

Human Disturbance

Federal Lands

There are several sources of noise disturbance that occur throughout the forest and include activities such as timber harvest, mastication, prescribed fire operations, and recreation. These activities have occurred in the past and will continue into the future (Twomile, Reynolds, Rim HT) whether or not this project is implemented. Mechanized equipment such as feller-bunchers, skidders, and chippers are used to accomplish vegetation treatments, while more manpower in the form of lighters, holders and fire engines with hose lays are used to accomplish prescribed fire operations. Under normal winter weather years, access to a large portion of the project area is restricted until late spring or early summer. This past winter snow has barely restricted access into the Rim Fire area. Vegetation, salvage, hazard tree removal, and prescribed fire treatments could occur during the pup rearing period, potentially affecting maternity colonies. Recreation disturbance likely occurs as soon as access to an area is opened and continues to some degree until access to the area is restricted by snow in the fall or early winter. Recreation disturbance would consist of OHVs, camping, hiking, cycling, wood cutting, and passenger car driving. These effects vary in intensity, duration and scope with weekends typically being a higher use time than weekdays.

Private Lands

Noise disturbance on private lands will primarily consist of salvage logging operations, involving feller bunchers, skidders, chippers, and logging trucks. This past winter, snow barely restricted access

Action Alternatives Contribution/Summary

The action alternatives are expected to contribute cumulatively to effects on pallid bats and fringed myotis. Removal of large fire-killed trees and hazard trees would result in fewer roost sites. Removal of biomass-sized trees is expected to open up the understory. Because pallid bats forage in open areas, the treatments would likely improve foraging opportunities for this species. Disturbance at roost sites is possible and may result in displacement of individuals or groups of roosting bats, including roost abandonment. LOPs in place near day roosts would afford protection to roosting bats, as their pup rearing season overlaps with the breeding seasons for spotted owls, goshawks, great gray owls, and bald eagles. The action alternatives would result in cumulative effects on about 4 percent of the analysis area. Thus, the cumulative contribution to effects on pallid bats and fringed myotis is considered negligible and is not expected to affect the viability of this species.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur.

The indirect effects of No Action are primarily related to the influence no action may have on future wildfires and how future wildfires may impact pallid bat and fringed myotis habitat. Predicting the effect no action would have on future wildfires and pallid bat and fringed myotis habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (Rim EIS Fuels Report). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

Indicator 1. Under Alternative 2, habitat quality would not be altered. Within the areas that burned at high severity, herbaceous and shrub vegetation is expected to be established within 3-5 years and would be suitable as foraging habitat for pallid bats. Edge habitat would also remain in the short-term, providing foraging habitat for fringed myotis.

When wildfire returns to this landscape, the remaining suitable forested habitat adjacent to or near areas that burned at high severity may be at increased risk of loss. One of the greatest risks to these bats is the loss of snags as roosting habitat. Within 10 years, the fuel loading is predicted to be four to eight times higher (78 tons per acre) than the desired condition as described in the Stanislaus National Forest, Forest Plan (Rim EIS Fuels Report). This would significantly increase the risk of fire suppression activities when the next wildfire occurs. The negative long-term effects on forested habitat for pallid bats and fringed myotis from this alternative outweigh the short-term beneficial effects.

CUMULATIVE EFFECTS

The Cumulative effects discussion under the action alternatives outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, there would be no direct cumulative effect expected because no active management would occur.

Alternative 2 Contribution/Summary

The cumulative contribution under Alternative 2 would not complement the treatments that have occurred in the past, thus increasing the risk of loss of remaining suitable habitat to wildfire in the long-term. The short-term beneficial impacts to pallid batsand fringed myotis such as retention of snags for roosting sites would be outweighed by the increased risk of additional habitat loss in the next wildfire.

Pallid Bat and Fringed Myotis: Summary of Effects:

Indicator 1. Table 3.15-56 shows Alternative 3 would result in the highest level of snag retention within treatment units. While Alternative 1 has the second highest level of snag retention, followed by Alternative 4. Because Alternative 4 has the least amount of suitable habitat acres proposed for treatment it is expected to provide the greatest benefit to pallid bats and fringed myotis.

Determinations

Alternative 1 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the pallid bat or the fringed myotis. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 2 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the pallid bat or the fringed myotis. Hermanson and O'Shea 1983 and O'Farrell and Studier 1980 were considered.

Alternative 3 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the pallid bat or the fringed myotis. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is demonstrated.

Alternative 4 may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the pallid bat or fringed myotis. The following logic check was considered (Robinson 1996): project occurs in or affects suitable habitat but compliance with existing forest plan direction is best demonstrated under this. Specifically, the least amount of suitable habitat would be modified across the analysis area would occur under this alternative.

Table 3.15-56 Summary of the minimum number of snags retained by alternative

Alternative	Total Acres Proposed For Treatment in Suitable Habitat (salvage and hazard tree)	Estimate of Snags per Acre ≥24 inches DBH in Low to Moderate Burn Severity Suitable Habitat* (Pre-Treatment)	Minimum Snags per Acre Retained Within Treatment Units Within Suitable Habitat** (Post-Treatment)
1	10,732	35,624	17,812
2	0	357,080	357,080
3	10,690	36,464	18,232
4	10,346	33,344	16,672

* No snags would be retained within the hazard tree removal area.
**Based on the minimum requirement of 4 snags per acre retained across all treatment units and the assumption that snags retained would be at least 24 inches dbh. Alternatives 3 and 4 would likely have more snags than is displayed.

Black-backed Woodpecker: Affected Environment

Species and Habitat Account

The black-backed woodpecker (*Picoides arcticus*) is currently listed as a Management Indicator Species (MIS) representing the ecosystem component of snags in burned forests, as described in the Rim Recovery MIS report available in the project record. Black-backed woodpeckers are distributed in boreal regions from south-central Alaska across Canada to Newfoundland and Nova Scotia, and south in the western United States in Montana and Washington through east-central California (Region 5 Sensitive species evaluation form for black-backed woodpecker 2012). The black-backed woodpecker is a monotypic species that occurs at elevations of 4,000-10,000 feet in the Siskiyou, Warner, Cascade, and Sierra Nevada Mountains of California and Nevada south to the southern limits of Tulare County in Sequoia National Forest (Ibid). Black-backed woodpeckers are still distributed across their historical breeding range in California (Bond et al. 2012). They have been documented on the Stanislaus National Forest in burned forest resulting from previous wildfires such as the Kibbie Fire which is within the analysis area (Siegel et al. 2008, 2010).

In December 2011, the California Fish and Game Commission accepted for consideration a petition submitted by the John Muir Project and the Center for Biological Diversity (Hanson and Cummings 2010) to list the black-backed woodpecker (Picoides arcticus) as Threatened or Endangered under the California Endangered Species Act. The Commission's December 15, 2011 action conferred on the species the interim designation of "candidate for listing", effective January 6, 2012, and gave the California Department of Fish and Game (now California Department of Fish and Wildlife or CDFW) 12 months from that date to review the petition, evaluate the available information, and report back to the Commission whether or not the petitioned action is warranted. In May 2013, the Commission found listing the black-backed woodpecker as Threatened or Endangered under CESA was not warranted. A consortium of environmental groups including the John Muir Project, the Center for Biological Diversity, the Blue Mountains Biodiversity Project, and the Biodiversity Conservation Alliance filed a petition (Hanson et al. 2012) to list the Oregon/California and Black Hills (South Dakota) populations of the black-backed woodpecker as Threatened or Endangered under the federal Endangered Species Act. The U.S. Fish and Wildlife Service prepared a 90-day finding indicating that the petitioned action may be warranted; therefore when funds become available, they will initiate a review of the status of the two populations to determine if listing either or both the Oregon Cascades-California population and the Black Hills population as either a subspecies or as a Distinct Population Segment is warranted (Federal Register 2013b).

Trends in black-backed woodpecker populations according to Breeding Bird Survey (BBS) data throughout the species range were non-significantly positive between 1966 and 2007 but significantly negative (a reduction of 7 percent per year) between 1980 and 2007. Within the Sierra Nevada Physiographic Province, including most of the species range in Region 5, trends were non-significantly negative during both 1966-2006 and 1980-2006, but these trend estimates were based on observations along only five BBS routes. Thus, black-backed woodpecker trends are not well-monitored by the BBS methodology, due to its patchy distribution and low detection probability during passive point counts (Region 5 Sensitive species evaluation form for black-backed woodpecker 2012). Recently initiated MIS monitoring will help address this issue (Siegel et al. 2008; 2010, Rim EIS MIS Report). Population trends of black-backed woodpeckers are poorly known (Bond et al. 2012). Such analyses are especially difficult for this species due to the ephemeral nature of the woodpecker's burned habitat, its tendency not to re-use nesting cavities in subsequent years, and the low density at which the species occurs in unburned forests (Ibid). Inclusion of black-backed woodpecker monitoring in the Forest Service's MIS program for 10 national forest units in California should yield trend information for the species in burned forests of the Sierra Nevada and southern Cascades in the coming years (Siegel et al. 2010, 2011, 2012b; Saracco et al. 2011).

The number of black-backed woodpeckers occupying recent fire areas that burned from 2000 to 2010 in the Sierra Nevada appears not to exceed several hundred pairs. Population estimates in 'green' forests of the Sierra Nevada range from several hundred to several thousand pairs (Bond et al. 2012).

As previously stated, recent inclusion of the black-backed woodpecker monitoring surveys for the Forest Service MIS program occurs on an annual basis and focuses on burned forests. Occupancy rates of burned forests during 2009 to 2011 suggest a relatively stable population at least during this time period (Siegel et al. 2012). Surveys on the Stanislaus in the past several years confirmed black-backed woodpecker occupancy in wildfire areas such as the Kibbie, Knight, and Ramsey Fires.

The analysis area is within the current distribution of black-backed woodpeckers across the Sierra Nevada Bioregion. Prior to the Rim Fire, there were very few acres of burned forest suitable for black-backed woodpeckers within the Rim Recovery analysis area. Exact acres could not be calculated because snag retention from previous fires and the associated projects were based on numbers of snags, not acres of snag patches. However, only low snag densities were retained and many of those snags have likely fallen. Therefore it is reasonable to assume that there were very few acres, if any, of burned forest suitable for black-backed woodpeckers prior to the Rim Fire. The project contains suitable habitat for this species and presence has recently been documented near Ackerson Meadow (NRIS Wildlife database).

The black-backed woodpecker is strongly associated with burned forests, more closely than any other western bird species (Hutto1995, Hutto 2008, Bond et al. 2012). Although the black-backed woodpecker is found in unburned forested stands throughout its range, population densities in recently burned forest stands are substantially higher (Hutto 1995, Hoyt and Hannon 2002, Smucker et al. 2005, Hutto 2008, Fogg et al. 2012). During broadcast surveys for black-backed woodpeckers in burned forests throughout the Sierra Nevada, southern Cascades, and Warner mountains in 2009 and 2010, 95 percent of detections were between 4,793 to 8,517 feet above sea level (R. Siegel unpublished data). Survey stations above 9,186 feet have not been established, so the upper boundary of the range of detection may be higher than currently documented. Black-backed woodpecker home-ranges are highly variable and are shown to range from 59 to 751 acres (Siegel pers. comm.). Snag basal area alone best predicted home-range size, explaining 54 to 62 percent of observed variation (Ibid). As snag basal area increased, home-ranges exponentially decreased in size, strongly suggesting increased habitat quality.

Suitable habitat is defined specifically for this project and includes the following (CWHR) habitat types, size classes, and densities: Douglas-fir (DFR), Jeffrey pine (JPN), lodgepole pine (LPN), ponderosa pine (PPN), red fir (RFR), subalpine conifer (SCN), Sierran mixed conifer (SMC), and white fir (WFR); size classes greater than or equal to 3; pre-fire canopy closures M and D; and basal area loss greater than or equal to 50 percent. Habitat criteria used in this analysis were determined from CWHR (CDFW 2014b), scientific literature (e.g., Russell et al. 2007, Hanson and North 2008, Vierling et al. 2008, Bond et al. 2012, Siegel et al. 2013) and Forest Service Region 5 Regional Office guidance.

Table 3.15-57 Amount of suitable black-backed woodpecker habitat in the Rim Fire area

	Suitable Habitat (acres)	Proportion of habitat
Private Lands	6,061	12
Public Lands (STF and YNP)	45,121	88
Total	**51,182**	**100**

Burned forest habitat is most productive for black-backed woodpeckers during the first eight years following a fire. Burned habitat on private lands is assumed to be completely removed through salvage logging. Treatments are limited on National Park Service Lands, typically consisting of minimal removal of hazardous trees along roadways. NFS lands are treated to varying degrees following a fire. In California from 2006-2013, approximately 21 percent of NFS lands classified as burned forest have been treated or are proposed for salvage logging or hazardous tree removal. This percentage includes the treatments proposed for the American, Aspen, and Rim fires which occurred in 2013. When combined with suitable burned forest habitat on National Park Service and private lands within California for the same timeframe (2006-2013), approximately 31 percent of burned forest has been or is proposed for salvage logging or hazardous tree removal. Approximately 69 percent of burned forest habitat remains or would remain untreated and available to black-backed woodpeckers. The Rim Fire burned primarily on public land in two administrative units: Stanislaus National Forest and Yosemite National Park. Most of the suitable black-backed woodpecker habitat within the Rim Fire perimeter occurs on Stanislaus National Forest. Table 3.15-57 shows the amount of suitable black-backed woodpecker habitat on both public and private lands. Table 3.15-58 shows the amount of suitable black-backed woodpecker habitat on public lands only.

Table 3.15-58 Amount of suitable black-backed woodpecker habitat on public lands only

	Suitable Habitat (acres)	Proportion of habitat
Yosemite NP (incl. 17 acre) BLM	17,504	39
Habitat Stanislaus NF	27,617	61
Total	**45,121**	**100**

Black-backed woodpeckers are primary cavity excavators, creating holes in trees in which to lay their eggs and raise their young (Dixon and Saab 2000). Breeding typically occurs in April-May and both sexes incubate, brood, and feed young (Ibid). Nest cavities are usually excavated in snags but can be found in dead portions of live trees and in unburned forests. Nests are excavated in conifer trees and typically average 13-14 inches, which corresponds to CWHR size classes 4-5. Nest trees have occasionally been documented as small as 7 inches, which corresponds with CWHR size class 3 (Bond et al. 2012 and Seavy et al. 2012).

Black-backed woodpeckers readily forage on larvae of wood-boring beetles, engraver beetles, and mountain pine beetles found in the trunks of burned conifers (Dixon and Saab 2000). Hanson and North (2008) found preferential foraging on large snags greater than 20 inches dbh in a study of 3 fire areas in the Sierra Nevada, which corresponds to CWHR size classes 4-6. Preliminary data from an ongoing study at two recent fire areas on the Lassen National Forest suggests that black-backed woodpeckers forage on all available size classes of snags (R. Siegel unpub. data).

Black-backed woodpeckers in western North America are not known to be migratory, although limited down-slope dispersal in winter has been reported (Dixon and Saab 2000). Reliance on recently burned areas of coniferous forest for breeding necessitates some post-breeding and post-natal dispersal to colonize new burns, but dynamics of dispersal in this species are not well studied (Ibid.). Occasional irruptions of 100's of km or more have been documented in eastern North America in response to food-resource and breeding dynamics; similar irruptions in western North America have not been recorded. In the Sierra Nevada, black-backed woodpeckers frequently colonize burned forest patches and breed in them less than one year after fire; no information is available indicating how far such individuals have dispersed (Dixon and Saab 2000, Siegel et al. 2008).

Risks factors to black-backed woodpeckers have been summarized in “A Conservation Strategy for the black-backed woodpecker (*Picoides arcticus*) in California – Version 1.0”:

- Salvage logging and other management involving post-fire snag removal. Management activities commonly employed following wildfire, including salvage logging and hazard tree removal, have resulted in negative impacts such as reduced abundance and reproductive success in black-backed woodpeckers (Saab and Dudley 1998, Hutto and Gallo 2006, Saab et al. 2007, Koivula and Schmiegelow 2007, Hutto 2008, Cahall and Hayes 2009, Saab et al. 2009). Saab and Dudley (1998) and Hutto and Gallo (2006) found that nest densities were much higher in unlogged post-fire stands when compared with salvaged stands.
- Thinning of unburned forests. Pre-fire forest thinning can decrease post-fire occupancy rates and nest densities of black-backed woodpeckers, and thinning or removal of medium and large snags may decrease habitat suitability in unburned forests. For example, black-backed woodpecker abundance in forests that were commercially thinned and then later burned in wildfire was lower than in burned forests that were not thinned before fire in the Rocky Mountains (Hutto 2008).
- Firewood cutting for personal use in recent fire areas. Although systematic data on the effects of fuelwood cutting on nesting black-backed woodpeckers are not available, small scale harvesting

of fuelwood by the public for personal use, from recent fire areas as well as unburned lodgepole pine forests, can destroy active black-backed woodpecker nests.

- Time since fire. Probability of occupancy and nesting by black-backed woodpeckers in burned forest is negatively correlated with years since fire during the decade after the fire.
- Fire Suppression. If fire suppression reduces the amount of mid- and high-severity post-fire habitat available for black-backed woodpecker, it may be considered a threat to the species.
- Climate change. Although uncertain, climate change may affect the black-backed woodpecker through altered fire regimes and adjustments in distribution (e.g., occupying higher elevations and northern latitudes).

Management Direction

The Forest Plan does not contain management direction for black-backed woodpeckers (USDA 2010a). Management direction for black-backed woodpecker populations and habitat, snags in burned forest, can be found in the Wildlife MIS Report. Management recommendations for black-backed woodpeckers can be found in the Conservation Strategy for the Black-backed Woodpecker (*Picoides arcticus*) in California. Version 1.0. The Conservation Strategy for black-backed woodpecker includes the following recommendations:

Recommendation 1.1. Within the range of the black-backed woodpecker, ensure that post-fire management occurring in new fires that burn 123 acres or more of conifer forest at moderate- to high-severity consider snag retention and other burned-forest habitat needs of the species. Where feasible, black-backed woodpeckers will likely benefit most from large patches of burned forest being retained in unharvested condition.

Recommendation 1.4. Retain high tree density in the unburned forest periphery around fire areas, to provide foraging habitat in the later post-fire years (Saab et al. 2011).

Recommendation 1.5. Avoid harvesting fire-killed forest stands during the nesting season (generally May 1 through July 31).

Black-backed Woodpecker: Environmental Consequences

This analysis is focused on the project effects related to management of burned forest, areas with documented basal area mortality greater than 50 percent. The project alternatives could result in direct and indirect effects to the black-backed woodpecker through the following activities:

- Salvage of fire-killed trees.
- Salvage of roadside hazard trees.

These activities may have direct and indirect effects on black-backed woodpeckers through the following:

- Project related death, injury or disturbance.
- Project related modifications to habitat quantity or quality.

Death, injury, or disturbance

Death or injury from project related activities would be unlikely to occur given the mobility of this species. However, there is the potential for death or injury if a nest tree were felled while being used by black-backed woodpeckers.

Project activities, especially loud noise, could result in disturbance that may impair essential behavior patterns of the black-backed woodpeckers related to breeding or foraging. Loud noise from equipment such as chainsaws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. The location of black-backed woodpeckers within the analysis area is uncertain but expected given the increase in available suitable habitat following the Rim Fire. Temporary avoidance of the project site or displacement of individuals is expected during project implementation. Any displacement or avoidance related to noise disturbance would be of short duration and would subside shortly after project implementation activities. LOPs in place for spotted owls, goshawks, great gray owls, and bald eagles would afford protection to individual black-backed woodpeckers in these areas during the nesting, nestling and fledgling periods. The potential risk to individual black-backed woodpeckers is uncertain because the presence of suitable habitat is a recent development and surveys have not yet been conducted. The length of exposure to these disturbances is expected for two to three years given the accelerated timeframe of this project and implementation.

Habitat Modification

Salvage logging and the removal of roadside hazard trees would eliminate suitable black-backed woodpecker habitat by removing the burned snags they require for breeding and foraging. Home ranges are known to average about 220 acres based on recent research (Siegel pers. comm.). The basal area of burned snags is correlated with the home range size of black-backed woodpeckers (Tingley et al. 2014). Retaining large patches of burned snags, preferably greater than 220 acres and at elevations above 4,793 feet would provide high quality habitat for black-backed woodpeckers, potentially increasing the predicted bird density across the analysis area (Bond et al. 2012, Tingley et al. 2014).

In order to compare alternatives and potential effects to black-backed woodpeckers, a model developed by Tingley and others (2014) was designed and used specifically for the Rim Fire area. This model presents a method for predicting black-backed woodpecker pair density that combines model-based estimates of occupancy with expected bird density given occupancy (Ibid). Some of the covariates used in the model include pre-fire canopy cover, burn severity, CWHR size class greater than 3, and CWHR forest class. This model allows us to compare alternatives, accounting for the expected effects to black-backed woodpeckers. The model predicts the probability that a single cell (98 feet by 98 feet) is occupied by a black-backed woodpecker. The developer's intent for use of this model includes using density estimates to examine the relative effects of proposed alternatives to black-backed woodpeckers. Values are relative and should scale proportionally (Ibid).

Tingley and others (2014) report a total of 42 predicted pairs of black-backed woodpeckers within the Rim Fire area on the Stanislaus National Forest, which includes the Rim Recovery Project and the Rim HT project. For analysis of direct and indirect effects associated with the Rim Recovery project only, 39 was used as the maximum predicted pair density possible. The cumulative effects analysis includes the predicted pairs associated with the Rim HT project and Yosemite National Park.

Indicators

The following indicators provide a relative measure of the direct and indirect effects to the black-backed woodpecker and to determine how well project alternatives comply with this species' conservation strategy recommendations.

1. Amount of suitable habitat modified.
2. Predicted pair density retained as a proportion of modeled pairs (Tingley et al. 2014).

These criteria were chosen to supplement information provided in the MIS report by identifying and analyzing potential effects to the black-backed woodpecker related to expected densities within the project area. While the Rim Recovery MIS Report focuses on the relationship of project-level habitat impacts to bioregional scale trend, the effects analysis here focuses on the relative value of different proposed management units by alternative within the Rim Fire area based on habitat quantity and quality (Tingley et al. 2014). Acres in this analysis may vary slightly from those presented in the MIS report due to rounding error or to minor corrections made to continuously revised dynamic database sources.

Alternative 1 (Proposed Action)

Direct and Indirect Effects

Indicator 1. Table 3.15-59 shows 17,461 acres of suitable habitat would be removed under Alternative 1.

Indicator 2. Table 3.15-59 shows the proportion of modeled pairs retained is 41 percent under Alternative 1. Under Alternative 1, 10,156 acres (37 percent) of suitable habitat would be retained. The remaining suitable habitat is predicted to support a density of 16 pairs of black-backed woodpeckers. Of the action alternatives, Alternative 1 results in the least amount of habitat retention for black-backed woodpeckers and the lowest predicted pair density.

Table 3.15-59 Proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 1

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total Acres Treated	Percent of Habitat Removed	Modeled Pairs Retained	Percent of Modeled Pairs Retained
1	16,099	1,362	17,461	63	16	41

Cumulative Effects

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 was considered (found in Appendix B, Cumulative Effects). Some, but not all of these actions have or may contribute cumulatively to effects on black-backed woodpeckers.

Risk factors potentially affecting black-backed woodpecker abundance and distribution have been identified and include habitat removal through salvage logging and other management involving post-fire snag removal, such as hazard tree removal. The following evaluation criterion was used as a relative measure of cumulative effects of this alternative to black-backed woodpeckers: habitat modification.

Habitat Modification

Federal Lands

Present and foreseeable future salvage and hazard tree removal projects on federal lands include: the Rim Fire Hazard Tree project, which would affect 2,370 acres of suitable habitat and Yosemite National Park hazard tree removal, which affected about 43 acres of suitable habitat.

Private Lands

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 6,060 acres of suitable black-backed woodpecker habitat is presently being salvage logged. These salvage activities generally result in the complete removal of suitable habitat.

Alternative 1 Contribution/Summary

Alternative 1 is expected to contribute cumulatively to effects on black-backed woodpeckers. Removal of 17,461 acres (34 percent of the remaining suitable habitat within the analysis area) is expected from implementation of this alternative. The predicted pair density within the remaining suitable habitat on Stanislaus NFS lands within the fire perimeter is 16 pairs of black-backed woodpeckers. When added to other private and federal salvage and hazard tree removal projects, a total of 51 percent of suitable black-backed woodpecker habitat would be removed from the analysis area. The remaining suitable habitat across the analysis area is predicted to support a total of 86 pairs of black-backed woodpeckers. Table 3.15-60 displays proposed treatments, suitable habitat retained, and the corresponding predicted black-backed woodpecker pair density across the cumulative analysis area under this alternative.

Table 3.15-60 Cumulative proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 1

Alternative	Salvage and Hazard Tree Removal Within Suitable Habitat on STF* (acres)	Rim HT Project STF (acres)	Suitable Habitat Remaining Post Treatment STF (acres)	Suitable Habitat YNP (acres)	Total Suitable Habitat Post Treatment** STF, YNP, and Pvt (acres)	Percent of Habitat Removed (STF, YNP, and Pvt)	Modeled Pairs Retained	Percent of Modeled Pairs Retained
1	17,461	2,370	10,156	17,461	27,617	34	86	77

*STF equals Stanislaus National Forest
**private lands are assumed to have no suitable habitat retained after salvage operations; therefore, acres reported are on STF and YNP only.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury or disturbance would not be an issue because no active management would occur.

The indirect effects of No Action are related to the amount of habitat retained across the Rim Fire area. Under this alternative, 27,617 acres of suitable habitat would be available to black-backed woodpeckers. The predicted pair density associated with this alternative is 39. This alternative provides the most habitat and the highest predicted pair density when compared to the action alternatives. Black-backed woodpeckers would be expected to occupy the available suitable habitat for 8-10 years, which is typically the period of time burned habitat remains suitable for this species.

CUMULATIVE EFFECTS

The Cumulative effects discussion under Alternative 1 outlines those present and reasonably foreseeable future activities scheduled on public and private lands. Under the No Action alternative, there would be no direct cumulative effect expected because no active management would occur.

Table 3.15-61 Cumulative proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 2

Alternative	Salvage and Hazard Tree Removal Within Suitable Habitat on STF (acres)	Rim HT Project STF (acres)	Suitable Habitat Remaining Post Treatment STF (acres)	Suitable Habitat YNP (acres)	Total Suitable Habitat Post Treatment* STF, YNP, and Pvt (acres)	Percent of Habitat Removed (STF, YNP, and Pvt)	Modeled Pairs Retained	Percent of Modeled Pairs Retained
2	0	2,370	27,617	17,461	45,078	0	109	97

*private lands are assumed to have no suitable habitat retained after salvage operations; therefore, acres reported are on STF and YNP only.

No Action Alternative Contribution/Summary: The cumulative contribution under this alternative would result in the highest retention of suitable habitat available for black-backed woodpeckers. Retention of about 27,617 acres (54 percent of the suitable habitat within the analysis area) is expected from implementation of this alternative. The predicted pair density within the remaining suitable habitat on Stanislaus National Forest lands is 39 pairs of black-backed woodpeckers. When added to other private and federal salvage and hazard tree removal projects, a total of 45,078 acres (83 percent) of suitable black-backed woodpecker habitat would be retained across the analysis area. This habitat is predicted to support a total of 109 pairs of black-backed woodpeckers. Table 3.15-61 displays proposed treatments, suitable habitat retained, and the corresponding predicted black-backed woodpecker pair density across the cumulative analysis area under this alternative.

Alternative 3

Direct and Indirect Effects

Indicator 1. Under Alternative 3, about 16,633 acres of suitable habitat would be removed (Table 3.15-62).

Indicator 2. Under Alternative 3, the proportion of modeled pairs retained is 46 percent (Table 3.15-62).

Table 3.15-62 Proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 3

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total Acres Treated	Percent of Habitat Removed	Modeled Pairs Retained	Percent of Modeled Pairs Retained
3	15,311	1,322	16,633	60	18	46

Under Alternative 3, 10,984 acres (40 percent) of suitable habitat would be retained. The remaining suitable habitat is predicted to support a density of 18 pairs of black-backed woodpeckers. Alternative 3 results in retention of an additional 800 acres of suitable habitat compared to Alternative 1 and is predicted to support an additional two pairs of black-backed woodpeckers.

Cumulative Effects

Alternative 3 cumulative effects are similar to Alternative 1 discussed previously and which outlines those present and foreseeable future activities scheduled on public and private lands.

Habitat Modification

Alternative 3 Contribution/Summary

Alternative 3 is expected to contribute cumulatively to effects on black-backed woodpeckers. Removal of 16,633 acres (32 percent of the suitable habitat within the analysis area) is expected from implementation of this alternative. The predicted pair density within the remaining suitable habitat on Stanislaus NFS lands within the fire perimeter is 18 pairs of black-backed woodpeckers. When added to other private and federal salvage and hazard tree removal projects, a total of 49 percent of suitable black-backed woodpecker habitat would be removed from the analysis area. The remaining suitable habitat across the analysis area is predicted to support a total of 88 pairs of black-backed woodpeckers. Table 3.15-63 displays proposed treatments, suitable habitat retained, and the corresponding predicted black-backed woodpecker pair density across the cumulative analysis area under this alternative.

Table 3.15-63 Cumulative proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 3

Alternative	Salvage and hazard tree removal within suitable habitat on STF (acres)	Rim HT STF (acres)	Suitable habitat remaining post treatment STF (acres)	Suitable habitat YNP (acres)	Total suitable habitat post treatment* STF, YNP, and private (acres)	Percent of habitat removed STF, YNP, and private (acres	Modeled pairs retained	Percent of modeled pairs retained
3	16,633	2,370	10,984	17,461	28,445	32	88	79

*private lands are assumed to have no suitable habitat retained after salvage operations; therefore, acres reported are on STF and YNP only.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Indicator 1. Under Alternative 4, Table 3.15-64 shows 15,261 acres of suitable habitat would be removed.

Indicator 2. Under Alternative 4, Table 3.15-64 shows the proportion of modeled pairs retained is 54 percent.

Table 3.15-64 Proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 4

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total Acres Treated	Percent of Habitat Removed	Modeled Pairs Retained	Percent of Modeled Pairs Retained
4	13,640	1,621	15,261	55	21	54

Under Alternative 4, 45 percent of suitable habitat would be retained. The remaining suitable habitat is predicted to support a density of 21 pairs of black-backed woodpeckers. Of the action alternatives, Alternative 4 results in the greatest amount of habitat retained for black-backed woodpeckers and the highest predicted pair density. Alternative 4 predicted pair density is 21, which is three more than Alternative 3 and five more than Alternative 1. Alternative 4 is the only action alternative retaining at least half of modeled pairs on NFS lands. Table 3.15-65 shows the proposed specific black-backed woodpecker habitat retention units.

Table 3.15-65 Retention units for black-backed woodpecker habitat, Alternative 4

Units Retained for Black-backed Woodpecker Habitat	Acres
A01B, A03, A04, A05A, A05B	538
D01A, D02, E01A, E01B, E02	1,229
O01, O02A, O02B, O04, O05, O12	670
R01A, R02	136
Total Acres Retained for Black-backed Woodpeckers	2,571

Using the model created by Tingley and others (2014), patches of retention were selected that ranked among the highest predicted values per cell and associated predicted pair occupancy, shown in Figure 3.15-5 below. The Wildlife Wildlife BE Appendix has more details.

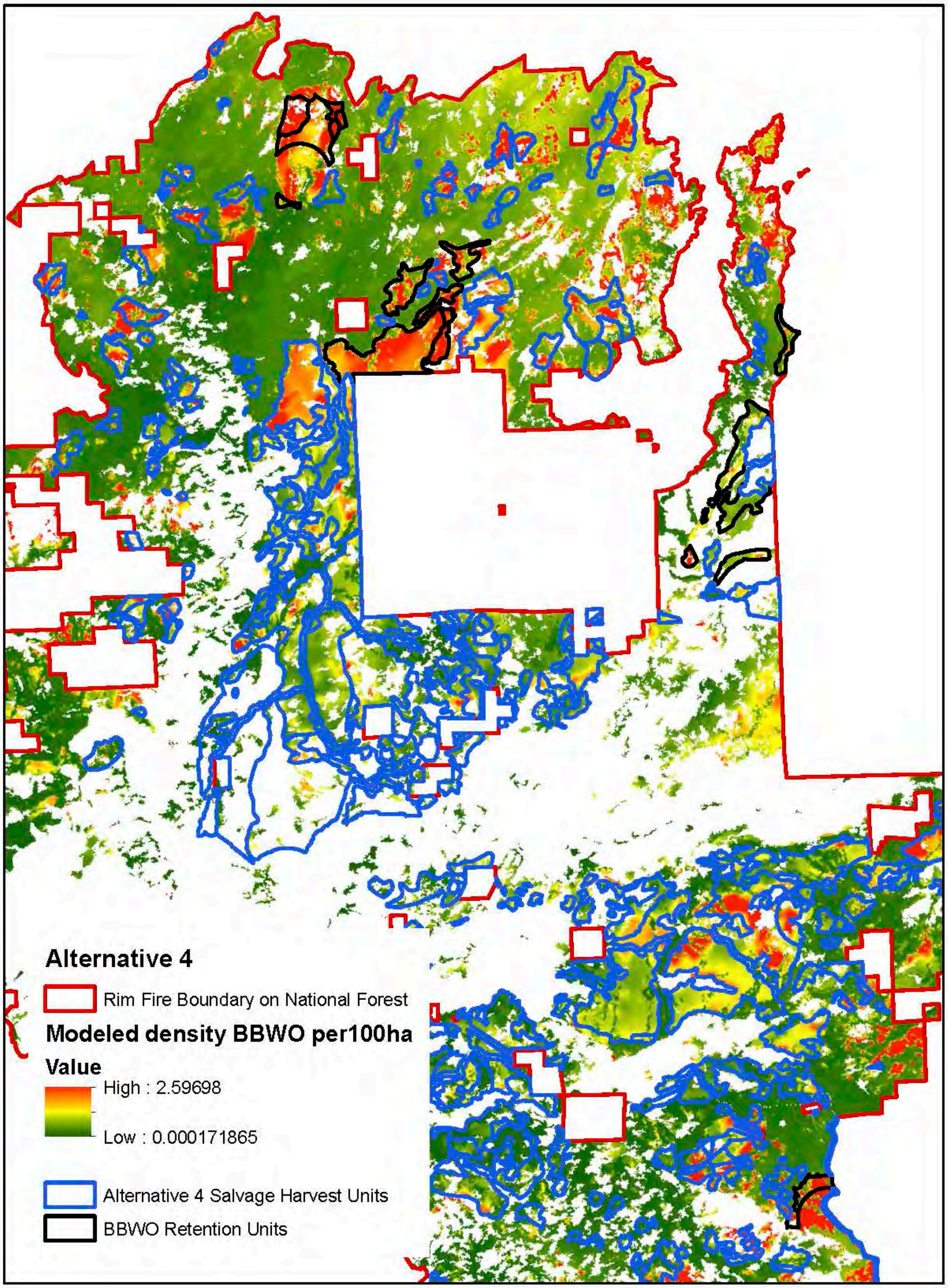

Figure 3.15-5 Modeled black-backed woodpecker density

CUMULATIVE EFFECTS

Alternative 4 cumulative effects are similar to Alternative 1 discussed previously and which outlines those present and foreseeable future activities scheduled on public and private lands.

Habitat Modification

Alternative 4 Contribution/Summary

Alternative 4 is expected to contribute cumulatively to effects on black-backed woodpeckers. Removal of 15,261 acres (30 percent of the suitable habitat within the analysis area) is expected from implementation of this alternative. The predicted pair density within the remaining suitable habitat on Stanislaus NFS lands within the fire perimeter is 21 pairs of black-backed woodpeckers, the highest of the action alternatives. When added to other private and federal salvage and hazard tree removal projects, a total of 46 percent of suitable black-backed woodpecker habitat would be removed from the analysis area. The remaining suitable habitat across the analysis area is predicted to support a total of 91 pairs of black-backed woodpeckers. Table 3.15-66 below displays proposed treatments, suitable habitat retention, and associated predicted black-backed woodpecker pair density across the cumulative analysis area under this alternative.

Table 3.15-66 Cumulative proposed treatments in suitable black-backed woodpecker habitat and corresponding predicted pairs retained, Alternative 4

Alternative	Salvage and Hazard Tree Removal Within Suitable Habitat on STF (acres)	Rim HT STF (acres)	Suitable Habitat Remaining Post Treatment STF (acres)	Suitable Habitat YNP (acres)	Total Suitable Habitat Post Treatment STF, YNP, and Pvt (acres)	Percent of Habitat Removed (STF, YNP, and Pvt)	Modeled Pairs Retained	Percent of Modeled Pairs Retained
4	15,261	2,370	12,356	17,461	29,817	30	91	81

*private lands are assumed to have no suitable habitat retained after salvage operations; therefore, acres reported are on STF and YNP only.

Black-backed Woodpecker: Summary of Effects

Indicator 1. The predicted pair density varies among the action alternatives, shown in Table 3.15-67. Alternative 1 would result in the lowest predicted pair density when compared with Alternatives 3 and 4. Alternative 3 would result in the second lowest predicted pair density and Alternative 4 would result in the highest predicted pair density among the action alternatives. Alternative 4 would retain over half of modeled pairs on National Forest.

Table 3.15-67 Summary of predicted pair density of black-backed woodpeckers

Alternative	Salvage (acres)	Hazard Tree Removal (acres)	Total Acres Treated	Percent of Habitat Removed	Modeled Pairs Retained	Percent of Modeled Pairs Retained
1	16,099	1,362	17,461	63	16	41
2	0	0	0	0	39	100
3	15,311	1,322	16,633	60	18	46
4	13,640	1,621	15,261	55	21	54

Black-backed Woodpecker: Compliance

The Conservation Strategy for the Black-backed Woodpecker (*Picoides arcticus*) in California version 1.0 includes the following recommendations:

- Recommendation 1.1. Within the range of the black-backed woodpecker, ensure that post-fire management occurring in new fires that burn 50 or more ha of conifer forest at moderate- to high-severity consider snag retention and other burned-forest habitat needs of the species. Where feasible, Black-backed Woodpeckers will likely benefit most from large patches of burned forest being retained in unharvested condition.
- Recommendation 1.4. Retain high tree density in the unburned forest periphery around fire areas, to provide foraging habitat in the later post-fire years (Saab et al. 2011).
- Recommendation 1.5. Avoid harvesting fire-killed forest stands during the nesting season (generally May 1 through July 31).

Alternatives 1 and 3 do not consider snag retention specifically for black-backed woodpeckers. Alternatives 1 and 3 do not propose to remove green trees in unburned forest unless deemed as hazardous along Maintenance Level 2 roads. Alternatives 1 and 3 do not incorporate a limited operating period to prohibit salvage harvest during the black-backed woodpecker nesting season.

Alternative 4 considers full snag retention on 2,571 acres of high quality habitat specifically for black-backed woodpeckers. Alternative 4 does not propose to remove green trees in unburned forest unless deemed as hazardous along Maintenance Level 2 roads. Alternative 4 does not incorporate a limited operating period to prohibit salvage harvest during the black-backed woodpecker nesting season.

Mule Deer: Affected Environment

Species and Habitat Account

The mule deer (*Odocoileus hemionus*) is an MIS species representing oak-associated hardwood and hardwood/conifer in the Sierra Nevada. The mule deer is also a species of conservation concern on the Stanislaus National Forest and is considered common to abundant with a wide distribution throughout the Sierra Nevada. They occur at elevations of 1,800 feet to 11,800 feet on the west slope of the Sierra Nevada. Summer range typically occurs above 6,500 feet elevation, transition range occurs between 4,500 feet to 6,500 feet elevation and winter range from 1,800 feet to 4,500 feet elevation. Mule deer are an important game species that is hunted throughout its range in California.

Trends in the migratory deer populations on the Stanislaus National Forest have been declining since the 1970’s (Maddox 1980). The Tuolumne and Yosemite herds have experienced downward population trends over the past several decades (Graveline pers. comm.).

Deer composition counts are conducted by California Department of Fish and Wildlife (CDFW) in the spring and fall of each year in order to assess population trends. In 2009, Greg Gerstenberg, Senior Environmental Scientist with CDFW, initiated a study of the Tuolumne Mule Deer Herd to investigate exotic louse infestation, and its effects on individuals, potential spread, and the resulting influence on deer populations. Very High Frequency (VHF) ear tag transmitters and GPS collars are being used to monitor deer and gather data on over-winter survival, habitat relationships such as migration routes, summer range extent, and winter range use (Gerstenberg 2012, unpub. report). Collared deer were monitored shortly after the Rim Fire burned through the critical winter range for the Tuolumne Deer herd. Several collared individuals were lost, which indicates loss of many deer during the fire (Gerstenberg pers. comm.). Because the fire hit prior to the winter migration, most migratory deer were still on their summer ranges at higher elevations. There is a resident herd that remains in the lower country year round and these deer were much more susceptible to mortality from the Rim Fire. Eighty percent of collared deer (with a sample size of 5) are thought to have perished in the fire (Graveline pers. comm.).

The Tuolumne and Yosemite deer herds have summer, transition, and winter range within the analysis area. The Jawbone Ridge area on the Stanislaus National Forest currently supports the highest concentration of wintering California mule deer from the Tuolumne Deer Herd and much of this area burned at high severity in the Rim Fire.

Mule deer utilize a variety of vegetation types including oak woodlands, coniferous forest, meadows and grasslands, chaparral and riparian corridors. Favorable habitat conditions for deer include vegetation communities that occur in a mosaic pattern with multiple age classes represented, and where cover and forage are in close proximity to free water (Ahlborn 2006).

During project development, CDFW was consulted. New telemetry data identified changes to the deer critical winter range in the Jawbone Ridge area. During the winter months, deer were using additional critical areas.

Mule deer are polygynous, bucks mate with multiple does. Rutting begins in the fall and dominant bucks mate with multiple does as they come into estrous. Bucks fight and displace each other establishing and re-establishing dominance throughout the season. Gestation is about six to seven months, with fawns born typically between the months of May and July.

Mule deer browse or graze, showing preferences for forbs and grasses, as well as tender new shoots on various shrub species including manzanita, ceanothus, mountain mahogany, and bitterbrush (Kufeld 1973). Forage patterns vary with season, forage quality, and availability. Acorns are a critically important fall and winter food. Fawns from the Tuolumne Herd have an average weight that is 10-15 percent greater with a heavy black oak acorn crop (Gerstenberg 2012, unpub. report).

Mule deer are either resident or migratory. Migratory deer travel downslope in the winter where conditions are milder and snow PACk is minimal. The deer then migrate upslope in the spring and early summer after the snow melts to birth fawns and gain access to high elevation meadows and grasslands that offer herbaceous forage high in nutrients.

Risk Factors

Risks to mule deer on the Stanislaus National Forest have been summarized by CDFW (Maddox 1980) and include:

- Range decadence. Areas where shrub communities become decadent from the lack of fire or active management results in forage providing less nutrients to deer, becoming inaccessible or unavailable and may impact individual fitness.
- Grazing. On the summer range, cattle and deer compete for limited forage found in meadows and grasslands. Conflicts between cattle and deer on the winter range is not known as a limiting factor for deer.
- Oak and shrub removal in type conversions. Establishment of plantations in areas that would otherwise be dominated by shrub and oaks can reduce the amount of forage available to deer in a given area.
- Poaching. Poaching occurs most often on the winter range and has affected not only the number of deer, but the age distribution of bucks. Poachers typically target older bucks presumably for the extensive antlers sought by many hunters; however, does are taken as well.
- Loss of Acorn Producing Oaks due to Catastrophic or Stand Replacing Wildfire. Oaks take several decades to develop the capacity to produce acorns. Oaks that are lost to wildfire effectively reduce the amount of forage available and this is a critical food source in both transition and winter ranges.
- Loss of Meadow Habitat. Meadows are an important component of deer habitat. Conifer encroachment threatens the viability and availability of meadows in the long-term.

Management Direction

Mule deer are a MIS species representing oak woodland and are also a species of conservation concern on the Stanislaus National Forest generally associated with early seral ecosystems (Damarais and Krausman 2000). Identifying areas within critical winter deer range for salvage and non-merchantable material removal to achieve the desired forage/cover ratios was identified as one of the purpose and needs for the Rim Recovery project.

The desired condition for units identified within critical winter range is to have forage to cover ratios of about 70 to 30 and to promote the protection and retention of hardwood (individual trees and aggregations), meadow, seep, and spring vegetation.

Mule Deer: Environmental Consequences

The project alternatives could result in direct and indirect effects to the mule deer through the following activities:

- Salvage of fire-killed trees.
- Fuels Treatments.
- New permanent and temporary road construction, road reconstruction, and maintenance.

These activities may have direct and indirect effects on mule deer through the following:

- Project related death, injury or disturbance.
- Project related modifications to habitat quantity or quality.

Death, injury, or disturbance

Death or injury from project related activities would be unlikely to occur given the mobility of this species.

Project activities, especially loud noise, could result in disturbance that may impair essential behavior patterns of deer primarily on the winter range and transition or intermediate zones present within the analysis area. Loud noise from equipment such as chainsaws or tractors is expected to occur in salvage units, project roads, and at landings, material sources, and water sources. The location of deer within the analysis area is uncertain following the Rim Fire, a large-scale disturbance event. Temporary avoidance of the project site or displacement of individuals is expected during project implementation. Any displacement or avoidance would be of short duration and would subside shortly after project implementation activities. LOPs in place for spotted owls, goshawks, great gray owls, and bald eagles would afford protection to individual deer in these areas. The potential risk to individual deer is considered low because of their natural avoidance behavior and length of exposure expected given the accelerated timeframe of this project and implementation.

Habitat Modification

Salvage logging and the removal of roadside hazard trees would result in short and long-term benefits to mule deer.

Short-term (10 to 20 years), removal of fire-killed trees (i.e., merchantable and non-merchantable) would open up areas for vegetation to reclaim the understory. Early seral vegetation, shrubs, grasses, and forbs are expected to be established within a few years and would benefit deer. Retaining large structural elements available such as snags and down woody material at small scales would provide cover for travelling or resting deer. Removing non-merchantable material within migration corridor pinch points would allow deer to continue to use traditional migration routes without obstruction. Deer would benefit by more easily traversing through the winter range due to removal of non-merchantable material. Lyon and Jensen (1980) found that elk habitat use was altered when down woody debris occurred at depths greater than two feet. Because deer are smaller than elk, they may respond at depths less than those that affect elk. For example, Salwasser and others (1982) have suggested that optimal habitat structure for deer in areas of cover includes dense vegetation, but any vegetation under four feet should be sufficiently open to allow for deer movement. Removal of non-merchantable material would also improve their ability to evade predators while on the winter range or while transitioning between summer and winter ranges with young fawns (Graveline pers. comm.). Removing non-merchantable material from critical winter range would result in the release of surviving oaks crowded by standing dead trees and increase light penetration to re-sprouting oaks that may have been burned severely in the fire.

Long-term benefits include: the ability to manage for the appropriate ratio of forage to cover, providing a more navigable landscape, and potentially reducing deer susceptibility to predation.

Roads modify deer habitat by directly removing it or indirectly reducing its quality, resulting in both short and long-term effects. Gaines et al. (2003) studied the response of several focal species, including ungulates related to roads and trails. Ungulates in this study were displaced, shifting use of habitat away from human activities on or near roads or trails. In addition, increased heart rate has been documented, which may decrease survivorship or productivity (Ibid). Rost and Bailey (1979) found deer avoid areas within 656 feet of a roads edge. New construction, temporary road construction, and reconstruction would result in increased habitat fragmentation and disturbance to deer. The potential for road related mortality may increase during project implementation because of the increase in the amount of motorized use, particularly logging trucks.

Indicators

The following indicators provide a relative measure of the direct and indirect effects to mule deer.

1. Amount of critical winter deer range with target forage/cover ratio of 70 to 30.
2. Road density (miles per square mile) in critical winter range.
3. Retention of hardwoods and hardwood aggregations, meadow and seep vegetation.

These criteria were chosen based on the best available scientific literature which focuses on various aspects of deer ecology and life history requirements. These criteria focus on those life history aspects, or habitat elements, considered most limiting to deer persistence across their range and where project effects are expected.

Alternative 1 (Proposed Action)

DIRECT AND INDIRECT EFFECTS

Indicator 1. Under Alternative 1, 1,064 acres were identified for removal of non-merchantable material. Table 3.15-68 displays units identified or created and associated non-merchantable material removal acres.

Deer are expected to benefit in the short and long-term from the removal of non-merchantable material. Under Alternative 1, habitat quality would be improved on about 19 percent of the critical winter range as shown in the Wildlife BE Appendix. Non-merchantable material would be removed in a mosaic pattern such that patches of surviving shrubs and small patches of surviving trees would be retained to provide forage and cover. Non-merchantable material next to or near surviving or sprouting oaks would be removed to provide growing space and greater sunlight penetration to oaks. In addition, the removal of this material would allow for the uninhibited re-establishment of herbaceous vegetation important to deer in the fall and spring on the winter range. Treatments are designed to achieve optimal forage to cover ratios.

Deer would be able to navigate the winter range more effectively if this material were removed. With the dense vegetation conditions that currently exist, deer have limited movement corridors within the winter range and are more susceptible to predation; therefore by removing this material, habitat conditions would be improved. Proposed treatments would result in beneficial impacts on individual fitness through increased forage availability and quality, as well as the potential reduction in susceptibility to predation.

Table 3.15-68 Non-merchantable material removal for mule deer, Alternative 1

Unit	Non-Merchantable Material Removal Acres	Total Unit Acres
L03	31	31
L06	10	10
L07	5	5
L202	28	142
L203	265	265
L204	87	87
L205	140	140
L206	138	138
M201	35	50
O201	140	299
P201	185	185
Total	1064	1352

Indicator 2. Table 3.15-69 displays the miles of each type of road related treatment in Alternative 1 and the resulting miles per square mile.

Table 3.15-69 Miles of road treatments proposed, Alternative 1

Alternative	New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project use During Implementation (mi/mi²)	Total Road Density Existing plus Additional for Project (mi/mi²)
1	0.5	15.8	5.4	3.3	0.8	4.4

The road treatments under Alternative 1 would result in an increase of 0.8 miles per square mile of road utilized for motor vehicle traffic, effectively increasing the road density from 3.6 miles per square mile to 4.4 miles per square mile during implementation. This may increase the potential for road related mortality during implementation while the roads are open and regularly used. Most project activity would be accomplished during the non-winter season, and any road improved for project related activities would be blocked before the winter season. Therefore, negative effects to non-migratory deer are expected to be higher because these deer would be displaced. The effects are expected to be minor and of short duration. The new permanent road, designated as blocked Maintenance Level 1 or gated year round Level 2, would alleviate the risk of disturbance during the critical winter period due to intermittent management use. Obliterated temporary roads would provide deer browse over time.

Indicator 3. Alternative 1 has no requirements for retention and protection of hardwood aggregates. This could result in the removal of newly sprouting hardwood aggregations of 1/10 to ½ acre if the trees are not large enough to be protected under the retention of all hardwoods greater than or equal to 12 inches dbh management requirement. Although aggregations are not mapped, a few have been observed after the fire. Under Alternative 1, they would not be retained.

Hardwood aggregations are important in holding areas, areas where deer “hole up” for a few days to several weeks until conditions (such as weather) cause them to continue on with their migration (Bertram 1977). Holding areas are often areas with a dominant hardwood component. Deer often put on significant fat reserves in these holding areas essential to help get them through the tough winter months. Hardwood aggregations on the winter range are important because the acorns provide the greatest potential to maintain fat reserves. The removal of any potential aggregations of hardwoods under this alternative would have a negative effect on deer. Because it is not known how many aggregations may be affected, the extent of adverse impacts is unknown.

CUMULATIVE EFFECTS

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 was considered (found in Appendix B, Cumulative Effects). Some, but not all of these actions have or may contribute cumulatively to effects on mule deer.

Risk factors potentially affecting mule deer abundance and distribution has been identified and include range decadence, degradation, and loss of acorn producing oaks. The following evaluation criterion was used as a relative measure of cumulative effects from this alternative to mule deer: Habitat Modification.

Habitat Modification

Federal Lands

Past, present, and foreseeable future timber harvests and hazard tree removal sales on public lands have and will result in habitat modification to deer. Present actions within the analysis area, including the Twomile Ecological Restoration Vegetation Management Groovy and Funky timber sales and the Soldier Creek timber sale, are scheduled to treat about 2,045 acres through commercial thinning, biomass removal, mastication, and prescribed fire treatments. These types of treatments can benefit deer through opening up the understory reestablishing herbaceous and shrub vegetation and providing new and more palatable forage. These projects are located in general habitat areas and not critical winter or summer range. In addition, the Yosemite National Park hazard tree removal on 816 acres is expected to have a negligible effect on deer habitat and use.

Foreseeable future actions on federal lands includes Reynolds Creek Ecological Restoration involving meadow and aspen restoration. These types of projects generally include the removal of encroaching trees. These treatments are occurring in potential transition areas and would benefit deer by providing important forage during migration between summer and winter ranges. In addition, Twomile (Campy, Looney, and Thommy) and Reynolds Creek timber sales are scheduled to occur over the next few years and will result in treatment of about 3,798 acres through commercial thinning, biomass removal, mastication, and prescribed fire. These treatments will benefit deer as described under present actions above. As a result of the Rim Fire, the Rim HT project, scheduled for implementation beginning in the summer of 2014, is expected to have negligible effects on deer habitat and use.

Thirteen grazing allotments are either wholly or partially within the analysis area, resulting in a maximum number of 1,632 cow/calf pairs across the landscape. Cattle are speculated to exclude deer from important critical summer foraging areas, but this conflict does not occur on the winter range (Gerstenberg pers. comm.). Grazing practices may influence meadow hydrology and the quality of forage available for deer year round and throughout the analysis area.

Road density is known to affect deer through changes in behavior and habitat modification as discussed in this analysis. Twomile Transportation, a foreseeable future action, will result in a slight reduction in motorized routes, essentially removing 11.4 miles by gating, decommissioning, or closing to Maintenance Level 1. Reynolds Creek Motorized Routes project will decommission 3.5 miles of unauthorized routes in the near future as well. The Mi-Wok OHV Restoration project proposes to block and restore 11.6 miles of unauthorized OHV routes. While these route segments are not in critical winter or summer range, there are year round resident deer and deer that travel through these areas that are expected to benefit from a reduction in about 26.5 miles of motorized roads and trails across the landscape.

Private Lands

As a result of the Rim Fire, several private land owners have submitted emergency fire salvage notices to Cal Fire. A total of 18,407 acres is presently being salvage logged and are expected to have herbicide applied and to be replanted. While this may benefit deer with a flush of new and more palatable forage, benefits on private lands are expected to be limited in space and time based on typical reforestation efforts.

Alternative 1 Contribution/Summary

Alternative 1 is expected to contribute cumulatively to effects on mule deer. Removal of non-merchantable material is expected to open up the understory and provide new and more palatable forage for deer. The proposed 1,064 acres of biomass removal on the Tuolumne Deer Herds critical winter range and migration pinch points would improve habitat conditions on about 12 percent of the critical winter range. Biomass removal is expected to benefit deer in year round and transition habitat areas in the short-term. Alternative 1 would result in an increase in road density within critical winter range, including the addition of 0.5 miles of new permanent road construction. These effects are expected to impact deer in the short-term during project implementation. The cumulative contribution under Alternative 1 would provide minor benefits to deer in general habitat areas and would provide substantial benefits on the critical winter range near Jawbone Ridge.

Alternative 2 (No Action)

DIRECT AND INDIRECT EFFECTS

Under Alternative 2, death, injury, or disturbance would not be an issue because no active management would occur.

The indirect effects of No Action are related to the influence no action may have on future wildfires and how future wildfires may impact deer habitat. Predicting the effect no action would have on future wildfires and deer habitat is largely speculative given the numerous factors involved over time. As fire-killed trees fall and contribute to surface fuel pools, potential fire behavior may be expected to increase (Rim EIS Fuels Report). However, potential fire behavior in the future may be dependent on how future management actions, especially prescribed fire, are planned and implemented (Stephens and Moghaddas 2005, Stephens et al. 2009, Roberts et al. 2011, Crook et al. 2013).

Indicator 1. Under Alternative 2, no removal of non-merchantable material would occur. Within areas that burned at high severity, herbaceous vegetation is expected to be established within 3-5 years (Gray et al. 2005 and Moghaddas et al. 2008) which would benefit deer in the short-term. When the smaller plantation trees fall, they would likely fall together creating several jackstraw piles over hundreds of acres covering a good portion of the ground and shading out herbaceous vegetation. Not only would there be a reduction in forage availability in these areas, the jackstraw trees on the ground would be difficult for deer to navigate, further reducing the effective habitat area available to them and potentially increasing their susceptibility to predation.

Deer take the same migratory path every year (Bertram 1977). Because of this, migration pinch points that burned at high severity are at risk of becoming un-navigable by the deer that use them if the non-merchantable material were left on site. Navigation of migration corridors and pinch points would be more difficult under this alternative, especially for does travelling with young fawns. They would be forced to find a new route through unfamiliar territory and may be more susceptible to predation as a result.

When wildfire returns to this landscape, the remaining habitat adjacent to or near areas that burned at high severity may be at increased risk of loss. Within 10 years, the fuel loading is predicted to be four to eight times higher (78 tons per acre) than the desired condition as described in the Stanislaus National Forest, Forest Plan (Rim EIS Fuels Report). This would significantly increase the risk of fire suppression activities when wildfire occurs in the future. Oaks that survived the Rim Fire or those that are re-sprouting would be at increased risk of loss under these conditions. The synergistic effects over time to the forage and habitat availability to deer on the winter range in particular could be devastating to the population. The negative long-term effects on habitat for deer of this alternative outweigh the short-term beneficial effects.

Indicator 2. Under Alternative 2, no new permanent road construction, temporary road construction, reconstruction, or maintenance would occur. This alternative would provide the greatest benefit to deer because there would be no increase in road density across the analysis area and no potential increase of road related mortality in the short or long-term.

Indicator 3. Under Alternative 2, all hardwood aggregations, meadow and seep vegetation would be retained which may have short-term beneficial effects. As discussed under Indicator 1 under this alternative, the increased susceptibility to future wildfire would put these aggregations at higher risk than any of the action alternatives.

CUMULATIVE EFFECTS

The Cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands. Under Alternative 2, there would be no direct cumulative effect expected because no active management would occur.

Alternative 2 Contribution/Summary: The cumulative contribution under Alternative 2 include: New understory vegetation would be expected to become established and provide new and more palatable forage that would benefit deer in the short-term. Existing conditions consisting of dense standing dead conifers throughout the critical winter range would remain. Over time, these snags will fall and contribute to fuel loads that would potentially increase fire behavior in the future. The remaining suitable habitat would be at greater risk of loss to the next wildfire under these conditions. The short-term beneficial impacts to deer such as increased early successional habitat would be outweighed by the long-term negative impacts.

Alternative 3

DIRECT AND INDIRECT EFFECT

Indicator 1. Under Alternative 3, 1,739 acres were identified for removal of non-merchantable material. Table 3.15-70 displays units identified and associated non-merchantable material removal acres.

Under Alternative 3, additional units within the critical winter range were identified for biomass removal. Deer are expected to benefit in the short and long-term from the removal of non-merchantable material. Under Alternative 3, habitat quality would be improved on 63 percent of the critical winter range as shown in the Wildlife BE Appendix.

Non-merchantable material would be removed in a mosaic pattern such that patches of surviving shrubs and small patches of surviving trees would be retained to provide forage and cover. Non-merchantable material next to or near surviving or sprouting oaks would be removed to provide growing space and greater sunlight penetration to the oaks. In addition, the removal of this material would allow for the uninhibited re-establishment of herbaceous vegetation important to deer in the fall and spring on the winter range. Treatments are designed to achieve optimal forage to cover ratios.

Deer would be able to traverse the winter range more effectively if this material were removed. With the dense vegetation conditions that currently exist, deer have limited movement corridors within the winter range and are more susceptible to predation. Therefore, by removing this material, habitat conditions would be improved. These treatments would result in beneficial impacts on individual fitness through increased forage availability and quality, as well as the potential reduction in susceptibility to predation.

Table 3.15-70 Non-merchantable material removal for mule deer, Alternatives 3 and 4

Unit	Non-Merchantable Material Removal Acres	Total Unit Acres
L03	30	30
L04	25	79
L07	5	5
L201	92	92
L202	28	142
L203	250	695
L204	340	1519
L205	475	755
L206	15	81
M201	35	74
M202	20	138
M203	20	63
M204	79	282
O201A	80	156
O201B	60	120
P201	185	185
Total	**1,739**	**4,416**

Indicator 2. Table 3.15-71 displays the miles of each type of road related treatment in Alternative 3 and the resulting miles per square mile.

Table 3.15-71 Miles of road treatments, Alternatives 3 and 4

Alternative	New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project use During Implementation (mi/mi²)	Total Road Density Existing plus Additional for Project (mi/mi²)
3	0	22.6	4.0	6.4	0.9	4.5
4	0	22.6	4.0	6.4	0.9	4.5

Under Alternative 3, no new permanent road construction is proposed. The temporary road construction, reconstruction and maintenance proposed under these alternatives would result in an increase of 0.9 miles per square mile of road utilized for motor vehicle traffic, effectively increasing the road density from 3.6 miles per square mile to 4.5 miles per square mile during implementation. This may increase the potential for road related mortality project implementation while the roads are open and regularly used. Most project activity would be accomplished during the non-winter season, and any road improved for project related activities would be blocked before the winter season. Therefore, adverse effects to non-migratory deer are expected to be higher because these deer would be displaced. The effects are expected to be minor and of short duration.

Indicator 3. Under Alternative 3, all hardwood aggregations, meadow and seep vegetation within units would be flagged, avoided, and retained. Aggregations are 1/10 to 1/2 acre groups of sprouting hardwood or of meadow or seep vegetation.

Although aggregations aren't mapped, a few have been observed after the fire. Hardwood aggregations are important in holding areas, areas where deer "hold up" for a few days to several weeks until conditions (such as weather) cause them to continue on with their migration (Bertram 1977). Holding areas are often areas with a dominant hardwood component. Deer often put on significant fat reserves in these holding areas essential to help get them through the tough winter months. Hardwood aggregations on the winter range are important because the acorns provide the greatest potential to maintain fat reserves. Retaining the aggregations of hardwoods under these alternatives would benefit deer. Because it is not known how many aggregations may be affected, the extent of beneficial impacts is unknown.

CUMULATIVE EFFECTS

The Cumulative effects discussion under the Alternative 1 outlines those present and foreseeable future activities scheduled on public and private lands and are considered in Alternative 3. The cumulative contribution of Alternatives 3 would be greater than those described under Alternative 1 because the Tuolumne Deer Herd critical winter range would have an additional 675 acres of non-merchantable material removed, improving habitat conditions across 63 percent of the critical winter range. Fuels treatments, including biomass removal and pile and burning outside the critical winter range, would affect 6,640 acres within treatment units and are expected to benefit deer in year-round and transition habitat areas in the short-term. There would be no new permanent road construction under Alternative 3. The cumulative contribution under Alternatives 3 would provide minor benefits to deer in general habitat areas and would provide substantial benefits on the critical winter range near Jawbone Ridge.

Alternative 4

DIRECT AND INDIRECT EFFECTS

Same as Alternative 3.

CUMULATIVE EFFECTS

Same as Alternative 3.

Mule Deer: Summary of Effects

Indicator 1. Table 3.15-72 shows Alternatives 3 and 4 would improve the greatest amount of habitat by removing non-merchantable material. Alternative 1 would improve the least amount of habitat.

Table 3.15-72 Summary of non-merchantable material removal

Alternative	Units with Non-Merchantable Material Removal	Total Acres
1	L03, L06, L07, L202-206, M201, O201, P201	1,064
2	N/A	0
3	L03, L04, L07, L201-206, M201-204, O201, P201	1,739
4	L03, L04, L07, L201-206, M201-204, O201, P201	1,739

Indicator 2. Table 3.15-73 shows the amount of new permanent road construction is highest under Alternative 1. There is no new permanent road construction proposed under Alternatives 3 and 4. Increases to road density are similar among all action alternatives, but long-term effects related to road density are greatest under Alternative 1 because of the new permanent road construction.

Table 3.15-73 Summary of road treatments

Alternative	New Permanent Road Construction	Road Reconstruction (currently designated for motor vehicle travel)	Road Reconstruction (currently NOT designated for motor vehicle travel)	Temporary Road Construction	Roads Added for Project use During Implementation (mi/mi²)	Total Road Density Existing plus Additional for Project (mi/mi²)
1	0.5	15.8	5.4	3.3	0.8	4.4
2	0	0	0	0	0	3.6
3	0	22.6	4.0	6.4	0.9	4.5
4	0	22.6	4.0	6.4	0.9	4.5

Indicator 3. Hardwood aggregations, meadow and seep vegetation would be retained under Alternatives 3 and 4 and would provide the greatest beneficial effects to deer. No retention would occur under Alternative 1.

3.16 Short-Term Uses and Long-Term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). Alternatives 3, 1 then 4 respectively from most to least could potentially improve the long-term productivity by reducing the impacts of the existing fuel load of standing dead trees to protect multiple resources including soils and watersheds from future high-intensity fires; improving the hydrologic function of the road system and thereby reducing road sediment discharge and protecting watersheds, soils, and aquatic habitat; deep tilling of legacy skid trails and old roads improving soil productivity; and leaving additional ground cover through mastication or drop and lop to prevent erosion. Where not already impaired due to legacy impacts, resource conditions would be maintained or would show improvement towards desired conditions.

3.17 Unavoidable Adverse Effects

Implementation of any of the alternatives would result in some unavoidable adverse environmental effects. Although formation of the alternatives included avoidance of some effects, other adverse effects could occur that cannot be completely mitigated. The environmental consequences section for each resource area discusses these effects.

3.18 Irreversible and Irretrievable Commitments

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of a mined ore. No irreversible commitments of resources would result from implementation of any of the alternatives because no permanent, irreversible resource loss would occur.

Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road. Irretrievable losses can be regained over time. Implementation of all action alternatives would not irretrievably commit resources, but help in the long-term recovery of the landscape.

3.19 Other Required Disclosures

National Environmental Policy Act of 1969: NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders." This DEIS was prepared in accordance with the following regulations.

National Historic Preservation Act: The National Historic Preservation Act (NHPA) of 1966 is the principle, guiding statute for the management of cultural resources on NFS lands. Section 106 of NHPA requires federal agencies to consider the potential effects of a Preferred Alternative on historic, architectural, or archaeological resources that are eligible for inclusion on the National Register of Historic Places and to afford the President's Advisory Council on Historic Preservation an opportunity to comment. The criteria for National Register eligibility and procedures for implementing Section 106 of NHPA are outlined in the U.S. Code of Federal Regulations (36 CFR Parts 60 and 800, respectively). Section 110 requires federal agencies to identify, evaluate, inventory, and protect National Register of Historic Places resources on properties they control.

Potential impacts to archaeological and historic resources were evaluated in compliance with Section 106. The Forest Service and the California State Historic Preservation Officer (SHPO) have agreed that the timber management program will be performed in accordance with the terms and conditions of a Programmatic Agreement (PA, FS No. 06-MU- 11040218-059, project record) to satisfy the Stanislaus NF's NHPA Section 106 responsibilities for all individual undertakings of the program. The PA outlines procedures for the identification, evaluation, and resolution of adverse effects to historic properties in Allotment areas. The criteria for determining adverse effects are outlined in the PA. The resolution of adverse effects, if adverse effects are identified, is also established in the PA.

Public law protects the confidentiality of cultural resources information. The Archeological Resources Protection Act, as referenced in the Freedom of Information Act, protects from public disclosure the nature and location of archeological sites. For this reason, site locations in the project area are not displayed in the DEIS, nor are the contents of these sites discussed in detail.

Executive Order 12898 Environmental Justice: EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (issued February 11, 1994), requires that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high or adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. None of the alternatives disproportionately affect minority and low-income populations. Social and economic effects of all alternatives were analyzed (Chapter 3.10, Society, Culture and Economy).

Clean Water Act: regulates the dredging and filling of freshwater and coastal wetlands. Section 404 (33 USC 1344) prohibits the discharge of dredged or fill material into waters (including wetlands) of the United States without first obtaining a permit from the U.S. Army Corps of Engineers. Wetlands are regulated in accordance with federal Non-Tidal Wetlands Regulations (Sections 401 and 404). No dredging or filling is part of this proposed action and no permits are required.

Clean Air Act of 1970: provides for the protection and enhancement of the nation's air resources. No exceeding of the federal and state ambient air quality standards is expected to result from any of the alternatives.

Endangered Species Act (ESA) of 1973: requires that any action authorized by a federal agency not be likely to jeopardize the continued existence of a threatened or endangered species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA (16 USC 1531 et seq.), as amended, requires the responsible federal agency to consult with the USFWS and the National Marine Fisheries Service concerning endangered and threatened species under their jurisdiction.

The USFWS was consulted during analysis, and project activities were assessed to determine their effects on threatened, endangered, and candidate plant and animal species. Two amphibian species (California red-legged frog and Sierra Nevada yellow-legged frog) and one terrestrial wildlife species (valley elderberry longhorn beetle) are found within the project analysis area in Tuolumne County, California (USFWS 2013). The Terrestrial Wildlife BA indicates that proposed activities are "Not Likely to Adversely Affect" the valley elderberry longhorn beetle. The Aquatics BA indicates that proposed activities "may affect, but are not likely to adversely affect" the California red-legged frog and the Sierra Nevada yellow-legged frog.

National Forest Management Act (NFMA) of 1976: amends the Forest and Rangeland Renewable Resources Planning Act of 1974 and sets forth the requirements for Land and Resource Management Plans (Forest Plans) for the National Forest System. The proposed action is consistent with the NFMA and the Forest Plan. The Forest Plan Compliance (project record) document identifies the Forest Plan S&Gs that specifically apply to this project and related information about compliance with the Forest Plan.

Executive Order 11988, Floodplain Management: Floodplains are found along stream channels throughout the project area. Implementation of any of the action alternatives would maintain or improve the existing condition of these floodplains by maintaining or improving meadow conditions. The intent of Executive Order 11988 would be met since this project would not affect floodplains in the Rim Recovery analysis area and thereby would not increase flood hazard.

Executive Order 11990, Protection of Wetlands: Wetlands within the project area include meadows, stream channels, springs, fens, and shorelines. This project is consistent with Executive Order 11990 since this project would maintain or improve the condition of wetlands in the Rim Fire Recovery project area. Chapter 3.03 (Aquatic Species) and the Watershed Report (project record) address wetlands.

Migratory Bird Treaty Act: The Migratory Bird Treaty Act decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected. Under the Act, taking, killing or possessing migratory birds is unlawful. The original intent was to put an end to the commercial trade in birds and their feathers that had wreaked havoc on the populations of many native bird species. On January 17, 2001, President Clinton signed an executive order directing executive departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act (FR Vol. 66, No.11, January 17, 2001).

The Forest Service and U.S. Fish and Wildlife Service have entered into a memorandum of understanding (MOU) to promote the conservation of migratory birds as a direct response to the executive order (USDA Forest Service and USFWS 2008). One of the steps outlined for the Forest Service is applicable to this analysis: "Within the NEPA process, evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors." The Forest Service additionally agreed, to the extent practicable, to evaluate and balance benefits against adverse effects, to pursue opportunities to restore or enhance migratory bird habitat, and to consider approaches for minimizing take that is incidental to otherwise lawful activities.

All of the alternatives would comply with the Migratory Bird Treaty Act but may result in an "unintentional take" of individuals during proposed activities. However the project complies with the U.S. Fish and Wildlife Service Director's Order #131 related to the applicability of the Migratory Bird Treaty Act to Federal agencies and requirements for permits for "take". In addition, this project complies with Executive Order 13186 because the analysis meets agency obligations as defined under the January 16,2001 Memorandum of Understanding between the Forest Service and U.S. Fish and Wildlife Service designed to complement Executive Order 13186. If new requirements or direction result from subsequent interagency memorandums of understanding pursuant to Executive Order 13186, this project would be reevaluated to ensure that it is consistent.

4. Consultation and Coordination

This Chapter includes a section for Preparers and Contributors followed by a section for Distribution of the EIS.

4.01 Preparers and Contributors

The Forest Service worked with the following individuals; federal, state and local agencies; organizations; and, tribes during the development of this EIS.

Interdisciplinary Team

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Experience: Wildlife Biologist, Stanislaus National Forest 6 years; Wildlife Biologist, Bureau of Land Management 2 years; Wildlife Technician, Bureau of Land Management 3 years
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Education: B.S. Landscape Architecture, Rutgers University, 1976; Master of Landscape Architecture, University of Illinois, 1978
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Team Responsibility: Aquatic Biologist

Federal, State and Local Agencies

Advisory Council on Historic Preservation
California Department of Fish and Wildlife
California Department of Transportation
USDI Fish and Wildlife Service
Yosemite National Park

Organizations

American Forest Resource Council
American Motorcyclist Association, District 36
Blue Mountain Minerals
California Forestry Association
Central Sierra Audubon Society
Central Sierra Environmental Resource Center
CT Bioenergy Consulting
Gold Rush News
James R. Dambacher Construction
Merced Dirt Riders/4x4 in Motion
Mule Deer Foundation
Rim Fire Technical Workshop
Sierra Pacific Industries
Stanislaus Trail Bike Association
Tuolumne County
Tuolumne County Alliance for Resources and the Environment (TuCARE)
Tuolumne County Farm Bureau
Tuolumne County Sportsmen
Tuolumne Group Sierra Club
Tuolumne River Trust
Yosemite Deer Herd Advisory Council
Yosemite Stanislaus Solutions (YSS)

Tribes

Tuolumne Band of Me-Wuk Indians

4.02 Distribution of the EIS

The Forest Service is circulating either the EIS or a notice of the availability of the EIS to the following agencies, elected officials, tribes, organizations and individuals.

Federal, State and Local Agencies

Federal Agencies

Advisory Council on Historic Preservation, Director, Planning and Review
Army Corp of Engineers
Environmental Protection Agency, Region 9 EIS Review Coordinator
Federal Aviation Administration, Western-Pacific Region Regional Administrator
Federal Highway Administration
National Marine Fisheries Service Habitat Conservationists Division Southwest Region
Rural Utilities Service
USDA APHIS PPD/EAD
USDA National Agricultural Library Head Acquisitions and Serials Branch
USDA Natural Resources Conservation Service, National Environmental Coordinator
USDA Office of Civil Rights
US Coast Guard, Environmental Management
US Department of Energy, Director, Office of NEPA Policy and Compliance
USDI Bureau of Land Management
USDI Fish and Wildlife Service
USDI Office of Environmental Policy and Compliance
Yosemite National Park

California State Agencies

California Department of Fish and Wildlife
California Department of Transportation
California Water Resources Control Board
State of California Sierra Nevada Conservancy
State Clearing House (California)

Local Agencies

Modesto Irrigation District
Tuolumne County Fish and Game
San Francisco, Hetch Hetchy Water and Power
San Francisco Public Utilities Commission
Turlock Irrigation District

Elected Officials

Federal Officials

Congressman Jeff Denham
Congressman Tom McClintock
Senator Barbara Boxer
Senator Diane Feinstein

California State Officials

Kristen Olsen, California Assembly
Tom Berryhill, California Assembly

Local Officials

Connie Williams, City of Sonora Council
Mariposa County Board of Supervisors
Tuolumne County Board of Supervisors

Tribes

Tuolumne Band of Me-Wuk Indians

Organizations

Associated California Loggers
American Forest Resource Council
California Forestry Association
California Native Plant Society
Center for Biological Diversity
Central Sierra Audubon Society
Central Sierra Environmental Resource Center
CT Bioenergy Consulting
John Muir Project of Earth Island Institute
Mule Deer Foundation
North Coast Rivers Alliance
Sierra Forest Legacy
Sierra Pacific Industries
TuCARE
Tuolumne County Sportsman, Inc.
Tuolumne Group of the Sierra Club
Tuolumne River Trust

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Ansley-Martin, Robin
Arnold, Gary
Arnold, Loren
Artley, Dick
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Bohn, Diana
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Buxton, Cindy
Catherine, John
Charles, Cindy
Chavez, Christa
Claunch, Alan
Clayton, Ronald
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Corzo, Martha
Cossutta, Renee
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Dahring, Karen
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Keitelman, Mary
Kesich, John
Knightly, Nickolas
Koch, Walter
Kramarz, Ken
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McKenzie, Leonard
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Re, Patricia
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Richardson, Matt
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Rougle, Wolfgang
Ruby, Kenneth
Ryther, David
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Selter, Carol
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Shubert, Lois E.
Silvers, Rod
Simpson, Sheila
Smernoff, David
Sondgeroth, Casey
Sperling, Ruth
Stanley, Sandra
Sugars, Marc
Tallal, Jimy
Tearson, P
Tek, Leon
Thompson, Arnie
Thompson, Jeffrey
Thompson, Larry
Toepke-Floyd, Marty
Toner, William
Tornieporth, Nadia
Trips, Arta
Vest, Lori
Vielma, Stacey
Wagner, Lara
Wallerstein, Beatrice
Walters, Patty
Wayland, Brian
Weberg, Melanie
Weinstein, Elyette
Weinstein, Joseph
Westbrook, Janet
Winks, Matthew
Wulff, Deanna
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A. Abbreviations and Acronyms

ACHP	Advisory Council on Historic Preservation
AMS	Aquatic Management Strategy
APCD	Air Pollution Control District
APE	Area of Potential Effects
ATV	All-Terrain Vehicle
BA	Biological Assessment
BACM	Best Available Control Measure
BAER	Burned Area Emergency Response
BARC	Burned Area Reflectance Classification
BE	Biological Evaluation
BF	Board Feet
BLM	Bureau of Land Management
BMI	Benthic Macro Invertebrate
BMP	Best Management Practices
BST	Bituminous Surface Treatment
BTU	British Thermal Units
CAA	Clean Air Act
CAR	Critical Aquatic Refuge
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRMR	Cultural Resources Management Report
CSO	California Spotted Owl
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRPR	California Rare Plant Rank
CSERC	Central Sierra Environmental Resource Center
CWD	Coarse Woody Debris
CWE	Cumulative Watershed Effects
CWHR	California Wildlife Habitat Relationships
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EHR	Erosion Hazard Rating
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERA	Equivalent Roaded Acres
ESA	Endangered Species Act of 1973
ESD	Emergency Situation Determination
FCCC	Forest Carnivore Connectivity Corridor
FFE	Fire and Fuels Extension

FOFEM	First Order Fire Effects Model
FS	Forest Service
FSEIS	Final Supplemental Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
FSS	Forest Service Sensitive
FTS	Forest Transportation System
FYLF	Foothill yellow-legged frog
GIS	Geographic Information System
GTR	General technical Report
HCRA	Home Range Core Area
HFC	Hydrologic Function Class
HFRA	Healthy Forests Restoration Act
HR	Heritage Resources
HSA	Hydrologically Sensitive Area
HT	Hazard Trees
HUC	Hydrologic Unit Code
ID	Interdisciplinary
IDT	Interdisciplinary Team
INFRA	Infrastructure Database
IRA	Inventoried Roadless Area
JPB	Jackpot Burning
LOP	Limited Operating Period
EHR	Erosion Hazard Rating
MBF	Thousand Board Feet
MMBF	Million Board Feet
MBTA	Migratory Bird Treaty Act
MIS	Management Indicator Species
ML1	Maintenance Level 1 Road
ML2	Maintenance Level 2 Road
MOI	Memorandum of Intent
MYLF	Mountain yellow-legged frog
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System Road
NFST	National Forest System Trail
NHPA	National Historic Preservation Act
NOI	Notice of Intent
NRHP	National Register of Historic Places
NRIS	Natural Resource Information System
NVUM	National Visitor Use Monitoring
OFEA	Old Forest Emphasis Area
OHV	Off-Highway Vehicle

PA	Programmatic Agreement
PAC	Protected Activity Center
PM	Particulate Matter
PSW	Pacific Southwest Research Station
R5	Forest Service Region 5
RAVG	Rapid Assessment of Vegetation Condition after Wildfire
RCA	Riparian Conservation Area
RCO	Riparian Conservation Objective
RD	Ranger District
RNA	Research Natural Area
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
SAF	Special Aquatic Feature
SHPO	State Historic Preservation Officer
SIA	Special Interest Area
S&G	Standard and Guideline
SMP	Smoke Management Program
SNFPA	Sierra Nevada Forest Plan Amendment
SNYLF	Sierra Nevada Yellow-Legged Frog
SOPA	Schedule of Proposed Actions
SPI	Sierra Pacific Industries
SPLAT	Strategically Placed Landscape Area Treatment
SPM	Semi-Primitive Motorized
SPNM	Semi-Primitive Non-Motorized
SSI	StreamScape Inventory
STF	Stanislaus National Forest
TE	Threatened and Endangered
TES	Threatened, Endangered and Sensitive
TOC	Threshold of Concern
TuCARE	Tuolumne County Alliance for Resources and Environment
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
VQO	Visual Quality Objective
WSA	Watershed Sensitive Area
YNP	Yosemite National Park
YSS	Yosemite Stanislaus Solutions

B. Cumulative Effects Analysis

According to the 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 Forest queried its databases, including the Schedule of Proposed Actions (SOPA) to determine past, present and reasonably foreseeable future actions as well as present and reasonably foreseeable future actions on other public (non-Forest Service) and private lands. This appendix lists the specific findings and information used for the cumulative effects analysis presented for each resource in Chapter 3. This list is not all inclusive since budgets and changing landscape conditions may warrant changes in management priorities or direction.

Past Actions

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. Existing conditions reflect the aggregate impact of all prior human actions and natural events that affected the environment and might contribute to cumulative effects. This cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis for three reasons.

First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Innumerable actions over the last century (and beyond) impacted current conditions and trying to isolate the individual actions with residual impacts would be nearly impossible.

Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because information on the environmental impacts of individual past actions is limited, and one cannot reasonably identify each and every action over the last century that contributed to current conditions. Additionally, focusing on the impacts of past human actions ignores the important residual effects of past natural events which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects.

Finally, the CEQ issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions" (CEQ 2005).

The cumulative effects analysis in this EIS is also consistent with Forest Service NEPA Regulations (73 Federal Register 143, July 24, 2008; p. 43084-43099), which state, in part:

> "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonably foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative

> effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)"

For these reasons, the analysis of past actions in this section is based on current environmental conditions described in Chapters 1 and 2. Specialist reports (including BAs and BEs) provide the rationale for addressing any specific past projects.

Present Actions

For the purposes of cumulative effects analysis, present actions include: ongoing activities; Forest Service and other Federal land disturbance actions with completed NEPA decisions that are not yet fully implemented on the ground; and private land activities.

Ongoing Activities

Ongoing activities on NFS lands within the Rim Fire perimeter include:

Livestock Grazing: 13 grazing allotments are either wholly or partially within the cumulative analysis area as defined previously. The maximum number of cattle run across all the allotments is about 1,632 cow/calf pairs in any given season. Grazing is subject to utilization standards in the SNFPA (2004) that protect resources such as meadow habitat.

Recreation: recreation is abundant in the area and consists of activities including, but not limited to, Off Highway Vehicle (OHV) use, passenger car driving, wood cutting, camping (dispersed and developed), hiking, cycling (mountain and road), fishing, backpacking, horseback riding, and winter sports. These recreation activities provide increased human access to the forest.

Forest Service

Table B.01-1 displays present NFS land disturbance actions, followed by a brief description of each.

Table B.01-1 Present National Forest System land disturbance actions

Project	Purpose	Decision	Acres
Twomile Ecological Restoration Vegetation: Groovy Timber Sale	Green Thinning	2012	839
Twomile Ecological Restoration Vegetation: Funky Timber Sale	Green Thinning	2012	1,031
Soldier Creek Timber Sale	Green Thinning	2008	175
		total	**2,045**

Groovy Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 839 acres include thinning (mechanical and hand) and biomass removal. These acres have dropped by almost half due to the fire. The high severity burn units are analyzed as part of this EIS.

Funky Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 1,031 acres include thinning (mechanical and hand) and biomass removal. These acres dropped slightly from the original proposal, two units are now a part of this EIS.

Soldier Creek Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 175 acres include thinning (mechanical and hand) and biomass removal.

National Park Service

Yosemite National Park Roadside Hazard Tree Removal: removal of hazard tree on 28.8 miles (816 acres) of high use roads within on Yosemite National Park.

Private Land

Table B.01-2 lists the present land disturbance actions on private lands that are on file with California Department of Forestry and Fire Protection (Cal Fire).

Table B.01-2 Present private lands disturbance actions

Landowner	Proposed Prescription	Acres
Choppers's Choice Emergency Notice Map	Emergency Fire Salvage	2,004
Rim Hansen Peak Emergency Overview Map	Emergency Fire Salvage	1,004
Cherry Emergency	Emergency Fire Salvage	47
Rim Northwest Emergency Overview Map	Emergency Fire Salvage	2,342
Duckwall Fireline Emergency Map	Emergency Fire Salvage	137
Schaezlein Emergency	Emergency Fire Salvage	326
Crook Property	Emergency Fire Salvage	484
Seastrom Fire Salvage/Jones Tract	Emergency Fire Salvage	168
Stone Meadow (Erickson) Emergency Notice	Emergency Fire Salvage	321
Lee Price Camp 24 Tract	Emergency Fire Salvage	200
Packard Canyon Emergency	Emergency Fire Salvage	64
Parson's Emergency	Emergency Fire Salvage	162
Quesnoy Emergency	Emergency Fire Salvage	44
Manly Emergency	Emergency Fire Salvage	141
Sawmill Emergency Notice	Emergency Fire Salvage	48
Filiberti Fire Salvage	Emergency Fire Salvage	83
Spinning Wheel EM	Emergency Fire Salvage	11
Looney-Reynolds Emergency Notice	Emergency Fire Salvage	779
Rim Woods Ridge Emergency Notice	Emergency Fire Salvage	4,531
Skunkjaw Emergency Notice	Emergency Fire Salvage	1,371
Duckwall Emergency	Emergency Fire Salvage	4,140
total		**18,407**

Reasonably Foreseeable Future Actions

For the purposes of cumulative effects analysis, the following reasonably foreseeable future actions are land disturbance projects with proposed actions published in the SOPA or with completed NEPA decisions not yet implemented (Table B.01-3).

Reynolds Creek Ecological Restoration Aspen Release: aspen stand improvement/expansion involving the removal of encroaching conifers. Treatments proposed in 2 stands for 2 acres include thinning (mechanical and hand), biomass removal, removal of encroaching conifers, repairing gullies and stabilizing streambeds.

Reynolds Creek Ecological Restoration Meadow Restoration: meadow treatments including headcut repair, fencing, removal of encroaching conifers, and planting of riparian vegetation. Treatments proposed in 8 meadows for 14 acres include thinning (mechanical and hand), biomass removal, removal of encroaching conifers, repairing gullies and stabilizing streambeds.

Twomile Ecological Restoration Meadow Restoration: improve meadow function in five meadows and associated streams by raising water tables nearer to natural levels. Treatments include stabilizing banks and headcuts, revegetation with native species and subsoiling compacted areas.

Twomile Ecological Restoration Noxious Weeds: control of 2 noxious weeds: the only known population of Dyers Woad on the Stanislaus National Forest and perennial sweetpea, on 8 acres near Reed Creek. The herbicide glyphosate is proposed for treatment since 12 years of hand pulling has not eradicated the weeds.

Twomile Ecological Restoration Soil Improvement: push apart windrowed materials to restore soil productivity on 23 acres of volcanic soils in a ponderosa pine plantation established after the 1950 Wrights Creek Burn.

Rim Fire Hazard Trees: remove hazard trees and suppression felled trees within and adjacent to facilities including: 194 miles of high use roads; private property; developed sites; recreation use areas; and, powerlines. Treatments proposed on 10,315 acres.

Reynolds Ecological Restoration Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 844 acres include thinning (mechanical and hand) and biomass removal.

Campy Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 995 acres include thinning (mechanical and hand), biomass removal.

Looney Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 1,445 acres include thinning (mechanical and hand), biomass removal.

Thommy Timber Sale: thinning to increase structural diversity, improve wildlife habitat, and encourage pine and hardwoods. Treatments proposed on 514 acres include thinning (mechanical and hand), biomass removal.

Miwok OHV Restoration: authorize physical road actions and access designation changes to minimize resource damage and move the road system toward one that can be efficiently maintained while also maintaining access for management and public use. Includes block and restore 11.6 miles of unauthorized OHV routes and restore 4 acres of impact areas; install barriers at beginning of blocked routes; designate rock barrier source at Bourland and Coffin Quarries.

Reynolds Creek Ecological Restoration Culvert and Road Work: replace and maintain 3 culverts to improve aquatic passage and hydrologic function. Decommission, close, reconstruct and complete watershed rehabilitation.

Twomile Ecological Restoration Motorized Trails: improve motorized trail system in the Twomile area to improve public safety and minimize resource damage. Treatments include closure and restoration actions on 72 segments of unauthorized routes, reconstruct and/or reroute 5 existing segments, and construction of 3 new segments.

Twomile Ecological Restoration Transportation: authorize physical road actions and access designation changes to minimize resource damage and move the road system toward one that can be efficiently maintained while also maintaining access for management and public use. Physical actions are those actions on the ground that involve moving earth and vegetation, and change the physical condition and drivability of the route. The proposed physical actions are oriented toward improving drivability and access and "storm-proofing" routes to minimize future erosion. Physical actions would occur on a total of 61 segments including: installation of 4 gates, close (ML1) 11 segments, decommission 14 segments, maintain 23 segments, construct one new segment, and reconstruct 9 segments.

Reynolds Creek Motorized Routes: decommissioning of 3.5 miles of unauthorized motorized routes in the Reynolds Creek area.

Livestock Grazing: present actions describe grazing allotments. This management activity will continue into the foreseeable future.

Recreation: present actions describe recreation opportunities. These opportunities will, to some degree, continue into the foreseeable future.

Table B.01-3 lists the reasonably foreseeable future NFS land disturbance actions described above.

Table B.01-3 Foreseeable Future NFS land disturbance actions

Project	Purpose	Decision	Miles	Acres
Reynolds Creek Ecological Restoration	Aspen Release	2012	0	2
Reynolds Creek Ecological Restoration	Meadow Restoration	2012	0	14
Twomile Ecological Restoration: Meadow Restoration	Restore Meadow Condition and Function	2012	0	11
Twomile Ecological Restoration: Noxious Weeds	Weed Eradication	pending	0	8
Twomile Ecological Restoration: Soil Improvement	Restore Soil Productivity	2012	0	23
subtotal Ecological Restoration			**0**	**58**
Rim Fire Hazard Trees	Hazard Tree Removal	pending	0	10,262
Reynolds Creek Ecological Restoration	Green Thinning	2012	0	844
Two Mile Ecological Restoration Vegetation: Campy Timber Sale	Green Thinning	2012	0	995
Two Mile Ecological Restoration Vegetation: Looney Timber Sale	Green Thinning	2012	0	1,445
Two Mile Ecological Restoration Vegetation: Thommy Timber Sale	Green Thinning	2012	0	514
subtotal Timber Harvesting			**0**	**14,060**
Mi-Wok OHV Restoration	Recreation Management	2012	11.6	4
Reynolds Creek Ecological Restoration	Culvert and Road Work	2012	27.6	0
Twomile Ecological Restoration: Motorized Trails	NFST Management	2012	24.5	0
Twomile Ecological Restoration: Transportation	NFSR Management	pending	29.2	0
Reynolds Creek Motorized Routes	Decommission unauthorized routes	2013	3.5	0
subtotal Transportation Restoration			**96.4**	**4**
total			**96.4**	**14,122**

C. Glossary

90th percentile weather conditions	High air temperature, low relative humidity, strong wind conditions and low fuel moisture content levels that historically that are met or exceeded on 10 percent of days during the fire season. It defines potential fire behavior as a result of these conditions: a 90th percentile weather day has the potential for severe wildfire behavior.
Activity Generated Fuel	Fuel resulting from, or altered by, management practices such as timber harvesting, thinning, or road construction.
Adaptive Management	A system of management practices based on clearly identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and, if not, to facilitate management changes that will best ensure that those outcomes are met or re-evaluated. Adaptive management stems from the recognition that knowledge about natural resource systems is sometimes uncertain (36 CFR 220.3).
Administrative Unit	A National Forest, a National Grassland, a purchase unit, a land utilization project, Columbia River Gorge National Scenic Area, Land Between the Lakes, Lake Tahoe Basin Management Unit, Midewin National Tallgrass Prairie, or other comparable unit of the National Forest System.
Alluvial	Pertaining to processes or materials associated with transportation or deposition by running water.
Aquatic	Growing or living in or frequenting water; taking place in or on water.
Aquatic Ecosystem	A stream channel, lake or estuary bed, the water itself, and the biotic (living) communities that occur therein.
ARC/INFO	The name of a Geographic Information System software program.
Area of Potential Effects (APE)	This is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.
Aspect	The direction a slope faces. For example, a hillside facing east has an eastern aspect.
Basal area	The total cross-sectional area of all stems, including the bark, in a given area, measured at breast height (4.5 feet above the ground). Usually given in units of square feet per acre.
Beneficial Uses of Water	Uses of water that are protected against degradation as described in the Basin Plan of the California Central Valley Regional Water Quality Control Board. These uses include municipal, agriculture, industry, recreation and aquatic and wildlife habitat categories.
Best Management Practices (BMPs)	Water Quality Best Management Practices, a codified series of about 100 practices for protecting water quality when conducting forest management activities. BMPs are referenced in R5 FSH 2509.22, Soil and Water Conservation Handbook; Chapter 10, Water Quality Management Handbook.
Biological Diversity (Biodiversity)	The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.
Biomass	Trees less than 10 inches dbh not used as sawlogs. This material is usually chipped and/or removed from the project area and hauled to a mill to be used for cogeneration of energy or as fiber for wood products.
Biota	The plant and animal life of a particular region.

Biotic Potential	Factors that influence the ability of an animal to utilize its environment, including: reproductive rates, dispersal ability, habitat and life requisite specificity, and adaptability. Combine, these factors assign biotic potential of the animal.
Blue Oak Woodlands	An ecosystem dominated by blue oak, valley oak, interior live oak (tree form), or Oregon white oak.
Board feet	A unit of measure of sawlog volume, equivalent to 12 inches by 12 inches by 1 inch. One thousand board feet is denoted as mbf.
Buffer	Used in the context of GIS; a buffer is a zone of a specified distance around a feature in a coverage.
Burned Area Emergency Response (BAER)	BAER is a Forest Service activity of immediate post-wildfire response to assess and reduce the risk of loss of human life, property damage, and adverse effects to critical natural and cultural resources from threats caused by the fire.
California Wildlife Habitat Relationships (CWHR)	A system of classifying vegetation in relation to its function as wildlife habitat. Tree-dominated habitat is classified according to tree size and canopy closure.
Canopy	The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied forest.
Canopy cover	The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. Same as crown closure.
Chief	The Chief, Forest Service, Department of Agriculture (36 CFR 212).
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government.
Collaboration	Managers, scientists and citizens working together to plan, implement and monitor National Forest management. The intention is to engage people who have information, knowledge, expertise and an interest in the health of National Forest ecosystems and nearby communities.
Connected Actions	Actions that: (i) automatically trigger other actions which may require environmental impact statements; (ii) cannot or will not proceed unless other actions are taken previously or simultaneously; or, (iii) are interdependent parts of a larger action and depend on the larger action for their justification (40 CFR 1508.25).
Connectivity (of Habitats)	The linkage of similar but separated vegetation stands by patches, corridors, or "stepping stones" of like vegetation. This term can also refer to the degree to which similar habitats are linked.
Coverage	A digital map or layer of data in the ARC/INFO software program.
Council on Environmental Quality (CEQ)	The Council on Environmental Quality established by Title II of NEPA (40 CFR 1508.6).
Critical Aquatic Refuge (CAR)	A relatively small watershed, ranging in size from about 3,000 to 85,000 acres, that is sometimes nested within an emphasis watershed and has localized populations of rare and/or at-risk populations of native fish and/or amphibians.
Critical Deer Winter Range	Areas of deer winter range that are of highest priority for protection.
Critical Habitat	Areas designated for the survival and recovery of federally listed threatened or endangered species.
Crown closure	Refer to canopy cover.
Cryptogamic Soil Crusts	Biological soil crust composed of living cyanobacteria, green algae, brown algae, fungi, lichens, and/or mosses.

Cumulative Impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).
Danger Tree	Refer to Hazard Tree
Decommission	Activities that result in the stabilization and restoration of unneeded roads or trails to a more natural state (FSM 7703.2(1)).
Designated Road, Trail or Area	A National Forest System road, trail or area that is designated for motor vehicle on a motor vehicle use map (36 CFR 212).
Desired Future Conditions	Land or resource conditions that are expected to result based on goals and objectives.
Diameter at Breast Height (DBH)	The diameter of a tree trunk 4.5 feet above the ground.
Digital Elevation Model (DEM)	A digital GIS file typically used to represent terrain relief.
Disjunct	A population of plants or animals which are separated by a large distance from the typical distribution of the species.
Draft Environmental Impact Statement (DEIS)	A detailed written statement as required by section 102(2) (C) of the NEPA (40 CFR 1508.11) that is released to governmental agencies and the general public for review and comment.
Drop and Lop	A treatment that involves felling non-merchantable trees less than about 10 inches dbh and lopping them into pieces small enough to ensure the material is not stacked and has as much ground contact as practical.
Early Forest Succession	The biotic (or life) community that develops immediately following the removal or destruction of vegetation in an area. For example, grasses may be the first plants to grow in an area that was burned.
Ecology	The interrelationships of living things to one another and to their environment, or the study of these interrelationships.
Ecosystem	An arrangement of living and non-living things and the forces that move them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within ecosystems.
Endangered Species	Those plant or animal species that are in danger of extinction throughout all or a significant portion of their range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.
Endemic	An organism that evolved in and is restricted to a particular locality. The Little Kern golden trout found only in the Sierra Nevada region is an example.
Endlining	Moving logs using cables where the log is in full or partial contact with the ground.
Environmental Justice	The state (or condition) which 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.
Environmental Impact Statement (EIS)	A detailed written statement as required by section 102(2) (C) of NEPA (CFR 1508.11).
Environmentally Preferable Alternative	The alternative that will best promote the national environmental policy as expressed in NEPA section 101 (42 USC 4321). Ordinarily, the environmentally preferable alternative is that which causes the least harm to the biological and physical environment; it also is the alternative which best protects and preserves historic, cultural, and natural resources. In some situations, there may be more than one environmentally preferable alternative (36 CFR 220.3).
Ephemeral Stream	Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow since their streambeds are not connected to groundwater below.

Equivalent Roaded Acres	A standardized unit of measure for land disturbance. A road prism is considered the reference to which other types of land disturbing activities are measured. A road is given an ERA coefficient of 1.0 (1 acre of road is equal to 1.0 ERA). Other disturbances such as logging, site preparation and wildfires are equated to a road surface by ERA coefficients that reflect their relative level of contribution to changes in runoff and sediment regimes in the watershed.
Erosion Hazard Rating (EHR)	A rating system used to classify the relative vulnerability of soil to erosion.
Escarpment	A long, more or less continuous cliff or relatively steep slope produced by erosion or by faulting.
Fauna	The animal life of an area.
Fireline	A corridor, which has been cleared of organic material to expose mineral soil. Firelines may be constructed by hand or by mechanical equipment (e.g., dozers).
Fire Return Interval	Number of years between 2 successive fires in a specified area.
Flag and Avoid	The hanging of flagging in order to identify for the purpose of avoidance of a special feature in an area.
Flame Length	The length of flame measured in feet. Increased flame lengths increase resistance to control and likelihood of torching events and crown fires.
Flora	The plant life of an area.
Focal Species	A species of concern.
Forest Road or Trail	A road or trail wholly or partly within or adjacent to and serving the National Forest system that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (36 CFR 212).
Forest Transportation Atlas	A display of the system of roads, trails, and airfields of an administrative unit.
Forest Transportation Facility	A forest road or trail or an airfield that is displayed in a forest transportation atlas, including bridges, culverts, parking lots, marine access facilities, safety devices, and other improvements appurtenant to the forest transportation system (36 CFR 212).
Forest Transportation System	The system of National Forest System roads, National Forest System trails, and airfields on National Forest System lands (36 CFR 212).
Free Flowing River	Existing or flowing in a natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway.
Fuelbreak	A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread, intensity, and create barriers to fire spread.
Fuel Loading	The weight per unit area of fuel, often expressed in tons per acre.
Fuels	Plants and woody vegetation, living and dead that are capable of burning.
Fuels Management	The planned manipulation and/or reduction of living and dead forest fuels for forest management and other land use objectives.
Fuels Treatment	The treatment of fuels that left untreated would otherwise interfere with effective fire management or control. For example, prescribed fire can reduce the amount of fuels that accumulate on the forest floor.
Fuelwood	Wood cut into short lengths for burning in a fireplace, woodstove or fire pit.
Geographic Information Systems (GIS)	A computer system capable of storing, manipulating, analyzing, and displaying geographic information.

Ground Cover	Natural organic and inorganic material that covers the watershed ground surface in sufficient quantity to allow a satisfactory rate of water infiltration to replenish ground water and limit erosion to natural rates. Ground cover usually consists of perennial vegetation, forest floor litter and duff, rock, downed wood, or similar erosion resistant material. Sufficient ground cover is usually 50% or greater, and cover of many forested ground surface areas is 80% or higher.
Habitat	The area where a plant or animal lives and grows under natural conditions.
Habitat Connectivity	The degree to which the landscape facilitates animal movement and other ecological flows.
Habitat Fragmentation	The degree to which a habitat type, specific to a plant or animal species, is interrupted by different, incompatible habitat characteristics or types.
Hand Piling	Piling by hand branches and limbs from tree harvests or thinnings by hand, for burning at a later time.
Hazard Tree	A standing tree that presents a hazard to people due to conditions such as deterioration of or damage to the root system, trunk, stem, or limbs or the direction or lean of the tree. Synonymous with danger tree for purposes of this project.
Herbaceous	A vascular plant having little or no woody tissue. This commonly refers to grass and grasslike plants.
Heritage Program	The comprehensive Forest Service program of responsibilities with regard to historic preservation. A pro-active program to manage prehistoric and historic cultural resources and cultural traditions for the benefit of the public through preservation, public use, and research.
High Clearance Vehicle	All sport utility vehicles (SUVs), light trucks, motorcycles, and other highway-legal vehicles designed for operation on rough terrain. These vehicles are also OHVs.
Highway	Highway is a way or a place of whatever nature publicly maintained and open to the use of the public for purposes of vehicular travel (CA Vehicle Code Section 360). However, the 38000 Division of the California Vehicle Code (the Off Highway Motor Vehicle section) states that for purposes of this division (38000) the term “highway” does not include fire trails, logging roads, service roads regardless of surface composition, or other roughly graded trails and roads upon which vehicular travel by the public is permitted (CA Vehicle Code 38001).
Home Range Core Area	An area designed to encompass the best available spotted owl habitat, and is in the closest proximity to owl protected activity centers where the most concentrated owl foraging activity is likely to occur.
Hydrologically Connected Segment (HCS)	Locations where drainage off a road or trail is likely to enter a watercourse.
Hydrophobic Soils	Soils that repel water, causing water to collect on the soil surface rather than infiltrate into the ground. Wild fires generally cause soils to be hydrophobic temporarily, which increases water repellency, surface runoff and erosion in post-burn sites.
Image	A graphic representation of a person or thing, typically produced by an electronic device. Common examples include remotely sensed data and photographs.
Indigenous	Any species of plant or animals native to a given land or water area by natural occurrence.
Interdisciplinary Team	A diverse group of professional resource specialists who analyze the effects of alternatives on natural and other resources. Through interaction, participants bring different points of view and a broader range of expertise.
Intermittent Stream	A stream that flows during the wet season due to precipitation runoff and has streamflow extending partially through the dry season due to at least some groundwater contribution.
Invasive Species	Refer to Noxious Weeds for the purposes of this project.

Inventoried Roadless Area	Areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any subsequent update or revision of those maps.
Irretrievable	A term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.
Irreversible	A term that describes the loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time
Jackpot Burning	The prescribed burning of heavy concentrations of down woody fuels.
Lahars	Landslide or mudflow material of pyroclastic (hot ash or tephra) on the flank of a volcano or the deposit formed by such a landslide or mudflow.
Landing	A forested opening, cleared of vegetation, leveled and graded, and used to stockpile sawlogs for eventual loading of load log trucks for haul to a sawmill.
Landscape	A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts.
Large Woody Debris	Large Woody Debris (LWD) is typically greater than 12 inches in diameter at the midpoint and at least 10 feet in length and refers to large logs on the forest floor or in stream areas. LWD provides wildlife habitat and soil building processes on land, and can provide aquatic habitat complexity and stream stability. Large woody debris is important habitat for a variety of wildlife species and their prey.
Late Forest Succession	The stage of forest succession in which most of the trees are mature or over mature.
Legacy Watershed Effects	Impacts to natural features in a watershed that originated in the distant past but presently remain evident. Impacts may have occurred from land uses prior to establishment of the national forest, forest management activities or natural events such as fires, floods and landslides.
Level 1 Road	Roads that have been placed in storage between intermittent uses. Level 1 roads are closed to vehicular traffic but may be available and suitable for non-motorized uses.
Level 2 Road	Roads open for use by high clearance vehicles. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Passenger cars are discouraged or prohibited.
Level 3 Road	Roads open and maintained for travel by a prudent driver in a standard passenger car. Roads in this maintenance level are typically low speed with single lanes and turnouts.
Level 4 Road	Roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most level 4 roads are double lane and aggregate surfaced, but may single lane, paved and/or dust abated.
Level 5 Road	Roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated.
Limited Operating Period (LOP)	A specified period of time during which certain land management activities are prohibited.
Long-Term Risk	A risk to be experienced within the next 50 to 100 years.
Machine Piling	The use of mechanical equipment to push brush skeletons, small dead trees and excess downed fuels into piles for burning.

Maintenance	The upkeep of the entire forest transportation facility including surface and shoulders, parking and side areas, structures, and such traffic-control devices as are necessary for its safe and efficient utilization (36 CFR 212).
Maintenance Level	Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria.
Management Action	Any activity undertaken as part of the administration of the National Forest.
Management Requirements	Mandatory components of each alternative designed to implement the Forest Plan and to minimize or avoid potential adverse impacts.
Mastication	Shredding of brush skeletons and small dead trees (generally under 10 inches dbh).
Meadow	Meadows are an ecosystem type dominated by herbaceous plants due to support of shallow groundwater that limits establishment of shrubs or trees. Meadows are usually comparatively flat in relation to their surrounding landscape.
Mesic	Moderately moist climates or environments. Mesic Vegetation generally refers to vegetation found in moist environments. Mesic Soil refers specifically to soils with mean annual temperatures of 8 to 15 degrees centigrade.
Metasedimentary Rock	Rock formed over a long period of time from marine sediments under heat and great pressure.
Mitigation	Avoiding an impact by not taking a certain action or parts of an action. Minimizing impacts by limiting the degree or magnitude of the action. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
Mixed Severity Fire	A wildfire that has a wide range of burn severity. This usually includes high, moderate and low soil burn severity and multiple classes of vegetation burn severity.
Montane Hardwood Forests	Vegetation communities dominated by California black oak, canyon live oak, Pacific madrone or tanoak, for the purposes of this project.
Mosaic	Areas with a variety of plant communities over a landscape. For example, areas with trees and areas without trees occurring over a landscape.
Motor Vehicle	Any vehicle which is self-propelled, other than: (1) a vehicle operated on rails; and (2) any wheelchair or mobility device, including one that is battery-operated, that is designed solely for use by a mobility-impaired person for locomotion, and that is suitable for use in an indoor pedestrian area (36 CFR 212).
Multiple Use	The management of all the various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output. (Multiple-Use Sustained-Yield Act; Public Law 86–517)
Multiplier	The concept in regional economic analysis describing how economic impacts that are directly caused by an action generally create additional economic impacts through indirect or induced mechanisms. The multiplier is the ratio of all economic impacts combined (through direct, indirect and induced mechanisms) divided by just the direct economic impacts.
Mycorrhizal Fungi	A type of fungi which forms a symbiotic relationship with vascular plants for the purpose of exchanging nutrients and moisture by growing amongst the roots of the plants.

National Environmental Policy Act (NEPA)	Codifies the national policy of encouraging harmony between humans and the environment by promoting efforts to prevent or eliminate damage to the environment, thereby enriching our understanding of ecological systems and natural resources. It declares the federal government to be responsible for: (a) coordinating programs and plans regarding environmental protection; (b) using an interdisciplinary approach to decision-making; (c) developing methods to ensure that non-quantifiable amenity values are included economic analyses; and (d) including in every recommendation, report on proposals for legislation, or other major federal actions significantly affecting the quality of the environment a detailed environmental impact statement (EIS).
National Forest System	As defined in the Forest Rangeland Renewable Resources Planning Act, the "National Forest System" includes all National Forest lands reserved or withdrawn from the public domain of the United States, all National Forest lands acquired through purchase, exchange, donation, or other means, the National Grasslands, and land utilization projects administered under title III of the Bankhead-Jones Farm Tennant Act (50 Stat. 525, 7 U.S.C. 1010-1012), and other lands, waters or interests therein which are administered by the Forest Service or are designated for administration through the Forest Service as a part of the system (36 CFR 212).
National Forest System Road	A forest road other than a road which has been authorized by a legally documented right-of-way held by a state, county, or local public road authority (36 CFR 212.1).
National Forest System Trail	A forest trail other than a trail which has been authorized by a legally documented right-of-way held by a state, county, or local public road authority (36 CFR 212.1).
Natural Resource	A feature of the natural environment that is of value in serving human needs.
Natural Succession	The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.
Noxious Weeds	Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.
Old Forest (Old Growth)	Areas that contain large, old trees relative to the species-specific, environmentally-constrained growth capacity of the site.
Operability	The ability to conduct vegetation management operations, which include construction of access roads and log landings, use of cable logging systems, clearing of central skid trails for tractor logging, and removal of trees that pose hazards to forest workers. Trees to be removed for operability would be designated by a Forest Service representative.
Outstanding Remarkable Value	A river-related value must be a unique, rare, or exemplary feature that is significant at a comparative regional or national scale.
Paleoecological	The study of ancient or prehistoric ecosystems.
Passenger Vehicle	All passenger vehicles such as sedans and other typical low clearance vehicles less than 10,000 GVW licensed to operate on public roads.
Patch	An area of vegetation, similar in structure and composition.
Perennial Stream	A stream that typically has running water on a year-round basis due to precipitation runoff in the wet season and continual contribution of groundwater to support streamflow throughout the dry season except in smaller streams during droughts.
Plantation	A group of trees that have been planted together.
Polygon	Used in a GIS to represent an area, a polygon is a digital feature class defined by arcs, or lines, that make up its boundary. A polygon would be used to represent areas such as lakes and land parcels on a map.

Preferred Alternative	The alternative(s) which the Agency believes would best fulfill the purpose and need for the proposal, consistent with the Agency's statutory mission and responsibilities, giving consideration to environmental, social, economic, and other factors and disclosed in an EIS.
Prescribed Fire or Burn	A type of fuel treatment whereby fire is intentionally set in wildland fuels under prescribed conditions and circumstances.
Proposed Action	A proposal made by the Forest Service to authorize, recommend, or implement an action to meet a specific purpose and need.
Protected Activity Centers (PACs)	Designated areas that are afforded protection to specific species by restricting certain management activities. For example, California spotted owl PACs protect owl habitat and breeding areas by restricting timber harvest.
Public Involvement	The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision-making.
Public Land	Land for which title and control rests with a federal, state, regional, county, or municipal government.
Public Road	Roads under the jurisdiction of and maintained by a public authority that are open to public travel (23 U.S.C 101(a)).
Radio Telemetry	The science and technology of automatic measurement and transmission of data by radio from remote sources to receiving stations for recording and analysis. Radio telemetry is used to track the movements of wild animals that have been tagged with radio transmitters.
Reasonably Foreseeable Future Actions	Those Federal or non-Federal activities not yet undertaken, for which there are existing decisions, funding, or identified proposals. Identified proposals for Forest Service actions are described in 220.4(a) (1) (36 CFR 220.3).
Record of Decision (ROD)	A concise public record of the responsible official's decision to implement an action when an environmental impact statement (EIS) has been prepared.
Reforestation	The natural or intentional restocking of existing forests and woodlands that have been depleted.
Regeneration	Tree seedlings and saplings that have the potential to develop into mature forest trees.
Remote Sensing	Acquiring information about a geographic feature without contacting it physically. Methods include aerial photography and satellite imaging.
Resilience	The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.
Responsible Official	The Agency employee who has the authority to make and implement a decision on a proposed action (36 CFR 220.3).
Riparian Area	The area along a watercourse, around a lake or pond, or in other wetlands.
Riparian Conservation Area (RCA)	Identified areas within a certain distance from streams, special aquatic features or riparian vegetation. RCA width and protection measures are determined through project level analysis.
Riparian Ecosystem	The ecosystem around or next to water or in wetlands that support unique vegetation and animal communities as a result of a high water table.
Riparian Obligate Vegetation	Trees, shrubs and herbaceous plants that are sustained by wetland conditions along stream courses and in and around meadows and other wetlands. Trees and shrubs are usually deciduous species such as alder, aspen, big leaf maple, and cottonwoods. Shrubs include willows and dogwoods. Herbaceous plants include sedges, rushes and other grasslike plants.
Road	A motor vehicle route over 50 inches wide, unless identified and managed as a trail (36 CFR 212).
Road Density	The length of roads within a given area, most often calculated as miles of road per square mile of land area. Road density is often used as an indicator of watershed disturbance.

Roadless Area	Refer to Inventoried Roadless Area for the purposes of this project.
Road Construction	Development of a new road, designed to engineering standards according to assigned management standards. Actions may include vegetation clearing, excavation and embankment, blading and shaping, installation of drainage structures, and importing of armoring and surfacing rock material as needed.
Road Reconstruction	Improvement, restoration, and/or realignment of a road. Actions may include surface improvement; construction of drainage dips, culverts, riprap fills or other drainage or stabilization features with potential disturbance outside the established roadway (toe of fill to top of cut); realignment; and widening of curves as needed for log trucks and chip van passage.
Salvage Logging	Dead conifer trees will be cut down and transported to a mill for processing. Logging systems may include ground based equipment such as harvesters and rubber tired skidders, or helicopter logging or skyline systems on steeper slopes and where necessary to meet resource objectives.
Schedule of Proposed Actions (SOPA)	A Forest Service document that informs the public about those proposed and ongoing Forest Service actions for which a record of decision, decision notice or decision memo would be or has been prepared. The SOPA also identifies a contact for additional information on any proposed actions (36 CFR 220.3).
Scope	The range of actions, alternatives and impacts to be considered in an environmental impact statement (40 CFR 1508.25).
Scoping	An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).
Sensitive Species	Plant or animal species which are susceptible to habitat changes or impacts from management activities. The official designation is made by the USDA Forest Service at the regional level and is not part of the designation of threatened or endangered species made by the U.S. Fish And Wildlife Service.
Seral Stage	The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.
Shaded Fuel Break	A defensible location where fuels have been modified, that can be used by fire suppression resources to suppress oncoming wildfires.
Short-Term Risk	A risk to be experienced within the next 10 to 15 years. For example, prescribed burns can disturb habitat in the short-term, but in the long-term the fire resiliency of the habitat may be improved.
Silvicultural System	The cultivation of forests; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.
Silviculture	The art and science that promotes the growth of single trees and the forest as a biological unit.
Skidding	Dragging a log with a tractor to a landing for loading onto a logging truck.
Skid Zone	Areas where landings for units harvested using ground based equipment are not located either within or adjacent to the units.
Slash	Tree tops and branches left on the ground after logging or accumulating as a result of natural processes.
Snag	A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.
Soil Burn Severity	The effect of a fire on ground surface characteristics, described in terms of char depth, organic matter loss, altered color and structure of soil, and reduced infiltration. Soil burn severity is measured in high, moderate and low classes based upon the degree of effects.
Soil Compaction	An increase in soil density resulting from repeated tracking by mechanized equipment. Compaction reduces infiltration of water and can cause subsequent erosion, and can adversely affect forest vegetation in compacted areas.

Soil Displacement	A lateral relocation of topsoil and often subsoil by movement of mechanized equipment or from sawlog yarding practices. Displacement can result in soil berms or ditches that divert water and lead to erosion.
Spatial Data	A GIS contains spatial data. The spatial data represents geographic features associated with real-world locations.
Special Aquatic Features	Lakes, ponds, vernal pools, meadows, bogs, fens, springs, and other wetlands.
Species	A class of individuals having common attributes and designated by a common name; a category of biological classification ranking immediately below the genus or subgenus; comprising related organisms or populations potentially capable of interbreeding.
Strategically Placed Land Area Treatment (SPLAT)	Fuel reduction treatments placed in a pattern to interrupt fire progression such that the fire reduces in intensity and becomes a surface fire in these areas. The overall pattern impedes fire spread.
Stand	A group of trees that occupies a specific area and is similar in species, age and condition.
Standards and Guidelines (S&Gs)	The primary instructions for land managers. Standards address mandatory actions, while guidelines are recommended actions necessary to a land management decision.
Stand-Replacing Fire	A fire that burns with sufficient intensity to kill the majority of living vegetation over a given area (grass and brush fires are stand replacement fires for that vegetation type, in forest vegetation types when 75-80% of the stand is killed by fire are also considered stand replacement fires).
Stewardship	Caring for the land and its resources in order to pass healthy ecosystems on to future generations.
Subsoiling	Mechanical lifting and shattering of the layer of soil beneath the topsoil in order to reduce soil density and strength, improve moisture infiltration and retention, and increase root penetration in the soil.
Suitability	The appropriateness of certain resource management to an area of land. Suitability can be determined by environmental and economic analysis of management practices.
Sustainability	The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.
Sustainable	The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable. Recreation activities are sustainable if the human activity does not reduce ecologic sustainability.
Taxa	The name applied to any one group or entity in the scientific classification system.
Temporary Road	A road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or a forest trail and that is not included in a forest transportation atlas.
Thermic	A soil with a mean annual soil temperature of greater than or equal to 15 degrees centigrade, but less than 22 degrees centigrade and a difference between the mean summer and winter soil temperatures of greater than 5 degrees centigrade measured at 50 cm below the surface.
Threatened Species	Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.
Threshold of Concern	The level of watershed disturbance which, if exceeded, could create adverse watershed or water quality effects, in spite of application of best management practices and project design criteria.
Understory	The trees and woody shrubs growing beneath branches and foliage formed collectively by the upper portions of adjacent trees.

Unroaded Area	Any area, without the presence of a classified road, of a size and configuration sufficient to protect the inherent characteristics associated with its roadless condition. Unroaded areas do not overlap with inventoried roadless areas.
Vegetation Burn Severity	The effect of a fire on vegetation, often described by the degree of scorch, consumption, and mortality of vegetation. Vegetation burn severity is measured by classes of canopy mortality or basal area loss.
Visual Quality	The forest visual resources; terrain, geological features, or vegetation.
Water Quality Objectives	Water quality objectives, as listed in the Basin Plan of the California Central Valley Regional Water Quality Control Board, are the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water.
Watershed	An area of land above a given point on a stream that contributes water to the streamflow at that point.
Watershed Sensitive Areas (WSAs)	Portions of watersheds determined to be at high risk of soil erosion and sedimentation due to the combined effects of fire and proposed activities. Criteria for evaluating WSAs include: proposed recovery activities, burn severity, percent slope, slope shape, slope length, existing and potential soil cover, proximity to intermittent and perennial drainages, and proximity to high runoff response soils.
Wetlands	Areas that are inundated by surface or ground water with a frequency sufficient to support (and that under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.
Wild and Scenic River	A river that is either already designated or proposed for designation because of its free flowing condition and outstanding remarkable values.
Wildland	An area in which development is essentially non-existent, except for roads, railroads, powerlines and similar transportation facilities.
Xeric	A soil moisture regime common to Mediterranean climates that have moist cool winters and warm dry summers. A limited amount of water is present but does not occur at optimum periods for plant growth.
Yarding	Bringing sawlogs or biomass to a central location for removal from a treatment area.

D. Research

The Rim fire presents a rare and compelling opportunity to investigate a number of key management questions that have challenged land managers for decades. The response of the ecosystem after such a large and intense fire raises many critical questions: how do different wildlife species respond, how do riparian systems recover, what are the ecological effects of varying levels of salvage treatments, what sort of fuels hazards remain, what management strategies can effectively control hillslope erosion, and how can restoration efforts today meet present-day restoration needs while setting the course for desired forest conditions decades into the future. By the same token the Forest Service also has the opportunity to evaluate the efficacy of various prior forest management strategies that were intended to reduce the risk of just such a fire. Some areas within the footprint of the fire had plots where extensive data were collected prior to the fire. Records of treatments exist that also can be used in follow up research. Collaborating with the staff in Yosemite National Park provides expanded opportunities to examine pre and post-fire conditions and attending management strategies.

Following is an integrated package of proposed studies and activities that will investigate key questions related to fireshed management and landscape restoration after a mega-fire. Scientists at the Pacific Southwest Research Station (PSW) developed this research agenda in collaboration with the the Stanislaus National Forest and research partners at multiple universities and other government agencies. They can be implemented as stand-alone projects, but they were designed as an integrated research approach, including integrated sampling design, treatment, data collection, and analysis elements.

The following research projects are proposed to be implemented for Alternatives 3 and 4:

1. Landscape fuel treatment effectiveness in the 2013 Rim Fire: a spatially explicit assessment of treatment impacts on fire severity patterns.
2. Effect of varying salvage and re-planting intensities on the fuel complex and native/non-native species abundance over time.
3. Forest resilience after large high-severity wildfire: effects of salvaging logging and green tree proximity on forest recovery and wildlife habitat.
4. Western Pond Turtle Survival and Habitat Use Following the Rim Fire.
5. Addressing levels of post-fire snag removal on Black-backed woodpecker nesting and foraging behavior.
6. Assessing the Response of California Spotted Owls to Wildfire and Salvage Logging on the Rim Fire.
7. Assessing the Response of Great Gray Owls to Wildfire and Salvage Logging on the Rim Fire.
8. Modeling the regional impacts of large-scale wildfire and subsequent restoration efforts on Pacific fisher habitat.
9. Effects of Salvage and Watershed Treatments on Hillslope Erosion
10. Effects of Salvage and Erosion Mitigation on Small Watershed Response
11. Effects of Salvage and Watershed Treatments on Riparian Conditions
12. Develop an online interface to the WEPP technology for prediction erosion risk after salvage logging and effects of various mitigation treatments on reducing that risk

The following descriptions provide information about each research proposal including:

- Research and/or management questions to be addressed
- Anticipated management implications
- A brief description of the sampling design and analysis
- Timeframe for project completion

1. Landscape fuel treatment effectiveness in the 2013 Rim Fire: a spatially explicit assessment of treatment impacts on fire severity patterns

The 255,000 acre 2013 Rim Fire in the Sierra Nevada created a unique opportunity to study fuels treatment effects across a large landscape. Nearly two-thirds of the total burned area was in mixed-conifer forest, which was relatively evenly divided between Yosemite National Park (YNP) and the Stanislaus National Forest (STF). A considerable portion of the mixed-conifer dominated area was treated for fuels reduction/restoration (~ 18,863 ac. within YNP and 17,222 ac. within STF). This includes prescribed fire and managed wildfire, mechanical thinning (including mastication), and combinations thereof. These treatments have been applied in various sizes, shapes, spatial arrangements, and conditions resulting in a range of severities (proportions of fuels removed), frequencies, and time since last treatments. This project leverages several existing datasets and on-going research for a comprehensive investigation on how fuel treatments affect fire severity and resulting forest structure.

This proposed project will answer the following questions

- How does the amount and configuration of fuels treatments across landscapes influence severity for subsequent large wildfires?
- How does the answer to the question above vary with characteristics of fuels treatments (i.e., type, intensity, age, spatial pattern), climatic variables (i.e., fire danger rating), or environmental (i.e., terrain, fuel type) conditions?
- How can landscape fuels treatment strategies maintain effectiveness over time?

Anticipated management implications

Modeling studies suggest that certain arrangements of fuels treatment across landscapes can affect the spread and/or severity patterns of wildfires. However, the effects of location, size, type, and configuration of fuels treatments on the patterns of real wildfires at landscape scales remains poorly documented and understood. It is also largely unknown if and how fuels treatments retain effectiveness under the influence of extreme fire weather, and to what extent effectiveness is influenced by suppression operations, antecedent climate conditions, previous wildfires, land use, and existing vegetation. This information is needed to prioritize fuel treatments that have the highest probability of minimizing undesirable fire behavior and effects, and to implement strategically placed treatments where their effects can extend beyond their physical footprint. This project will provide critical information on mitigating effects of large wildfires that will compliment much of the previous work which has been based primarily on fire modeling. This information will be particularly valuable for informing the design of fuels treatment projects, which are being called for at greater pace and scale in dry forest types throughout the western United States.

Sampling Design and Analysis

This study will primarily utilize existing remote sensing and other geospatial data that span the entire Rim Fire area. In addition, there will be field data collection focused on capturing a range of treatment types/ages and severities. The intent with these data is to ground-truth/validate remotely sensed estimates of fire severity across a range of stand and vegetation type conditions. Sampling will be focused on re-visiting existing plots. Based on initial investigation there are approximately 350 field plots within the fire perimeter that were established prior to the fire. These plots were established by YNP and university partners affiliated with project PI (Collins). Some of the richest sources of field data included 204 forest structure/inventory plots, all of which were established within six weeks prior to Rim Fire ignition date. The specific number of existing plots that are in previously treated areas is unknown at this time, but will be determined by the start of this project. Researchers will attempt to re-sample all existing plots that were in treated areas. This will allow for explicit characterization of change as a result of the Rim Fire and strengthen inferences made with remote sensing data.

Researchers will explicitly investigate the spatial aspects of whether/how treatments modified fire rate of spread and severity. To do so, a randomized, moving window approach within GIS will be employed and will identify focal areas, within which fire severity, fuel treatment characteristics, and other vegetation and weather covariates will be quantified. This approach of stratified, randomized focal area selection will be automated within ArcGIS to allow for sufficient samples sizes within each stratum, at each focal window size, but balances the potential for *n*-inflation.

Researchers will also perform a separate analysis focused on treatment units to assess potential treatment effects as a function of distance both within a treated area and on the lee-side of treatment. GIS will be used to extract fire severity, fuel treatment characteristics, and other vegetation and weather covariates within transects intersecting treatments units. These transects will be oriented in the direction of fire spread, and will start outside of treatment on windward side and extend beyond the treatment boundary to the leeward side. The intent of this analysis is to investigate potential distance lags in the modification of fire spread and severity as fires encounter treatments, as well as potential leeside effects of treatment outside of treated areas.

Study duration

The proposed project will be a collaborative effort between YNP, UC Berkeley, and PSW. The majority of the plot data collection, spatial analysis, and write-up of the final report will be conducted by PSW and UC Berkeley. The contribution from YNP will include plot data collection and compellation of spatial data, as well as assistance in interpreting results and writing the final report. Deliverables will be: 1) final report 2) geodatabase containing assembled spatial data layers, and 3) a journal publication. The duration of the project is approximately 2 years. Field data would be collected in the summer of 2014. Spatial analysis, which will incorporate the field data, would occur the following year. The write-up of the final report and preparation of a journal manuscript will take an additional 5 months.

2. Forest resilience after large high-severity wildfire: effects of salvaging logging and green tree proximity on forest recovery and wildlife habitat

Salvage logging is one of the most contentious issues in Forest Service management, yet there is scant research to help inform these debates from the fire-dependent forests where it is most needed. Wildfire size and severity has been increasing in much of the western U.S. and the recent Rim Fire, with its large size and contiguous areas of dead trees may be a new norm for wildland fire under changing climatic conditions. This research will examine how salvage logging and the size of high-severity patches effects key components of the recovering ecosystem. In a large part, burn area recovery will depend on dispersal of plants and wildlife from remnant islands of green forest. Does salvage hinder or help these processes? How do the size of dead tree patches and their proximity to live trees effect the abundance and diversity of plants and animals recolonizing high-severity landscapes?

This project will examine how salvage, and distance and orientation (aspect and prevailing wind direction) from green forest affect plant abundance and diversity, fuel conditions, and bird and small mammal communities. Sampling will be coordinated and use an integrated approach because of the strong linkage between vegetation, fuels and habitat conditions for facilitating or limiting plant and wildlife dispersal, and fire spread.

This proposed project will answer the following questions

- How does understory plant and tree regeneration decrease as the distance to green forest edge increases? Does this relationship change in areas that have been harvested for salvage?
- How does use of high severity patches by wildlife change as distance to green forest increases? Does this relationship change in areas that have been harvested for salvage?
- How do surface fuel loads vary as a function of salvage treatment and distance to green forest edge? Is there a relationship between surface fuel loads and understory plant/tree regeneration? How does variation in surface fuel loads influence use of burned habitat by wildlife?

Anticipated management implications

This research will address important management questions about ecological recovery in high-severity patches and the influence of green tree islands. For example, if wildlife use significantly decreases with distance from green edge, then managers can prioritize harvesting and replanting projects in areas of greatest need. This research addresses some of the contentious issues of wildlife response to salvage logging. California Spotted Owls are known to forage within high severity patches and foraging distance will depend on the availability of prey. Monitoring of avian populations will also provide important information regarding the impact of harvesting of dead trees on Black-backed Woodpeckers. In addition, this project will quantify vegetation recovery patterns across a large spatial extent, which will ultimately inform landscape-scale restoration efforts for this and other large fires in similar forest types.

Sampling Design and Analysis

Researchers will use transects to measure live and dead vegetation and habitat use by wildlife species. Two hundred transects will be placed within patches of fire that burned at high severity. Transect length will be dependent on the size of the patch and will originate within the green forest and finish at the center of the patch. Live and dead vegetation will be sampled every 30 meters using standard protocols. Wildlife will be monitored on each transect. Birds will be surveyed using point counts every 250 m with three visits to each point during the breeding season. Small mammal populations will be measured using live trapping mark-recapture techniques along each transect. Fuels will be measured with standard methods and potential fire behavior will be modeled from these data. Two years of field sampling are requested to follow temporal changes.

Study duration

After one year produce a General Technical Report of project results and convene a workshop for forest managers. After the second year, at least two papers will be submitted to peer-reviewed journals and conduct outreach through venues such as a webinar with the California Fire Science Consortium.

3. Effect of varying salvage and re-planting intensities on the fuel complex and native/ non-native species abundance over time

Salvage harvesting trees after high severity wildfire is highly controversial, in part because so little is known about short- and long-term effects. Much of the current understanding about snag, fuel, and understory dynamics in relation to salvage comes from observational and un-replicated studies and/or is based on short-term observations. The only replicated study of different levels of salvage is one described in Ritchie et al. (2013), within the Cone Fire in ponderosa pine dominated forests of the southern Cascades. Because rates of snag fall and fuel development varies with tree species, understory species, and site-specific factors such as climate that influence rates of decay, additional studies in different forest types are needed.

Snags provide food and shelter for cavity nesting birds, including various woodpecker species. Snags are some of the only vertical structure left in stands killed by fire. However, the snag phase is also transient, and within four to ten years, many snags fall to the ground and become fuel. Once on the ground, the dead woody fuel along with a developing shrub layer makes any young trees that establish susceptible to mortality in the event of another wildfire. Salvaging some of the wood may help increase chances that young trees will survive subsequent wildfires. The challenge is balancing short- and long-term objectives, providing some snags for wildlife without generating excess future fuels and potentially reducing the resilience of young stands. Salvage is also an additional soil disturbance in an already fire-disturbed system, thereby increasing the probability of invasion by exotic weedy species, potentially setting back the native re-sprouting species, and killing newly germinating tree seedlings. The Cone Fire salvage study found no effect of salvage treatment on exotic weedy species or tree seedlings, but this was only one site, with one suite of understory plants.

In the past, replanting after high-severity fire has frequently been done at a relatively even spacing. Such spacing differs from the documented structure of historical frequent-fire forests, consisting of individual trees, clumps of trees and openings - a structure which may enhance resilience to drought and fire. Dense brush and high fuel continuity contributed to the loss of many such plantations in the Rim Fire. Given that budgets for treating fuels in planted stands are likely to remain limited, new planting strategies that reduce the cost of maintaining resilience need to be tested. Because of the suppressing effect of shade on shrubs, a variable planting might also lead to a variable shrub understory, breaking up the fuel complex and reducing fire hazard with less intensive management.

This proposed project will answer the following questions

- How long do fire-killed trees remain upright as snags?
- How does the rate at which snags become fuel vary with tree species, tree size, and other local factors?
- Do salvage operations affect overall understory biodiversity and does logging disturbance facilitate invasion by non-native species?
- Do salvage operations positively or negatively affect rates of natural tree regeneration? and
- How does different spacing of planted tree regeneration affect tree survival, growth and resilience of the stand to future fire?

Anticipated management implications

Results of this study will improve the understanding of the longevity of snags, and the effect of salvage on fuel loading and understory development. Results will also provide information about replanting patterns that could reduce maintenance costs while simultaneously improving stand resilience.

Sampling Design and Analysis

Researchers will evaluate four levels of salvage (5 acre units) in a randomized complete block design. Treatments will be: unsalvaged, approx. 1/3 of basal area salvaged, approx. 2/3 of basal area salvaged, and 100% salvaged. [The two intermediate levels may be refined somewhat, based on input from the NFS and other researchers.] Treated units will be placed in close proximity to each other (with some buffer), within patches of complete tree mortality with otherwise relatively uniform species composition and topography. Four to five such blocks, each containing all four salvage levels, will be installed. At the time of re-planting, each unit will be divided into thirds and randomly assigned a planting treatment – unplanted, even spacing at the standard density, and variable spacing using the same number of trees but planting in dense patches, gaps, and more widely spaced individuals. The latter design will be based on the spatial scale and variability found historically within forests on the Stanislaus NF.

Plots will be established to sample approximately 10% of the area within each unit, using a grid of spatially referenced and marked points and circular plots of diameter depending on the variable being measured. Snags will be tagged, species, diameter, and height measured. Shrub cover and herbaceous species cover will be quantified by species. Density of natural regeneration will be determined. Planted seedlings will be mapped in relation to grid points, and height and condition noted. Fuel load will be estimated using two Brown's transects at each grid point. Data will be collected prior to salvage and in the two summers immediately following salvage.

Study duration

This study would be set up for the long term. Three years will allow us to set up the experimental design, collect pre-salvage stand data, and evaluate the initial response of understory vegetation and the fuel complex. Three years is well before many of the snags are expected to fall and become fuel, and before planted tree seedlings are large enough to influence competing vegetation. With a solid experimental design in place, the opportunity to leverage the initial investment through grant proposals to fund longer-term data collection will exist. Ultimately, data will likely be collected within the experimental units for decades.

4. Western Pond Turtle Survival and Habitat Use Following the Rim Fire

Western pond turtles (*Actinemys marmorata)* are currently a species of special concern in California and a candidate for federal listing. The range of this species has declined by 75-80% in the last 50 years. Most work done on this species to date has focused on populations in river systems. To date, few studies have examined the ecology of populations in ephemeral or intermittent ponds. Despite being highly aquatic, western pond turtles may use terrestrial habitat for much of the year for nesting, overwintering, and summer aestivation, particularly in ephemeral wetlands, but little is known about their terrestrial activities and habitat use. There is increased interest in determining appropriate ways to manage for upland habitat to support functioning populations of this species.

Researchers are aware of no work on the impacts of fire on western pond turtles. The Rim Fire affected turtle populations using Abernathy Meadow and the Kibbie Ponds in the Stanislaus National Forest. These are ephemeral wetlands that dry up in most years (the Kibbie Ponds dry in less than average years while Abernathy Meadow dries each year by mid-summer) yet sustain viable turtle populations independent of other water sources. Some turtles did succumb to the fire but the full impact on these populations is unknown.

This proposed project will answer the following questions

- What are the effects of the Rim fire on western pond turtle populations?
- How many turtle mortalities resulted from the Rim Fire?
- What is the timing, duration, and extent of western pond turtle terrestrial movements?

Anticipated management implications

Results from this study will provide information on the impacts of fire on western pond turtle populations and will help inform land management decisions for post-fire management, particularly the importance of previously unrecognized terrestrial habitats. Data from this study will also provide information on population size, current age and sex distribution, movement patterns, and the importance and characteristics of upland habitat used by pond turtles. Results from this study will be used to determine the type of habitat and area surrounding these wetlands used by pond turtles. Results will be published in a peer-reviewed journal and presented at a scientific conference.

Sampling Design and Analysis

Turtles will be captured for data collection, marking, and radio tagging using baited hoop nets. For all captured turtles, researchers will record sex, age, morphometric data (carapace length, width, shell height, and mass), and evaluate health, body condition, and injuries. Turtles will be marked for individual identification by notching marginal scutes. Females will be palpated for eggs. Adults will be fitted with radio transmitters weighing 10 g, with a life expectancy of 10-18 months (Model RI-2B, Holohil Systems Ltd., Ontario, Canada), mounted to their costal carapace scutes. Transmitters will be affixed to the carapace using non-exothermic epoxy cement with the whip antennae trailing free. Only turtles with a mass $\geq$ 450 g will be fitted with radio transmitters. Turtles will be returned to the pond and released after application of transmitters.

Turtles will be tracked and located 2 times per week using hand-held receivers (Model R1000, Communication Specialists; Orange, California) and 3-element Yagi antennas. Once a turtle is located, its location and activity will be noted and a GPS location will be recorded for all upland observations. Habitat characteristics of upland sites will be recorded, including substrate, canopy cover, distance to water, slope, and aspect. Turtles will be disturbed only to the extent necessary to establish their locations. For terrestrial locations, this occasionally may require manual searching through leaf litter. Upon completion of the study, all tags and epoxy will be removed. Data from a mark-recapture study done from 1996-1999 are available to provide a baseline estimate of pre-fire population size. Researchers will estimate population size using a closed mark-recapture model in Program MARK.

Study duration

This research is intended to extend through two field seasons.

5. Addressing levels of post-fire snag removal on Black-backed woodpecker nesting and foraging behavior

The value of dead and dying trees to cavity nesting birds in recently burned forests is well-documented. In the Sierra Nevada, over 30 species of cavity users across several taxa provide services that are essential for ecosystem function, including seed dispersal and control of insect populations. Although several animal species are dependent on a high density of dead wood characteristic of burned forest, concerns over the dependence of the Black-backed Woodpecker (*Picoides arcticus)* on burned forests has fueled much of the debate surrounding post-fire snag removal in high severity burn areas.

The recently compiled *Conservation Strategy for the Black-backed Woodpecker* made several recommendations that would be of the greatest benefit in advancing efforts to ensure this species' persistence. In particular, the strategy stated that "Data are not yet available to provide specific guidelines on the density of retained snags necessary to support Black-backed Woodpecker occupancy and reproduction." By using an experimental design that will be implemented in the SNF, this data deficiency will be addressed by monitoring nesting and foraging behavior of Black-backed Woodpeckers at three levels of salvage (none, retaining 30 ft^2/ac and 120 ft^2/ac). The research will compare how the abundance of nesting and foraging birds differences at each level of salvage to determine if these factors are limited by the volume of tree retention. In addition, by collecting data of tree and habitat characteristics, the study will address whether it is the quantity or quality of the remaining standing trees that increases habitat suitability.

This proposed project will answer the following questions

An experimental design is proposed for implementation in California Spotted Owl PACs impacted by the Rim fire, to address how three levels of salvage (none, retaining 30 ft2/ac and 120 ft2/ac) impact nesting density of Black-backed Woodpecker and other cavity-nesting birds. Researchers will compare how the density of nesting birds – Black-backed Woodpeckers as well as other cavity-nesting birds - differs at each level of salvage within Spotted Owl PACs. This work will complement IBP's simultaneous project to assess Black-backed Woodpecker occupancy across the broader Rim Fire footprint with a more spatially intensive study of nesting habitat selection (rather than occupancy).

Results from this research will enable managers with guidance on levels of post wildfire salvage intensities that can safeguard black-backed woodpecker populations in California. These analyses will provide useful information on how site-specific and fire-specific parameters influence black-backed woodpecker populations and use of habitat.

Anticipated management implications

One of the most controversial issues surrounding post-fire forest management is the treatment of standing dead trees. Dead or dying trees can contribute fuel to future fires and can pose a risk to human life or property when they fall. In many areas, post-fire harvest of dead and dying trees is conducted to reduce these risks and to realize economic benefits. This research will address important management questions related to the levels and types of snag retention that can provide suitable habitat for Black-backed Woodpeckers.

Sampling Design and Analysis

Monitor cavity use and foraging behavior of Black-backed Woodpeckers in 44, 200-ha areas that are part of a planned experiment to investigate the impact of different levels of dead tree retention on California Spotted Owl occupancy. At each 200-ha area, identify all active Black-backed Woodpecker nests using standard nest searching protocols. Once nests are found, vegetation data will be collected on characteristics of the nest tree and habitat within an 11.3-radius fixed-radius plot surrounding the nest tree. Foraging data will be collected opportunistically and will include the foraging item and characteristics of the foraging substrate. Two years of field sampling are requested to follow temporal changes.

Study duration

After the first year, a general technical report of project results will be produced and a workshop convened for forest managers. After the 2nd year, at least two papers will be submitted to peer-reviewed journals and outreach through venues such as a webinar with the California Fire Science Consortium will be conducted.

6. Assessing the Response of California Spotted Owls to Wildfire and Salvage Logging on the Rim Fire

Increasing research suggests that California spotted owls (*Strix occidentalis occidentalis*) can occupy landscapes that experience low-moderate severity and mixed-severity wildfire. However, uncertainty persists regarding thresholds where the amounts and patch sizes of high severity wildfire affect California spotted owl occupancy within the post-fire landscape. Further, post-fire salvage-logging introduces additional effects that are poorly understood and can interact with amounts of post-fire habitat to affect California spotted owl occupancy and habitat use patterns.

This proposed project will answer the following questions

- What are the effects of wildfire, particularly high severity wildfire, and salvage-logging on California spotted owl site occupancy?
- How do California spotted owls use habitats of vegetation patches of different burn severities and salvage-logging intensities?

Anticipated management implications

Uncertainty regarding the effects of high-severity wildfire and post-fire management (salvage-logging) is certain to drive increasing challenges for forest managers in the Sierra Nevada given increasing trends in the amounts and patch sizes of high severity wildfire, coupled with evidence indicating declining CSO populations across the Sierra Nevada. This research will provide information to better understand the effects of wildfire and salvage-logging that can serve as an empirical basis to inform future management decisions.

Sampling Design and Analysis

Scientists from PSW and managers from the Stanislaus National Forest worked collaboratively on the study design to allocate 44 CSO sites affected by the Rim Fire into treatment groups (Figure 1). Sample units consist of 200ha circular core areas around the centroid (nest/main roost) for each of the 44 CSO sites. Sample units were arrayed across gradients of amount of post-fire suitable habitat and proposed salvage/road hazard tree treatment acres and then allocated to one of three treatment groups: (1) controls; (2) Light Salvage prescription (retain 100ft^2 BA); and (3) High Salvage prescription (retain 30 ft^2 BA).

Site Occupancy: Occupancy surveys will be conducted annually for 5 years beginning in 2014. Assuming a best case treatment schedule, salvage treatments will be initiated in late Fall 2014 and continue thru at least 2016. Two years of post-treatment surveys are needed to assess the effects of both wildfire and salvage-logging. Occupancy surveys will consist of 3 nocturnal visits and/or 2-3 diurnal visits to each site per year to record CSO detections and assess reproduction. Current research indicates information on reproductive status can improve detectability modeling and also provide information on reproductive output. Data will be analyzed using Program MARK. Explanatory covariates will include amounts and patch-size of high severity fire, amount of suitable post-fire habitat, salvage prescription and acres treated.

Radio-telemetry will be used to document habitat use and foraging behavior of CSOs during the five year period post-fire. The objective of this research is to determine CSO use of forest patches of differing fire severity and post-fire salvage treatments. The study will be adapted to utilize the specific timing and spatial implementation of treatments.

Study duration

The site occupancy component of the research will be conducted annually from 2014-2018. Survey work will be a collaboration between PSW and the Stanislaus National Forest. Radio-telemetry research will be conducted over a 3-year period between 2015 and 2018. The specific 3-years will be determined on the specific timing and spatial allocation of salvage treatments. Approximately 20 owls per year will be studied. The project will attempt to follow CSOs during the 6-month winter period. It is important to understand seasonal variation in habitat use and elevational movements as CSOs are facultative altitudinal winter migrants in the Sierra Nevada, apparently in response to winter snow and prey factors.

7. Assessing the Response of Great Gray Owls to Wildfire and Salvage Logging on the Rim Fire

The Sierra Nevada Great Gray Owl (GGOW) is a State-endangered species with a small population estimated at 100-200 pairs and a geographically-limited distribution in the central Sierra Nevada centered on Yosemite National park and the surrounding Stanislaus and Sierra National Forests. Recent population genetics collaborative research between UCD and PSW has determined that the geographically-isolated population of GGOWs in the Sierra Nevada warrants sub-specific recognition. PSW has been conducting research and monitoring this population of GGOWs nearly continuously since 2004. The Rim Fire burned x GGOW Protected Activity Centers on the Stanislaus NF. This represents x% of the known GGOW sites on the Stanislaus NF. An additional 10-12 known sites were burned within adjacent Yosemite National Park.

GGOWs have a unique suite of habitat requirements. Dense stands of forest that contain a large nest snag or live oak with a large cavity are used for nesting. Conifer nest trees average about 40” dbh while oak (black, valley) nest trees can be significantly larger. GGOWs forage primarily on voles and gophers in meadows or other early-seral vegetation (recent burns, timber cuts, open understories). Thus, depending on the initial habitat conditions and burn severity patterns, wildfire can have both negative and positive effects on GGOW habitat.

This research proposal has two primary objectives. First, to resurvey all historic sites on the Stanislaus NF and Yosemite National Park where we have pre-fire monitoring information to assess GGOW occupancy and relate these observations to amounts of habitat (pre- and post-fire) and wildfire severity. This will be followed by monitoring these sites for 3-4 years to assess effects of salvage-logging. This secondary objective will be to randomly select a sample of high-severity burn sites that contain mature forest in the near vicinity and conduct occupancy surveys to assess GGOW colonization of these recently burned sites. This previous research results lead us to hypothesize that GGOWs exhibit long-term site occupancy associated with more permanent meadow systems, but that there is also a more dynamic aspect to their population dynamics whereby GGOWs can persist over shorter time periods in proximity to ephemeral foraging habitat created by wildfire and other disturbances.

This proposed project will answer the following questions

- What are the effects of wildfire on Great Gray Owl habitat occupancy?
- What are the effects of salvage logging on Great Gray Owl habitat occupancy?

Anticipated management implications

Recent UCD/PSW research identifying the Sierra Nevada GGOW as a unique sub-species has increased management and socio-political focus on this population and its habitat. No research has extensively investigated the effects of wildfire and salvage logging on GGOWs. Controversy and focus on this population of GGOWs is certain to increase given their conservation status and the effects of the Rim Fire on a large proportion of known GGOW sites on the Stanislaus NF. This research will provide information to better understand the effects of wildfire and salvage-logging that can serve as an empirical basis to inform future management decisions.

Sampling Design and Analysis

Scientists and managers from PSW, the Stanislaus National Forest, and UCD will work collaboratively to identify new areas for GGOW inventory and survey. Known sites are well-documented and have been surveyed nearly every year between 2004-2013. Occupancy surveys will be conducted annually at known sites for 4 years beginning in 2014. Assuming a best case treatment schedule, salvage treatments will be initiated in late Fall 2014 and continue thru at least 2016. At the very minimum, one year (two years would be better) of post-treatment surveys will be conducted to assess the effects of both wildfire and salvage-logging. Occupancy surveys will consist of 3 nocturnal visits and/or 2-3 diurnal visits to each site per year. Previous work has estimated detection probabilities for each of the specific GGOW survey methods. Researchers will attempt to assess reproductive status at each site to evaluate its effect on detection probabilities. Further, ongoing research assessing the use of molted feathers, commonly collected in the field, as a source for genetically identifying individual GGOWs for mark-resight analysis to estimate lambda and survival. Hence, past and ongoing research can be leveraged to significantly expand the value and scope of the proposed work. Data will be analyzed using Program MARK.

Study duration

The site occupancy component of the research will be conducted annually from 2014-2017. These surveys will serve to sample known owl sites as well as to conduct NEPA-required post-treatment surveys in salvage-logging and road hazard tree areas to meet management objectives.

8. Modeling the regional impacts of large-scale wildfire and subsequent restoration efforts on Pacific fisher habitat

The southern Sierra fisher population is small, isolated, and of great regional conservation concern. Currently the population is under consideration for endangered species listing at both the state and federal level, and significant efforts are underway to identify critical habitat and develop conservation strategies. While the Rim Fire landscape does not currently contain resident fishers, it did represent the best expansion habitat for the existing population. The loss of mature forest habitat and connectivity associated with the Rim Fire represents an increase in the fisher population's isolation and in the need for regional-level habitat connectivity planning. The overall goal of this project is to evaluate the impact of the 2013 Rim Fire on available but currently unoccupied fisher habitat in the Sierra Nevada region, and to project the effects of alternative restoration scenarios on fisher habitat availability and connectivity within the central Sierra Nevada. Furthermore, this project highlights the need for large-scale restoration planning and the development of associated tools in the face of potential habitat loss from expected increases in fire extent and severity, as exemplified by the Rim Fire. Specific objectives include:

- Parameterize the Rocky Mountain Landscape Simulator (RMLands) for use in the Stanislaus National Forest region.
- Characterize the pre-fire vegetation structure and dynamics in the Rim Fire landscape, and quantify the impacts of the fire on fisher habitat availability and connectivity.
- Project alternative restoration scenarios, and the subsequent reestablishment of fisher habitat connectivity.

This proposed project will answer the following questions

- What are the impacts of the Rim fire on fisher habitat connectivity?
- What are the expected future habitat conditions associated with alternative restoration scenarios?
- How can research plan for wildlife habitat restoration in the face of future large-scale disturbances?

Anticipated management implications

RMLands is designed to characterize the range of future variation given a certain suite of landscape structure, dynamics, and disturbance. Variation can be characterized within specific structural features, such as mature forest connectivity, or as a function of species-specific habitat requirements. Therefore, the anticipated results will be:

- A comparison of the potential impact of different restoration scenarios on fisher habitat.
- A detailed sensitivity analysis quantifying the relative influence of different restoration components such as salvage logging or nucleation-based replanting on fisher habitat recovery rates.

It is anticipated that these deliverables would be used to help guide restoration in both the Rim Fire and future efforts. Also, once modified for use in the Sierra Nevada bioregion, the RMLands software could be used extensively for evaluating the impacts of large-scale disturbances and subsequent restoration planning throughout the region. Used in conjunction with FVS, it could facilitate effective multi-scale planning efforts.

Sampling Design and Analysis

- Compile RMLands input spatial data layers for the project area.
- Compile data on regional disturbance and succession processes, and conduct statistical analyses as necessary to guide model parameterization. Given the novel situation presented by the Rim Fire, parameterization will require a combination of empirical data and regional expert opinion.
- Design and simulate alternative restoration scenarios aimed at achieving desired future conditions and restoring habitat connectivity.
- Summarize model application and output.
- Integrate model output into regional conservation planning efforts.

Study duration

Study duration is approximately 10 months depending on the availability of funds, with final deliverables due 31 March, 2105.

9. Effects of Salvage and Watershed Treatments on Hillslope Erosion

Quantify effects of salvage and several mitigation treatments on hillslope soil erosion, relative to untreated burned areas, in areas that are at high risk of erosion following wildfire. The mitigation treatments are practices that forest managers have proposed to treat severely burned watersheds and mitigate effects of salvage, including mastication of dead trees, dropping and lopping dead trees, and “ripping” the soils along contours. All of these treatments are intended to increase soil cover on denuded hillslopes, encourage water infiltration, and reduce downstream runoff and erosion.

This proposed project will answer the following questions

- What are the effects of salvage logging on hillslope erosion?
- How effective are watershed mitigation treatments at increasing soil cover?
- How effective are watershed mitigation treatments at reducing hillslope erosion?

Anticipated management implications

This research would help to answer a long-standing question about the extent to which salvage harvest following wildfire further increases soil erosion, and whether mitigation can even make treatments beneficial in reducing extreme rates of erosion. This information will also help to evaluate downstream sedimentation impacts and potentially fine-tune hillslope erosion models to help managers predict future effects. Therefore, it will be valuable to managers facing similar decisions about post-fire salvage as well as treatment to reduce the likelihood of such fires.

Sampling Design and Analysis

The study will use silt fences to measure erosion rates in small (<0.5 acre) treated and untreated swales within areas of high soil burn severity. Site selection would be guided by local staff familiar with the soils, topography, and proposed treatments. Monitoring sites would be dispersed to account for variation across the landscape. The response variable would be sediment accumulation behind silt fences, constructed of silt cloth wired to t-posts. Sediment would be field weighed, subsampled for moisture content, and corrected for the weight of the water. Ideally, the fences would be cleaned out after every storm or series of storms, but this may depend on site access. Tipping bucket rain gages and snow gages would be used to measure local precipitation totals and intensities.

Study duration

Silt fences would be constructed in 2014 after the ground-disturbing activities are completed. The study would last for two to three years, depending on recovery rates at the sites. Local forest personnel are expected available to maintain the silt fences and monitor precipitation, in which case the primary cost will be for project set-up, data analysis, and writing.

10. Effects of Salvage and Erosion Mitigation on Small Watershed Response

Quantify effects of salvage logging and erosion mitigation treatments on hillslope erosion, sediment yield and peak discharge at the small watershed scale that are at high risk of degrading water quality. This project would evaluate salvage logging alone, and in combination with proposed mitigation treatments (mastication and contour ripping) on small watershed response.

This proposed project will answer the following questions

- What are the effects of salvage logging on hillslope erosion, sediment yield and peak discharge at the small watershed scale?
- What are the combined effects of salvage logging and proposed watershed mitigation treatments on small watershed response?

Anticipated management implications

There is high interest and constant debate on efficacy of salvage logging as well as salvage logging mitigation treatments reduce the erosion risk. This research would help answer the questions on salvage and erosion mitigation at the most critical scale for forest managers, small catchments (10-20 acres). If there is no effect at this scale, it is unlikely to translate sediment increases in water reservoirs or affect downstream water quality. These results would provide guidelines of salvage effects, erosion mitigation on hillslope erosion rates, sediment yields from the 10-20 acre watersheds and effects on peak flow. Quantification of the total sediment yield (hillslope and channel processes) for this small-sized catchment would allow quantification and validation of the LIDAR measurements already underway. Therefore, this information on salvage effects would be valuable to managers facing similar salvage logging decisions as well as erosion mitigation effectiveness.

Sampling Design and Analysis

This study will use paired small catchment (10-20 acres) to measure total sediment yields, runoff and peak flow as well as small hillslope sediment fences to quantify hillslope contributions. Eight paired catchments (salvage, salvage with mastication, salvage with ripping, and control) with 2 reps of each treatment. Site selection within their proposal salvage units would be used to be sure to represent actual salvage conditions. Sheet metal sediment basins and weirs would be installed at each catchment and would be cleaned out after each major storm. Site and rain event data would also be collected in each catchment. Both the paired catchment sediment traps and hillslope sediment fences have been successes used on numerous fires to measure impacts on various erosion mitigation treatments and salvage effects.

Study duration

Sediment basins and weirs would be installed in 2014. Continuous monitoring would commence immediately after installation and continue for three years, as site in this region generally recover to significant erosion reduction in this timespan.

11. Effects of Salvage and Watershed Treatments on Riparian Conditions

Quantify effects of salvage and an erosion control method (contour ripping) on riparian conditions adjacent to flowing streams in watersheds that are at high risk of soil erosion following wildfire. In addition to evaluating effects on erosion, this study will compare fuel loading, vegetation recovery, effects on non-species, shading and temperature, and large woody debris loading to the streams. Measuring these response variables in treated areas will provide more a more integrated understanding of the effects of salvage in riparian areas.

This proposed project will answer the following questions

- How long do fire-killed trees remain upright as snags in riparian areas, and what tree attributes affect that longevity?
- How do salvage operations affect fuel loading and fire hazard in riparian areas over time?
- How do salvage operations affect loading of large woody debris to streams?
- Do salvage and contour ripping affect understory biodiversity and do they facilitate invasion by non-native species?

- Do salvage and contour ripping positively or negatively affect rates of natural tree regeneration?
- How do salvage and contour ripping affect soil movement into streams?
- How does salvage affect temperature in riparian areas and streams?

Anticipated management implications

Salvage has been proposed by forest managers as a means of reducing fuel loads and excessive loading of large woody debris to streams. Contour ripping has been used by forest managers in the region as an erosion control measure following wildfire. By evaluating a variety of important riparian attributes that would be affected by these treatments, the study will provide managers with essential knowledge when facing similar decisions about post-fire salvage. Both scientists and managers are divided about whether salvage in riparian areas is harmful or beneficial, and the potential to mitigate salvage using contour ripping is another hotly debated idea. This research would help to answer these critical questions about the extent to which fire salvage in riparian areas increases negative impacts to streams, and whether it provides benefits in terms of moderating fuel accumulations. Quantification of rill and channel erosion would be related to LiDAR data to groundtruth areas identified as erosion hotspots. The study areas would provide a long-term demonstration area of different treatment approaches, enabling future researchers to conduct retrospective analyses. Information from this study will also help to evaluate downstream sedimentation impacts and predict future effects of wildfires. Therefore, it will be valuable to managers and the public in understanding the impacts of high severity fires on important water resources.

Sampling Design and Analysis

Along eight streams, there will be a 300 m long control reach that extend 50 m wide on each side of the stream, to remain unsalvaged and untreated (60 acres total). There would be a similar 300 m long reach that is salvage logged, and a similar 300 m long reach with salvage logging plus contour ripping. Depending on treatment implementation, the control and treatment reaches could be interspersed. The study watersheds target perennial streams in watersheds located primarily on Forest Service lands that burned at high soil burn severity. Most drainages flow NE to SW and represent metasedimentary and granitic soils.

Soil Erosion

This component of the study will be similar to the hillslope erosion study, but monitoring would quantify rills and sediment plumes as they enter and leave the treatment areas adjacent to the streams. By combining information on soil erosion rates from this hillslopes, this study will help to calculate sediment loading to streams.

Riparian Vegetation and Dead Wood

This component of the study will parallel the upland study of effects of varying salvage on fuels and native/ non-native species abundance. In plots within treatment reaches, but outside of the erosion study reaches, research will establish plots to sample approximately 10% of the area within each unit, using a grid of spatially referenced and marked points and circular plots of diameter depending on the variable being measured. Snags will be tagged, species and diameter measured. Soil cover, shrub cover and herbaceous species cover will be quantified by species. Density of natural regeneration will be determined. Fuel load will be estimated using two Brown’s transects at each grid point. Temperature and relative humidity will be measured using Hobo data loggers.

Effects on Streams

The quantity and impacts of large woody debris that falls into streams will be monitored. In-stream temperature will be monitored using data loggers, and solar exposure will be measured. Gages would be used to measure local precipitation totals and intensities.

Study duration

Data will be collected before salvage and for two summers afterward. Erosion will be measured three times per year in conjunction with storms. The data will be collected in ways to track changes over long periods (decades) in the event of future reburns.

12. Modeling Erosion Risk after Salvage Logging, Adding an Interface to the WEPP Technology

Develop an online interface to the WEPP technology for prediction erosion risk after salvage logging and effects of various mitigation treatments on reducing that risk. This interface would allow managers to directly compare salvage activities with and without proposed erosion reduction mitigation treatments.

This proposed project will answer the following questions

The USDA - Water Erosion Prediction Project (WEPP) model represents a new erosion prediction technology based on fundamentals of stochastic weather generation, infiltration theory, hydrology, soil physics, plant science, hydraulics, and erosion mechanics. The hillslope or landscape profile application of the model provides major advantages over existing erosion prediction technology. The most notable advantages include capabilities for estimating spatial and temporal distributions of soil loss (net soil loss for an entire hillslope or for each point on a slope profile can be estimated on a daily, monthly, or average annual basis), and since the model is process-based it can be extrapolated to a broad range of conditions that may not be practical or economical to field test. In watershed applications, sediment yield from entire fields can be estimated. With this additional information, researchers will be able to include the effects of salvage logging into the predictive capabilities of the WEPP model.

Anticipated management implications

There is a significant amount of time and effort to quantify the effects of salvage logging on hillslope erosion, runoff, sediment yield and peak flow following major wildfires in the Western US. A land managers' user-friendly interface to the WEPP model would be developed as part of this proposal. WEPP is a process-based model that predicts runoff and sediment yields from hillslopes and small watersheds. This model would allow comparisons of salvage logging with and without mitigation treatments on erosion, runoff, sediment yield and peak flow.

Sampling Design and Analysis

Research would build on existing technology of FSWEPP interfaces that are currently in wide use within and outside of the agency (http://forest.moscowfsl.wsu.edu/FSWEPP). Management files from past salvage monitoring activities (Hayman, Red Eagle and Kraft Springs Fires) combined with active monitoring on this fire would allow for proper parameterization and calibration of the model. Selected storm response from this salvaged fire activities would be used for validation.

Using DEMs and smaller raster inputs files (soils, land cover, burn severity) combined with salvage disturbance for generating erosion risk maps with and without mitigation. Climate data input files are generated from the Forest Service RockClime weather generator. The resulting erosion risk predictions maps will be displayed tabular form and in the Google Earth platform for ease in use of identifying areas with high erosion potential.

Study duration

Model interface development would occur over an 18-month period with an identified post-doc who have proper modeling experience. Oversight will be by the cooperating university professor and agency's scientist. Validation would occur during the last 4 months of the project with data from this salvage monitoring activities.

E. Treatments

This Appendix provides detailed information about the treatments described in Chapter 2.01 and proposed in the action alternatives 1, 3 and 4 (Chapter 2.02). Appendix E.01 provides detailed information about the application of the primary objectives described in Chapter 2.01 and Table 2.01-1. Appendix E.02 provides detailed information about salvage and biomass treatments. Appendix E.03 provides detailed information about the additional fuels treatments proposed in Alternative 3 and Alternative 4. Appendix E.04 provides detailed information about the additional watershed treatments proposed in Alternative 3 and Alternative 4. Appendix E.05 provides detailed information about the road treatments.

E.01 PRIMARY OBJECTIVES

Treatment units and unit primary objectives vary between the action alternatives. Chapter 2.01 and Table 2.01-1 provide more details for the primary objectives listed below.

Primary Objectives

1. **Economic Value**: Capture the economic value of hazard trees and dead trees which pays for their removal from the forest and potentially for other future restoration treatments.
2. **Public and Worker Safety**: Remove dead and dying hazard trees adjacent to Forest Roads and project access areas. This primary objective also includes the health and safety of workers and permittees during range fence installation and maintenance.
3. **Fuel Reduction**: Reduce fuels to provide for future forest resiliency and firefighting safety and success. Additional treatments in SPLATS and Defense Zones.
4. **Enhance Hydrologic Function**: Improve road infrastructure to enhance hydrologic function of roads. This only applies to roads so it will not be displayed in Table E.01-1 which displays unit acres.
5. **Enhance Wildlife Habitat**: Retain specific old forest components (large snags and down logs) and/or remove material to improve wildlife habitat.
   a. **Deer Habitat Improvement**: Removal of dead trees (commercial and non-commercial) for movement and access, and to achieve desired forage/cover ratios
   b. **Snag Retention**
6. **Research**: Utilize the unique scale and intensity of the Rim Fire to answer questions and provide more information on a wide range of research topics.

Table E.01-1 displays the unit number, acres and primary objectives for each harvest unit as proposed in the action alternatives.

Table E.01-1 Primary Objectives for Treatment Units in Alternatives 1, 3 and 4

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
A01A	7	1						
A01B	143	1,2	A01B	143	1,2,5b			
A02	8	1,2						
A03	86	1,2	A03	55	1,2,5b			
A04	21	1	A04	21	1,5b			
A05	672	1,2						
			A05A	293	1,2,5b			
			A05B	25	1,5b			
			A05C	85	1,2,5b	A05C	85	1,2,5b
A08A	155	1,2	A08A	111	1,2,5b	A08A	111	1,2,5b
A08B	14	1,2						
A08C	33	1,2	A08C	18	1,5b	A08C	18	1,5b
A08D	28	1						
A09	53	1	A09	81	1,5b	A09	81	1,5b
A10	112	1,2						
A14	7	1	A14	8	1,3,5b	A14	8	1,3,5b
			A14X	2	1,3,5b,6	A14X	2	1,3,5b,6
A15	22	1	A15	22	1,3,5b,6	A15	22	1,3,5b,6
B01A	3	1						
B01B	9	1						
B02	60	1,2	B02	63	1,2	B02	63	1,2
B03	18	1	B03	18	1	B03	18	1
B21	4	1	B21	4	1	B21	4	1
B22	27	1	B22	8	1	B22	8	1
			B22X	19	1,5b,6	B22X	19	1,5b,6
B23	100	1,2	B23	100	1,2	B23	100	1,2
B24	87	1						
			B24X	87	1,5b,6	B24X	87	1,5b,6
B25	21	1,2						
			B25X	21	1,2,5b,6	B25X	21	1,2,5b,6
B32	62	1,2	B32	62	1,2	B32	62	1,2
B33	16	1						
C02	132	1,2	C02	86	1,5b	C02	86	1,5b
C03	39	1,2	C03	39	1,2,3,5b	C03	39	1,2,3,5b
C04	14	1,2						
			C04X	14	1,2,3,5b,6	C04X	14	1,2,3,5b,6
C05	10	1	C05	10	1,3,5b	C05	10	1,3,5b
C06	4	1,2	C06	4	1,2,3,5b	C06	4	1,2,3,5b
D01A	200	1,2	D01A	200	1,2,5b			
D01B	1	1	D01B	1	1,5b	D01B	1	1,5b
D01C	23	1,2	D01C	23	1,2	D01C	23	1,2
D01D	13	1,2	D01D	13	1,2	D01D	13	1,2
D01E	18	1	D01E	18	1	D01E	18	1
D02	108	1,2	D02	123	1,2,5b			
D03	26	1	D03	26	1,5b	D03	26	1,5b
D04A	32	1	D04A	32	1,5b	D04A	32	1,5b
D04B	345	1,2	D04B	345	1,2,5b	D04B	345	1,2,5b
D05	43	1	D05	22	1,5b	D05	22	1,5b
D06	16	1,2	D06	16	1,2,5b	D06	16	1,2,5b
D08	42	1,2	D08	42	1,2,5b	D08	42	1,2,5b
D09	63	1,2	D09	37	1,2,5b	D09	37	1,2,5b
D11	107	1,2	D11	107	1,2,3	D11	107	1,2,3

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
D12	408	1,2	D12	408	1,2,3	D12	408	1,2,3
D13	60	1,2	D13	150	2,3	D13	150	2,3
E01A	75	1	E01A	75	1			
E01B	719	1,2	E01B	719	1,2,3			
E02	112	1,2	E02	112	1,2			
E03A	174	1,2	E03A	174	1,2	E03A	174	1,2
E03B	157	1,2	E03B	190	1,2	E03B	190	1,2
E04	72	1,2	E04	72	1,2,3	E04	72	1,2,3
E05	10	1	E05	10	1	E05	10	1
E06	44	1,2						
F01	135	1	F01	196	1,5b,6	F01	196	1,5b,6
F02A	526	1,2	F02A	604	1,2,5b,6	F02A	604	1,2,5b,6
F02B	34	1,2	F02B	34	1,2,5b	F02B	34	1,2,5b
F03	58	1	F03	58	1,5b	F03	58	1,5b
F11	551	1,2	F11	551	2,3,5b	F11	551	2,3,5b
F12	157	1,2	F12	121	1,2,5b	F12	121	1,2,5b
F13	142	1	F13	177	1,5b	F13	177	1,5b
F14	158	1,2	F14	135	1,2,5b	F14	135	1,2,5b
F15	33	1,2	F15	33	1,2,5b	F15	33	1,2,5b
F16	69	1,2	F16	69	1,2,5b	F16	69	1,2,5b
F17	12	1,2	F17	12	1,2,5b	F17	12	1,2,5b
F18	51	1,2	F18	51	1,2,5b	F18	51	1,2,5b
F19	12	1,2	F19	12	1,2,5b	F19	12	1,2,5b
F20	127	1,2	F20	145	1,2,5b	F20	145	1,2,5b
F21	22	1	F21	22	1,5b	F21	22	1,5b
F22A	7	1	F22A	7	1,5b	F22A	7	1,5b
F22B	6	1	F22B	6	1,5b	F22B	6	1,5b
F23A	16	1	F23A	16	1,5b,6	F23A	16	1,5b,6
F23B	10	1,2	F23B	10	1,2,5b,6	F23B	10	1,2,5b,6
F23C	1	1	F23C	1	1,5b	F23C	1	1,5b
F23D	30	1	F23D	30	1,5b	F23D	30	1,5b
G01	106	1,2	G01	66	1,2,5b	G01	66	1,2,5b
			G01X	40	1,2,5b,6	G01X	40	1,2,5b,6
G02	5	1,2						
			G02X	5	1,2,5b,6	G02X	5	1,2,5b,6
G03A	131	1,2	G03A	131	1,2,5b	G03A	131	1,2,5b
G03B	119	1,2	G03B	119	1,2,5b	G03B	119	1,2,5b
G04	24	1,2	G04	24	1,2,5b	G04	24	1,2,5b
G05	23	1,2	G05	23	1,2,5b	G05	23	1,2,5b
G06	23	1,2	G06	23	1,2,5b,6	G06	23	1,2,5b,6
G07	2	1	G07	2	1,5b,6	G07	2	1,5b,6
G08	52	1,2	G08	24	1,2,5b	G08	24	1,2,5b
			G08X	29	1,5b,6	G08X	29	1,5b,6
G09	43	1,2	G09	43	1,2,5b,6	G09	43	1,2,5b,6
G10	6	1	G10	6	1,5b,6	G10	6	1,5b,6
G11	28	1,2						
			G11A	5	1,2,5b,6	G11A	5	1,2,5b,6
			G11B	7	1,2,5b,6	G11B	7	1,2,5b,6
			G11C	15	1,2,5b,6	G11C	15	1,2,5b,6
G12	10	1,2	G12	10	1,2,5b,6	G12	10	1,2,5b,6
G13	19	1,2						
			G13A	16	1,2,5b	G13A	16	1,2,5b
			G13B	5	1,2,5b	G13B	5	1,2,5b
G14A	6	1	G14A	6	1,5b,6	G14A	6	1,5b,6

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
G14B	6	1,2	G14B	6	1,2,5b,6	G14B	6	1,2,5b,6
G15	58	1,2	G15	95	1,2,5b	G15	95	1,2,5b
G25	60	1,2	G25	60	1,2,5b,6	G25	60	1,2,5b,6
G26	24	1,2	G26	24	1,2,5b,6	G26	24	1,2,5b,6
G35	3	1,2	G35	3	1,2	G35	3	1,2
H01	4	1,2	H01	4	1,2,3,5b	H01	4	1,2,3,5b
H02	9	1	H02	9	1,3,5b	H02	9	1,3,5b
H03	3	1,2						
H04	13	1						
H05	28	1						
H06	6	1,2	H06	34	1,2,5b	H06	34	1,2,5b
H07	2	1,2						
H08	26	1						
H09	6	1,2	H09	21	1,2,5b	H09	21	1,2,5b
H11	44	1,2	H11	27	1,2,5b	H11	27	1,2,5b
			H11X	17	1,2,5b,6	H11X	17	1,2,5b,6
H12	37	1,2	H12	6	1,2,5b	H12	6	1,2,5b
			H12X	31	1,2,5b,6	H12X	31	1,2,5b,6
H13A	103	1,2	H13A	54	1,2,5b	H13A	54	1,2,5b
			H13AX	52	1,2,5b,6	H13AX	52	1,2,5b,6
H13B	65	1,2	H13B	13	1,2,5b	H13B	13	1,2,5b
			H13BX	52	1,2,5b,6	H13BX	52	1,2,5b,6
K01	11	1,2	K01	11	1,2	K01	11	1,2
K02	132	1,2	K02	132	1,2	K02	132	1,2
L01	61	1,2	L01	39	1,2,5b	L01	39	1,2,5b
L02A	374	1,2	L02A	369	1,2,3,5b	L02A	369	1,2,3,5b
			L02AX	5	1,2,3,5b,6	L02AX	5	1,2,3,5b,6
L02B	715	1,2	L02B	275	1,2,3,5b	L02B	275	1,2,3,5b
			L02BX	215	1,2,3,5b,6	L02BX	215	1,2,3,5b,6
L02C	796	1,2	L02C	610	1,2,5b	L02C	610	1,2,5b
			L02CX	185	1,2,5b,6	L02CX	185	1,2,5b,6
L02D	257	1,2	L02D	257	1,2,5b	L02D	257	1,2,5b
			L02E	62	1,2,5b	L02E	62	1,2,5b
			L02F	185	1,2,3,5b	L02F	185	1,2,3,5b
L03	31	1,2,5a	L03	31	1,2,5a,5b	L03	31	1,2,5a,5b
L04	79	1,2	L04	79	1,2,5b	L04	79	1,2,5b
L05A	9	1,2						
			L05AX	9	1,2,5b,6	L05AX	9	1,2,5b,6
L05B	17	1						
			L05BX	17	1,5b,6	L05BX	17	1,5b,6
L06	10	1,5a						
L07	5	1,2,5a	L07	5	1,2,5a,5b	L07	5	1,2,5a,5b
			L201	92	5a,5b	L201	92	5a,5b
L202	142	2,5a	L202	142	2,5a,5b	L202	142	2,5a,5b
			L203	695	2,5a,5b	L203	695	2,5a,5b
L203A	152	2,5a						
L203B	113	2,5a						
			L204	1519	2,5a,5b	L204	1519	2,5a,5b
L204A	55	2,5a						
L204B	32	2,5a						
L205	140	2,5a	L205	756	2,3,5a,5b	L205	756	2,3,5a,5b
L206	138	2,5a	L206	81	2,5a,5b	L206	81	2,5a,5b
M01	701	1,2	M01	701	1,2,5b,6	M01	701	1,2,5b,6
M02A	110	1,2	M02A	141	1,2,3,5b,6	M02A	141	1,2,3,5b,6

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
M02B	3	1,2						
M02C	10	1	M02C	30	1,5b,6	M02C	30	1,5b,6
M04A	254	1,2	M04A	260	1,2,5b	M04A	260	1,2,5b
M04B	4	1,2	M04B	13	1,2,5b	M04B	13	1,2,5b
M04C	10	1	M04C	15	2,5b	M04C	15	2,5b
M05A	34	1	M05A	34	1,3,5b	M05A	34	1,3,5b
M05B	245	1,2	M05B	120	1,2,3,5b	M05B	120	1,2,3,5b
			M05C	24	2,3,5b	M05C	24	2,3,5b
			M05D	76	1,2,3,5b	M05D	76	1,2,3,5b
			M05E	21	1,2,3,5b	M05E	21	1,2,3,5b
			M05F	39	1,3,5b	M05F	39	1,3,5b
			M05G	11	1,3,5b	M05G	11	1,3,5b
M06	97	1,2	M06	97	1,2,5b	M06	97	1,2,5b
M07	21	1,2	M07	21	1,2,5b	M07	21	1,2,5b
M08A	98	1,2	M08A	98	1,2,5b	M08A	98	1,2,5b
M08B	33	1,2	M08B	29	1,2,5b	M08B	29	1,2,5b
M08C	11	1,2	M08C	11	1,2,5b	M08C	11	1,2,5b
M08D	27	1,2	M08D	27	1,2,5b	M08D	27	1,2,5b
M08E	3	1	M08E	8	1,5b	M08E	8	1,5b
M09	211	1,2	M09	224	1,2,5b,6	M09	224	1,2,5b,6
M10	71	1,2	M10	71	1,2,5b	M10	71	1,2,5b
M12	15	1	M12	12	1,2,5b	M12	12	1,2,5b
M13	10	1,2	M13	10	1,2,5b	M13	10	1,2,5b
M15	28	1	M15	28	1,2,5b	M15	28	1,2,5b
M16A	10	1	M16A	10	1,2,5b	M16A	10	1,2,5b
M16B	86	1,2	M16B	86	1,2,3,5b	M16B	86	1,2,3,5b
M18	58	1,2	M18	58	1,2,3,5b	M18	58	1,2,3,5b
M19	27	1,2	M19	27	1,2,5b	M19	27	1,2,5b
			M20	15	1,2	M20	15	1,2
M201	50	2,5a	M201	74	2,5a,5b	M201	74	2,5a,5b
			M202A	117	1,2,5a,5b	M202A	117	1,2,5a,5b
			M202B	21	1,2,5a,5b	M202B	21	1,2,5a,5b
			M203	63	1,2,5a,5b	M203	63	1,2,5a,5b
			M204	282	1,2,5a,5b	M204	282	1,2,5a,5b
N01	732	1,2						
			N01A	37	1,2,5b	N01A	37	1,2,5b
			N01B	13	1	N01B	13	1
			N01C	225	1,2,5b	N01C	225	1,2,5b
			N01D	14	1,5b	N01D	14	1,5b
			N01E	71	1,5b	N01E	71	1,5b
			N01F	2	1,5b	N01F	2	1,5b
			N01G	5	1,5b	N01G	5	1,5b
			N01H	49	1,5b	N01H	49	1,5b
			N01I	28	1,5b	N01I	28	1,5b
			N01J	21	1,2,5b	N01J	21	1,2,5b
N02	42	1,2						
			N02A	24	1,2	N02A	24	1,2
			N02B	5	1,2	N02B	5	1,2
N03	26	1,2	N03	26	1,2,5b	N03	26	1,2,5b
O01	11	1,2	O01	8	1,2,3,5b			
O02	472	1,2						
			O02A	262	1,2,3,5b			
			O02B	173	1,2,5b			
O03	46	1	O03	46	1,5b	O03	46	1,5b

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
O04	19	1	O04	32	1,5b			
O05	100	1,2	O05	100	1,2,5b			
O06	33	1	O06	33	1,5b	O06	33	1,5b
O07	48	1	O07	48	1	O07	48	1
O08	27	1	O08	27	1	O08	27	1
O09	10	1	O09	10	1	O09	10	1
O10A	14	1	O10A	14	1,3	O10A	14	1,3
O10B	6	1	O10B	6	1	O10B	6	1
O11A	27	1	O11A	27	1	O11A	27	1
O11B	39	1,2	O11B	39	1,2	O11B	39	1,2
O11C	15	1	O11C	15	1,3	O11C	15	1,3
O12	96	1	O12	96	1,3,5b			
O201	299	2,5a						
			O201A	156	2,5a,5b	O201A	156	2,5a,5b
			O201B	121	2,5a,5b	O201B	121	2,5a,5b
P201	185	1,5a	P201	185	1,5a,5b	P201	185	1,5a,5b
Q06	19	1,2	Q06	19	1,2,5b	Q06	19	1,2,5b
Q07	13	1,2	Q07	13	1,2,5b	Q07	13	1,2,5b
Q08	42	1,2	Q08	42	1,2,5b	Q08	42	1,2,5b
Q09	18	1,2	Q09	18	1,2,5b	Q09	18	1,2,5b
Q13	81	1	Q13	81	1,5b	Q13	81	1,5b
Q14A	397	1,2	Q14A	395	1,2,5b,6	Q14A	395	1,2,5b,6
Q14B	146	1	Q14B	146	1,5b,6	Q14B	146	1,5b,6
Q15	14	1,2	Q15	17	1,2,5b	Q15	17	1,2,5b
Q16	8	1	Q16	8	1,5b,6	Q16	8	1,5b,6
R01A	325	1,2	R01A	106	1,2,3,5b			
R01B	11	1,2	R01B	11	1,2,3,5b	R01B	11	1,2,3,5b
R02	36	1,2	R02	30	1,2,3			
R03	32	1,2						
R04A	52	1,2	R04A	52	1,2,3,5b,6	R04A	52	1,2,3,5b,6
R04B	41	1,2	R04B	41	1,2,3	R04B	41	1,2,3
R06A	9	1	R06A	12	1,3	R06A	12	1,3
R06B	24	1	R06B	21	1	R06B	21	1
R07	83	1,2						
			R07A	98	1,2	R07A	98	1,2
			R07B	19	1,2	R07B	19	1,2
R08	2	1						
R12	64	1	R12	8	1,5b	R12	8	1,5b
			R12X	56	1,5b,6	R12X	56	1,5b,6
R14	5	1,2						
R15	25	1	R15	66	1,3,5b	R15	66	1,3,5b
R16	98	1,2	R16	98	1,2,5b	R16	98	1,2,5b
R17	72	1,2						
			R17X	72	1,2,5b,6	R17X	72	1,2,5b,6
R18	100	1,2	R18	83	1,2,5b	R18	83	1,2,5b
			R18X	17	1,5b,6	R18X	17	1,5b,6
R19A	52	1	R19A	52	1,3,5b,6	R19A	52	1,3,5b,6
R19B	12	1,2	R19B	12	1,2,3,5b,6	R19B	12	1,2,3,5b,6
R19D	70	1,2	R19D	91	1,2,3,5b,6	R19D	91	1,2,3,5b,6
			R19DX	24	1,2,5b,6	R19DX	24	1,2,5b,6
R19E	4	1,2	R19E	4	1,2,5b,6	R19E	4	1,2,5b,6
R19F	5	1	R19F	11	1,2,5b,6	R19F	11	1,2,5b,6
R20	37	1	R20	50	1,5b,6	R20	50	1,5b,6
R22	28	1,2	R22	28	1,2,3,5b	R22	28	1,2,3,5b

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
R23	13	1,2	R23	13	1,2	R23	13	1,2
R24A	41	1,2	R24A	41	1,2,5b	R24A	41	1,2,5b
R24B	5	1,2						
R25	34	1,2						
			R25X	34	1,2,5b,6	R25X	34	1,2,5b,6
R31	140	1,2	R31	120	1,2,3,5b	R31	120	1,2,3,5b
			R31X	67	1,2,3,5b,6	R31X	67	1,2,3,5b,6
R32	30	1,2	R32	31	1,2,6	R32	31	1,2,6
R33	12	1,2						
			R33X	12	1,2,3,5b,6	R33X	12	1,2,3,5b,6
R35	26	1,2						
			R35A	10	1,2,3,5b	R35A	10	1,2,3,5b
			R35B	16	1,2,3,5b	R35B	16	1,2,3,5b
R36	15	1,2	R36	12	1,2,3,5b	R36	12	1,2,3,5b
R37	25	1,2	R37	25	1,2,5b	R37	25	1,2,5b
R38	20	1,2	R38	20	1,2,3	R38	20	1,2,3
R39	3	1	R39	3	1,2,3,5b	R39	3	1,2,3,5b
			R40A	32	2,3,5b	R40A	32	2,3,5b
			R40B	52	2,3,5b	R40B	52	2,3,5b
S01	34	1	S01	53	1,5b	S01	53	1,5b
S02	135	1,2	S02	135	1,2,5b	S02	135	1,2,5b
S03	168	1,2	S03	168	1,2,5b	S03	168	1,2,5b
S04	284	1,2	S04	284	1,2,5b	S04	284	1,2,5b
S05A	46	1,2						
S05B	28	1,2	S05B	7	1,2,5b	S05B	7	1,2,5b
S05C	27	1						
S06	28	1	S06	28	1,3,5b	S06	28	1,3,5b
S08	81	1,2	S08	81	1,2,5b	S08	81	1,2,5b
S10	9	1	S10	9	1,3,5b	S10	9	1,3,5b
S11	25	1	S11	25	1,3	S11	25	1,3
T01	19	1	T01	19	1,3	T01	19	1,3
T02	33	1,2	T02	33	1,2,3	T02	33	1,2,3
T03	29	1,2	T03	29	1,2	T03	29	1,2
T04A	266	1,2	T04A	266	1,2,3	T04A	266	1,2,3
T04B	904	1,2	T04B	904	1,2,3	T04B	904	1,2,3
T04C	77	1	T04C	101	1,3	T04C	101	1,3
T04D	9	1	T04D	9	1,3	T04D	9	1,3
T04E	2	1	T04E	2	1,3	T04E	2	1,3
T20	9	1	T20	9	1,3	T20	9	1,3
T21A	3	1,2						
T21B	18	1	T21B	18	1,3,5b	T21B	18	1,3,5b
T22	16	1,2	T22	18	1,2,5b	T22	18	1,2,5b
T23	82	1,2	T23	28	1,2,5b	T23	28	1,2,5b
			T23X	54	1,2,5b,6	T23X	54	1,2,5b,6
T24	151	1,2	T24	154	1,2,3,5b	T24	154	1,2,3,5b
T25	32	1,2	T25	6	1,2	T25	6	1,2
			T25X	26	1,2,5b,6	T25X	26	1,2,5b,6
T26	15	1,2	T26	15	1,2	T26	15	1,2
T27A	1075	1,2	T27A	926	1,2,3,5b	T27A	926	1,2,3,5b
			T27AX	150	1,2,3,5b,6	T27AX	150	1,2,3,5b,6
T27B	953	1,2	T27B	573	1,2,3	T27B	573	1,2,3
			T27BX	360	1,2,3,6	T27BX	360	1,2,3,6
			T27C	97	1,2,3	T27C	97	1,2,3
T28	44	1,2						

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
U01	775	1,2						
			U01A	3	1,2	U01A	3	1,2
			U01B	26	1,2	U01B	26	1,2
			U01C	12	1	U01C	12	1
			U01D	617	1,2,3,5b,6	U01D	617	1,2,3,5b,6
			U01DX	33	1,2,5b,6	U01DX	33	1,2,5b,6
U02	65	1,2	U02	56	1,2	U02	56	1,2
U03	347	1,2	U03	320	1,2,3	U03	320	1,2,3
V01	20	1	V01	20	1	V01	20	1
V02	17	1,2	V02	16	1,2	V02	16	1,2
V03	35	1,2	V03	25	1,2	V03	25	1,2
V04	15	1,2						
			V04A	2	1,2	V04A	2	1,2
			V04B	3	1,2	V04B	3	1,2
V05A	3	1,2						
V05B	7	1	V05B	6	1	V05B	6	1
V06	9	1	V06	4	1	V06	4	1
V10	50	1,2	V10	50	1,2,3	V10	50	1,2,3
V12A	9	1	V12A	9	1,3	V12A	9	1,3
V12B	16	1	V12B	16	1,2,3	V12B	16	1,2,3
V13	160	1,2	V13	119	1,2,3	V13	119	1,2,3
			V13X	69	1,2,3,5b,6	V13X	69	1,2,3,5b,6
V14A	15	1,2	V14A	15	1,2,3	V14A	15	1,2,3
V14B	382	1,2	V14B	382	1,2,3	V14B	382	1,2,3
V14C	70	1,2	V14C	70	1,2,3,5b	V14C	70	1,2,3,5b
V15	61	1,2	V15	61	1,2	V15	61	1,2
W01	51	1,2	W01	51	1,2	W01	51	1,2
W02	226	1,2	W02	226	1,2	W02	226	1,2
W03	21	1,2	W03	21	1,2,3	W03	21	1,2,3
W04	85	1,2	W04	74	1,2	W04	74	1,2
W05	51	1						
			W05A	3	1	W05A	3	1
			W05B	5	1	W05B	5	1
W06	63	1						
			W06A	13	1	W06A	13	1
			W06B	7	1	W06B	7	1
X01	21	1						
			X01A	8	1,3	X01A	8	1,3
			X01B	3	1,3	X01B	3	1,3
X02	43	1,2	X02	43	1,2,3	X02	43	1,2,3
X03	58	1,2	X03	58	1,2,3,5b	X03	58	1,2,3,5b
X04	7	1,2	X04	7	1,2,3	X04	7	1,2,3
X05	33	1,2	X05	33	1,2,3	X05	33	1,2,3
X06	56	1,2	X06	60	1,2,3	X06	60	1,2,3
X07	43	1,2	X07	43	1,2	X07	43	1,2
X08	20	1	X08	20	1	X08	20	1
X09	5	1	X09	5	1,3	X09	5	1,3
X10	10	1,2	X10	8	1,2,3,5b	X10	8	1,2,3,5b
X11	19	1,2						
X12	23	1,2	X12	23	1,2,3,5b	X12	23	1,2,3,5b
X13	19	1,2	X13	19	1,2,3,5b	X13	19	1,2,3,5b
X14	12	1,2						
X15	76	1,2	X15	116	1,2,3,5b	X15	116	1,2,3,5b
X16	16	1,2	X16	16	1,2,5b	X16	16	1,2,5b

Alternative 1			Alternative 3			Alternative 4		
Unit	**Acres**	**Objectives**	**Unit**	**Acres**	**Objectives**	**Unit**	**Acres**	**Objectives**
X17	51	1,2	X17	51	1,2,3,5b,6	X17	51	1,2,3,5b,6
X18	19	1,2	X18	19	1,2,3,5b,6	X18	19	1,2,3,5b,6
X19	4	1,2	X19	4	1,2,3,5b,6	X19	4	1,2,3,5b,6
X22	52	1,2	X22	52	1,2,3,5b	X22	52	1,2,3,5b
X23	353	1,2	X23	353	1,2,3,5b	X23	353	1,2,3,5b
X24	76	1,2	X24	76	1,2,5b	X24	76	1,2,5b
X25	253	1,2	X25	253	1,2,5b,6	X25	253	1,2,5b,6
X26	75	1,2	X26	75	1,2,3,5b	X26	75	1,2,3,5b
X27	34	1,2	X27	34	1,2,5b	X27	34	1,2,5b
X40	8	1,2	X40	8	1,2	X40	8	1,2
X41	21	1,2	X41	21	1,2,3	X41	21	1,2,3
X100	22	1,2	X100	22	1,2,5b	X100	22	1,2,5b
X101	21	1,2	X101	31	1,2	X101	31	1,2
X102	23	1,2	X102	23	1,2	X102	23	1,2
X103	28	1,2	X103	28	1,2,3	X103	28	1,2,3
X104	76	1,2	X104	72	1,2,3,5b	X104	72	1,2,3,5b
X105	14	1,2	X105	14	1,2	X105	14	1,2
X106	18	1,2	X106	18	1,2	X106	18	1,2
X107	142	1,2	X107	70	1,2,3	X107	70	1,2,3
X108	183	1,2	X108	183	1,2,3,5b	X108	183	1,2,3,5b
X109A	28	1,2	X109A	28	1,2,5b	X109A	28	1,2,5b
X109B	8	1,2	X109B	8	1,2,5b	X109B	8	1,2,5b
X109C	12	1,2	X109C	18	1,2,3,5b	X109C	18	1,2,3,5b
X109D	13	1,2	X109D	13	1,2,3,5b	X109D	13	1,2,3,5b
X109E	9	1,2	X109E	9	1,2,5b	X109E	9	1,2,5b
X110	18	1	X110	18	1	X110	18	1
X111	32	1,2						
			X111X	32	1,2,5b,6	X111X	32	1,2,5b,6
X112	15	1,2	X112	14	1,2	X112	14	1,2
X114	13	1,2						
			X114X	18	1,2,5b,6	X114X	18	1,2,5b,6
X115	150	1,2	X115	150	1,2,3,5b	X115	150	1,2,3,5b
X116	109	1,2	X116	110	1,2,3,5b	X116	110	1,2,3,5b
X117	14	1,2	X117	9	1,2,5b	X117	9	1,2,5b
X118	162	1,2	X118	7	1,2	X118	7	1,2
			X118X	156	1,2,5b,6	X118X	156	1,2,5b,6
X119	114	1,2						
			X119X	113	1,2,5b,6	X119X	113	1,2,5b,6
X120	19	1	X120	24	1,3,5b	X120	24	1,3,5b
Y01	132	1,2						
			Y01A	36	1,3	Y01A	36	1,3
			Y01B	18	1,2,3	Y01B	18	1,2,3
			Y01C	3	1	Y01C	3	1
			Y01D	22	1,2,3	Y01D	22	1,2,3
Y02	19	1,2	Y02	15	1,2	Y02	15	1,2
Y03	17	1,2						
			Y03A	10	1	Y03A	10	1
			Y03B	2	1,3	Y03B	2	1,3
AA01	34	1,2	AA01	34	1,2,3,5b	AA01	34	1,2,3,5b
AA02	10	1						
AA03	28	1,2	AA03	28	1,2,3,5b	AA03	28	1,2,3,5b
AA04	25	1	AA04	28	1,3,5b	AA04	28	1,3,5b
AA05	11	1,2						
AA07	14	1,2	AA07	10	1,2,3,5b	AA07	10	1,2,3,5b

Alternative 1			Alternative 3			Alternative 4		
Unit	Acres	Objectives	Unit	Acres	Objectives	Unit	Acres	Objectives
AA08	19	1,2	AA08	19	1,2,3,5b	AA08	19	1,2,3,5b
AA09	66	1	AA09	66	1,3,5b	AA09	66	1,3,5b
AA11	12	1,2	AA11	12	1,2	AA11	12	1,2
AA12	4	1,2	AA12	4	1,2,3	AA12	4	1,2,3
AA13	12	1,2	AA13	12	1,2	AA13	12	1,2
Total	**28,326**		**Total**	**30,399**		**Total**	**27,826**	

Blank entries indicate the item does not apply.

E.02 SALVAGE AND BIOMASS TREATMENTS

Table E.02-1 displays the unit number, harvest system[9], salvage acres and biomass acres for each salvage and biomass treatment unit as proposed in the action alternatives.

Table E.02-1 Salvage and Biomass Treatment Units in Alternatives 1, 3 and 4

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
A01A	G	7									
A01B	G	143		A01B	G	143					
A02	S	8									
A03	G	86		A03	G	55					
A04	H	21		A04	H	21					
A05	H	672									
				A05A	H	293					
				A05B	H	25					
				A05C	H	85		A05C	H	85	
A08A	G	155		A08A	G	111		A08A	G	111	
A08B	G	14									
A08C	G	33		A08C	H	18		A08C	H	18	
A08D	G	28									
A09	H	53		A09	H	81		A09	H	81	
A10	G	112									
A14	G	7	7	A14	G	8	8	A14	G	8	8
				A14X	G	2	2	A14X	G	2	2
A15	G	22	22	A15	H	22		A15	H	22	
B01A	G	3									
B01B	G	9									
B02	G	60		B02	G	63		B02	G	63	
B03	G	18		B03	G	18		B03	G	18	
B21	G	4		B21	G	4		B21	G	4	
B22	G	27		B22	G	8		B22	G	8	
				B22X	G	19		B22X	G	19	
B23	G	100		B23	G	100		B23	G	100	
B24	H	87									
				B24X	H	87		B24X	H	87	
B25	G	21									
				B25X	G	21		B25X	G	21	
B32	G	62		B32	G	62		B32	G	62	
B33	G	16									
C02	S	132		C02	H	86		C02	H	86	

[9] Harvest System: G=Ground based equipment; H=Helicopter; S=Skyline

Alternative 1				Alternative 3				Alternative 4			
Unit	**System**	**Salvage** (acres)	**Biomass** (acres)	**Unit**	**System**	**Salvage** (acres)	**Biomass** (acres)	**Unit**	**System**	**Salvage** (acres)	**Biomass** (acres)
C03	G	39	39	C03	G	39	39	C03	G	39	39
C04	G	14	14								
				C04X	G	14	14	C04X	G	14	14
C05	G	10	10	C05	G	10	10	C05	G	10	10
C06	G	4	4	C06	G	4	4	C06	G	4	4
D01A	G	200		D01A	G	200					
D01B	G	1		D01B	G	1		D01B	G	1	
D01C	G	23		D01C	G	23		D01C	G	23	
D01D	G	13		D01D	G	13		D01D	G	13	
D01E	G	18		D01E	G	18		D01E	G	18	
D02	G	108		D02	G	123					
D03	G	26		D03	G	26		D03	G	26	
D04A	G	32		D04A	G	32		D04A	G	32	
D04B	G	345		D04B	G	345		D04B	G	345	
D05	G	43		D05	G	22		D05	G	22	
D06	G	16		D06	G	16		D06	G	16	
D08	G	42		D08	G	42		D08	G	42	
D09	G	63		D09	G	37		D09	G	37	
D11	G	107	40	D11	G	107	40	D11	G	107	40
D12	G	408	291	D12	G	408	291	D12	G	408	291
D13	G	60	58	D13	G	150	147	D13	G	150	147
E01A	G	75		E01A	G	75					
E01B	G	719	97	E01B	G	719	97				
E02	G	112		E02	G	112					
E03A	G	174		E03A	G	174		E03A	G	174	
E03B	G	157		E03B	G	190		E03B	G	190	
E04	G	72	71	E04	G	72	71	E04	G	72	71
E05	G	10		E05	G	10		E05	G	10	
E06	H	44									
F01	H	135		F01	H	196		F01	H	196	
F02A	G	526		F02A	G	604		F02A	G	604	
F02B	G	34		F02B	G	34		F02B	G	34	
F03	H	58		F03	H	58		F03	H	58	
F11	G	551	551	F11	G	551	551	F11	G	551	551
F12	G	157		F12	G	121		F12	G	121	
F13	H	142		F13	H	177		F13	H	177	
F14	G	158		F14	G	135		F14	G	135	
F15	H	33		F15	H	33		F15	H	33	
F16	G	69		F16	G	69		F16	G	69	
F17	S	12		F17	S	12		F17	S	12	
F18	G	51		F18	G	51		F18	G	51	
F19	G	12		F19	G	12		F19	G	12	
F20	H	127		F20	H	145		F20	H	145	
F21	G	22		F21	G	22		F21	G	22	
F22A	G	7		F22A	G	7		F22A	G	7	
F22B	G	6		F22B	G	6		F22B	G	6	
F23A	G	16		F23A	G	16		F23A	G	16	
F23B	G	10		F23B	G	10		F23B	G	10	
F23C	G	1		F23C	G	1		F23C	G	1	
F23D	G	30		F23D	G	30		F23D	G	30	
G01	G	106		G01	G	66		G01	G	66	
				G01X	G	40		G01X	G	40	
G02	G	5									
				G02X	G	5		G02X	G	5	

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
G03A	G	131		G03A	G	131		G03A	G	131	
G03B	G	119		G03B	G	119		G03B	G	119	
G04	G	24		G04	G	24		G04	G	24	
G05	G	23		G05	G	23		G05	G	23	
G06	G	23		G06	G	23		G06	G	23	
G07	G	2		G07	G	2		G07	G	2	
G08	G	52		G08	G	24		G08	G	24	
				G08X	G	29		G08X	G	29	
G09	G	43		G09	G	43		G09	G	43	
G10	S	6		G10	S	6		G10	S	6	
G11	S	28									
				G11A	S	5		G11A	S	5	
				G11B	S	7		G11B	S	7	
				G11C	G	15		G11C	G	15	
G12	S	10		G12	S	10		G12	S	10	
G13	S	19									
				G13A	S	16		G13A	S	16	
				G13B	G	5		G13B	G	5	
G14A	H	6		G14A	H	6		G14A	H	6	
G14B	H	6		G14B	H	6		G14B	H	6	
G15	G	58		G15	G	95		G15	G	95	
G25	G	60		G25	G	60		G25	G	60	
G26	G	24		G26	G	24		G26	G	24	
G35	G	3		G35	G	3		G35	G	3	
H01	G	4	3	H01	G	4	3	H01	G	4	3
H02	G	9		H02	G	9		H02	G	9	
H03	G	3									
H04	H	13									
H05	H	28									
H06	G	6		H06	G	34		H06	G	34	
H07	G	2									
H08	H	26									
H09	G	6		H09	G	21		H09	G	21	
H11	G	44		H11	G	27		H11	G	27	
				H11X	G	17		H11X	G	17	
H12	G	37		H12	G	6		H12	G	6	
				H12X	G	31		H12X	G	31	
H13A	G	103		H13A	G	54		H13A	G	54	
				H13AX	G	52		H13AX	G	52	
H13B	G	65		H13B	G	13		H13B	G	13	
				H13BX	G	52		H13BX	G	52	
K01	G	11		K01	G	11		K01	G	11	
K02	G	132		K02	G	132		K02	G	132	
L01	S	61		L01	S	39		L01	S	39	
L02A	G	374	373	L02A	G	369	368	L02A	G	369	368
				L02AX	G	5	5	L02AX	G	5	5
L02B	G	715		L02B	G	275		L02B	G	275	
				L02BX	G	215		L02BX	G	215	
L02C	G	796		L02C	G	610		L02C	G	610	
				L02CX	G	185		L02CX	G	185	
L02D	G	257		L02D	G	257		L02D	G	257	
				L02E	H	62		L02E	H	62	
				L02F	G	185		L02F	G	185	
L03	G	31	31	L03	G	31	31	L03	G	31	31

Alternative 1				Alternative 3				Alternative 4			
Unit	**System**	**Salvage** (acres)	**Biomass** (acres)	**Unit**	**System**	**Salvage** (acres)	**Biomass** (acres)	**Unit**	**System**	**Salvage** (acres)	**Biomass** (acres)
L04	G	79		L04	G	79	25	L04	G	79	25
L05A	S	9									
				L05AX	H	9		L05X	H	9	
L05B	S	17									
				L05BX	H	17		L05BX	H	17	
L06	S	10	10								
L07	G	5	5	L07	G	5	5	L07	G	5	5
				L201	G	92	92	L201	G	92	92
L202	G	142	28	L202	G	142	28	L202	G	142	28
				L203	G	695	250	L203	G	695	250
L203A	G	152	152								
L203B	G	113	113								
				L204	G	1519	340	L204	G	1519	340
L204A	G	55	55								
L204B	G	32	32								
L205	G	140	140	L205	G	756	756	L205	G	756	756
L206	G	138	138	L206	G	81	15	L206	G	81	15
M01	G	701		M01	G	701		M01	G	701	
M02A	G	110	110	M02A	G	141	141	M02A	G	141	141
M02B	G	3	3								
M02C	G	10		M02C	G	30		M02C	G	30	
M04A	G	254		M04A	G	260		M04A	G	260	
M04B	G	4		M04B	G	13		M04B	G	13	
M04C	G	10		M04C	G	15		M04C	G	15	
M05A	G	34	34	M05A	H	34		M05A	H	34	
M05B	G	245	245	M05B	H	120		M05B	H	120	
				M05C	G	24	24	M05C	G	24	24
				M05D	G	76	76	M05D	G	76	76
				M05E	G	21	21	M05E	G	21	21
				M05F	G	39	39	M05F	G	39	39
				M05G	G	11	11	M05G	G	11	11
M06	G	97		M06	G	97		M06	G	97	
M07	G	21		M07	G	21		M07	G	21	
M08A	G	98		M08A	G	98		M08A	G	98	
M08B	G	33		M08B	G	29		M08B	G	29	
M08C	G	11		M08C	G	11		M08C	G	11	
M08D	G	27		M08D	G	27		M08D	G	27	
M08E	G	3		M08E	G	8		M08E	G	8	
M09	H	211		M09	H	224		M09	H	224	
M10	G	71		M10	G	71		M10	G	71	
M12	G	15		M12	G	12		M12	G	12	
M13	H	10		M13	H	10		M13	H	10	
M15	G	28		M15	G	28		M15	G	28	
M16A	G	10		M16A	G	10		M16A	G	10	
M16B	G	86	18	M16B	G	86	18	M16B	G	86	18
M18	G	58	34	M18	G	58	34	M18	G	58	34
M19	G	27		M19	G	27		M19	G	27	
				M20	G	15		M20	G	15	
M201	G	50	35	M201	G	74	35	M201	G	74	35
				M202A	G	117	17	M202A	G	117	17
				M202B	G	21	3	M202B	G	21	3
				M203	G	63	20	M203	G	63	20
				M204	G	282	79	M204	G	282	79
N01	G	732									

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
				N01A	G	37		N01A	G	37	
				N01B	G	13		N01B	G	13	
				N01C	G	225		N01C	G	225	
				N01D	G	14		N01D	G	14	
				N01E	G	71		N01E	G	71	
				N01F	G	2		N01F	G	2	
				N01G	G	5		N01G	G	5	
				N01H	G	49		N01H	G	49	
				N01I	G	28		N01I	G	28	
				N01J	G	21		N01J	G	21	
N02	G	42									
				N02A	G	24		N02A	G	24	
				N02B	G	5		N02B	G	5	
N03	G	26		N03	G	26		N03	G	26	
O01	G	11	10	O01	G	8	8				
O02	G	472	202								
				O02A	G	262	193				
				O02B	G	173					
O03	H	46		O03	H	46		O03	H	46	
O04	H	19		O04	H	32					
O05	G	100		O05	G	100					
O06	H	33		O06	H	33		O06	H	33	
O07	H	48		O07	H	48		O07	H	48	
O08	G	27		O08	G	27		O08	G	27	
O09	G	10		O09	G	10		O09	G	10	
O10A	G	14	14	O10A	G	14	14	O10A	G	14	14
O10B	G	6		O10B	G	6		O10B	G	6	
O11A	G	27		O11A	G	27		O11A	G	27	
O11B	G	39		O11B	G	39		O11B	G	39	
O11C	G	15	15	O11C	G	15	15	O11C	G	15	15
O12	H	96		O12	H	96					
O201	G	299	140								
				O201A	G	156	80	O201A	G	156	80
				O201B	G	121	60	O201B	G	121	60
P201	H	185		P201	H	185		P201	H	185	
Q06	G	19		Q06	G	19		Q06	G	19	
Q07	G	13		Q07	G	13		Q07	G	13	
Q08	G	42		Q08	G	42		Q08	G	42	
Q09	S	18		Q09	S	18		Q09	S	18	
Q13	G	81		Q13	G	81		Q13	G	81	
Q14A	G	397	10	Q14A	G	395	10	Q14A	G	395	10
Q14B	G	146		Q14B	G	146		Q14B	G	146	
Q15	S	14		Q15	S	17		Q15	S	17	
Q16	G	8		Q16	G	8		Q16	G	8	
R01A	G	325	325	R01A	G	106	106				
R01B	G	11	11	R01B	G	11	11	R01B	G	11	11
R02	S	36		R02	S	30					
R03	G	32	32								
R04A	G	52	52	R04A	G	52	52	R04A	G	52	52
R04B	G	41	41	R04B	G	41	41	R04B	G	41	41
R06A	G	9	9	R06A	G	12	12	R06A	G	12	12
R06B	G	24		R06B	G	21		R06B	G	21	
R07	H	83									
				R07A	S	98		R07A	S	98	

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
				R07B	G	19		R07B	G	19	
R08	G	2	2								
R12	G	64		R12	G	8		R12	G	8	
				R12X	G	56		R12X	G	56	
R14	G	5									
R15	G	25	25	R15	G	66	26	R15	G	66	26
R16	G	98		R16	G	98		R16	G	98	
R17	G	72									
				R17X	G	72		R17X	G	72	
R18	S	100		R18	S	83		R18	S	83	
				R18X	S	17		R18X	S	17	
R19A	G	52	38	R19A	G	52	38	R19A	G	52	38
R19B	G	12	7	R19B	G	12	7	R19B	G	12	7
R19D	G	70	11	R19D	G	91	11	R19D	G	91	11
				R19DX	G	24		R19DX	G	24	
R19E	G	4		R19E	G	4		R19E	G	4	
R19F	G	5		R19F	G	11		R19F	G	11	
R20	H	37		R20	H	50		R20	H	50	
R22	G	28	11	R22	G	28	11	R22	G	28	11
R23	H	13		R23	H	13		R23	H	13	
R24A	G	41		R24A	G	41		R24A	G	41	
R24B	G	5									
R25	G	34									
				R25X	G	34		R25X	G	34	
R31	G	140	140	R31	G	120	120	R31	G	120	120
				R31X	G	67	67	R31X	G	67	67
R32	G	30		R32	G	31		R32	G	31	
R33	H	12									
				R33X	H	12		R33X	H	12	
R35	S	26									
				R35A	S	10		R35A	S	10	
				R35B	G	16	16	R35B	G	16	16
R36	G	15	15	R36	G	12	12	R36	G	12	12
R37	G	25		R37	G	25		R37	G	25	
R38	G	20	20	R38	G	20	20	R38	G	20	20
R39	G	3	3	R39	G	3	3	R39	G	3	3
				R40A	G	32	32	R40A	G	32	32
				R40B	G	52	52	R40B	G	52	52
S01	G	34		S01	G	53		S01	G	53	
S02	G	135		S02	G	135		S02	G	135	
S03	G	168		S03	G	168		S03	G	168	
S04	G	284		S04	G	284		S04	G	284	
S05A	G	46									
S05B	G	28		S05B	G	7		S05B	G	7	
S05C	G	27									
S06	G	28	28	S06	G	28	28	S06	G	28	28
S08	S	81		S08	S	81		S08	S	81	
S10	H	9		S10	H	9		S10	H	9	
S11	G	25	11	S11	G	25	11	S11	G	25	11
T01	G	19	5	T01	G	19	5	T01	G	19	5
T02	G	33	24	T02	G	33	24	T02	G	33	24
T03	S	29		T03	S	29		T03	S	29	
T04A	G	266	2	T04A	G	266	2	T04A	G	266	2
T04B	G	904	744	T04B	G	904	744	T04B	G	904	744

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
T04C	G	77	77	T04C	G	101	101	T04C	G	101	101
T04D	G	9	9	T04D	G	9	9	T04D	G	9	9
T04E	G	2	2	T04E	G	2	2	T04E	G	2	2
T20	G	9	9	T20	G	9	9	T20	G	9	9
T21A	G	3	3								
T21B	G	18	18	T21B	G	18	18	T21B	G	18	18
T22	G	16		T22	G	18		T22	G	18	
T23	G	82		T23	G	28		T23	G	28	
				T23X	G	54		T23X	G	54	
T24	G	151	87	T24	G	154	90	T24	G	154	90
T25	S	32		T25	S	6		T25	S	6	
				T25X	S	26		T25X	S	26	
T26	S	15		T26	S	15		T26	S	15	
T27A	G	1075	531	T27A	G	926	427	T27A	G	926	427
				T27AX	G	150	104	T27AX	G	150	104
T27B	G	953	784	T27B	G	573	540	T27B	G	573	540
				T27BX	G	360	227	T27BX	G	360	227
				T27C	G	97	64	T27C	G	97	64
T28	G	44	14								
U01	G	775	117								
				U01A	G	3		U01A	G	3	
				U01B	G	26		U01B	G	26	
				U01C	G	12		U01C	G	12	
				U01D	G	617	105	U01D	G	617	105
				U01DX	G	33		U01DX	G	33	
U02	G	65	3	U02	G	56	3	U02	G	56	3
U03	G	347	80	U03	G	320	75	U03	G	320	75
V01	G	20		V01	G	20		V01	G	20	
V02	G	17		V02	G	16		V02	G	16	
V03	G	35		V03	G	25		V03	G	25	
V04	G	15									
				V04A	G	2		V04A	G	2	
				V04B	G	3		V04B	G	3	
V05A	G	3									
V05B	G	7		V05B	G	6		V05B	G	6	
V06	G	9		V06	G	4		V06	G	4	
V10	G	50	46	V10	G	50	46	V10	G	50	46
V12A	G	9	9	V12A	G	9	9	V12A	G	9	9
V12B	G	16	13	V12B	G	16	13	V12B	G	16	13
V13	G	160	110	V13	G	119	96	V13	G	119	96
				V13X	G	69	21	V13X	G	69	21
V14A	G	15	8	V14A	G	15	8	V14A	G	15	8
V14B	G	382	90	V14B	G	382	90	V14B	G	382	90
V14C	G	70	7	V14C	G	70	7	V14C	G	70	7
V15	H	61		V15	H	61		V15	H	61	
W01	G	51		W01	G	51		W01	G	51	
W02	G	226		W02	G	226		W02	G	226	
W03	G	21	20	W03	G	21	20	W03	G	21	20
W04	G	85		W04	G	74		W04	G	74	
W05	G	51									
				W05A	G	3		W05A	G	3	
				W05B	G	5		W05B	G	5	
W06	G	63									
				W06A	G	13		W06A	G	13	

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
				W06B	G	7		W06B	G	7	
X01	G	21	21								
				X01A	G	8	8	X01A	G	8	8
				X01B	G	3	3	X01B	G	3	3
X02	H	43		X02	H	43		X02	H	43	
X03	S	58		X03	S	58		X03	S	58	
X04	G	7	7	X04	G	7	7	X04	G	7	7
X05	H	33		X05	H	33		X05	H	33	
X06	H	56		X06	H	60		X06	H	60	
X07	G	43		X07	G	43		X07	G	43	
X08	H	20		X08	H	20		X08	H	20	
X09	G	5	5	X09	G	5	5	X09	G	5	5
X10	H	10		X10	H	8		X10	H	8	
X11	G	19	19								
X12	S	23		X12	S	23		X12	S	23	
X13	G	19	19	X13	G	19	19	X13	G	19	19
X14	G	12	12								
X15	G	76	47	X15	G	116	87	X15	G	116	87
X16	G/S	16		X16	G/S	16		X16	G/S	16	
X17	S	51		X17	S	51		X17	S	51	
X18	G	19	19	X18	G	19	19	X18	G	19	19
X19	G	4	4	X19	G	4	4	X19	G	4	4
X22	S	52		X22	S	52		X22	S	52	
X23	H	353		X23	H	353		X23	H	353	
X24	S	76		X24	S	76		X24	S	76	
X25	S	253		X25	S	253		X25	S	253	
X26	G	75	52	X26	G	75	52	X26	G	75	52
X27	S	34		X27	S	34		X27	S	34	
X40	G	8		X40	G	8		X40	G	8	
X41	G	21	21	X41	G	21	21	X41	G	21	21
X100	G	22		X100	G	22		X100	G	22	
X101	G	21		X101	G	31		X101	G	31	
X102	G	23		X102	G	23		X102	G	23	
X103	G	28	6	X103	G	28	6	X103	G	28	6
X104	G	76	5	X104	G	72	4	X104	G	72	4
X105	G	14		X105	G	14		X105	G	14	
X106	G	18		X106	G	18		X106	G	18	
X107	G	142	142	X107	G	70	70	X107	G	70	70
X108	G	183	183	X108	G	183	183	X108	G	183	183
X109A	G	28		X109A	G	28		X109A	G	28	
X109B	G	8		X109B	G	8		X109B	G	8	
X109C	G	12		X109C	G	18	1	X109C	G	18	1
X109D	G	13	13	X109D	G	13	13	X109D	G	13	13
X109E	G	9		X109E	G	9		X109E	G	9	
X110	G	18		X110	G	18		X110	G	18	
X111	G	32									
				X111X	G	32		X111X	G	32	
X112	G	15		X112	G	14		X112	G	14	
X114	G	13									
				X114X	G	18		X114X	G	18	
X115	G	150	91	X115	G	150	91	X115	G	150	91
X116	G	109	27	X116	G	110	27	X116	G	110	27
X117	G	14		X117	G	9		X117	G	9	
X118	G	162		X118	G	7		X118	G	7	

Alternative 1				Alternative 3				Alternative 4			
Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)	Unit	System	Salvage (acres)	Biomass (acres)
				X118X	G	156		X118X	G	156	
X119	G	114									
				X119X	G	113		X119X	G	113	
X120	S	19		X120	H	24		X120	H	24	
Y01	G	132	69								
				Y01A	G	36	11	Y01A	G	36	11
				Y01B	G	18	18	Y01B	G	18	18
				Y01C	G	3		Y01C	G	3	
				Y01D	G	22	8	Y01D	G	22	8
Y02	G	19	1	Y02	G	15		Y02	G	15	
Y03	G	17	6								
				Y03A	G	10		Y03A	G	10	
				Y03B	G	2	2	Y03B	G	2	2
AA01	G	34	34	AA01	G	34	34	AA01	G	34	34
AA02	H	10									
AA03	G	28	28	AA03	G	28	28	AA03	G	28	28
AA04	H	25		AA04	H	28		AA04	H	28	
AA05	G	11	11								
AA07	G	14	14	AA07	G	10	10	AA07	G	10	10
AA08	G	19	19	AA08	G	19	19	AA08	G	19	19
AA09	H	66		AA09	H	66		AA09	H	66	
AA11	S	12		AA11	S	12		AA11	S	12	
AA12	G	4	4	AA12	G	4	4	AA12	G	4	4
AA13	S	12		AA13	S	12		AA13	S	12	
	total	**28,326**	**7,626**		**total**	**30,399**	**8,379**		**total**	**27,826**	**7,975**

Harvest System: G=Ground based equipment; H=Helicopter; S=Skyline
Blank entries indicate the item does not apply.

E.03 FUELS TREATMENTS

Alternative 3 and Alternative 4 include fuels treatments that are not included in Alternative 1. These fuels treatments are Strategically Placed Land Area Treatments (SPLAT), non-SPLAT fuels treatments, and fuels ground pile treatments including the following.

1. Lop and scatter to 12" dbh in SPLAT areas within S and helicopter units.
2. Lop and scatter to 18" dbh in non-SPLAT areas within S and helicopter units.
3. Ground pile (jackpot or pile burning) in all units following hand and mechanical fuels treatments.

Table E.03-1 displays the unit number, SPLAT acres, non-SPLAT acres and ground pile acres for each fuels treatment unit as proposed in Alternative 3 and Alternative 4.

Table E.03-1 Fuels Treatment Units in Alternatives 3 and 4

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
A01B		143	38				
A03		55	55				
A04		21					
A05A		293					
A05B		25					
A05C		85		A05C		85	
A08A		111	102	A08A		111	102

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
A08C		18		A08C		18	
A09		81		A09		81	
A14	8		8	A14	8		8
A14X	2		2	A14X	2		2
A15	22			A15	22		
B02		63	63	B02		63	63
B03		18	18	B03		18	18
B21		4	4	B21		4	4
B22		8	8	B22		8	8
B22X		19	19	B22X		19	19
B23		100	100	B23		100	100
B24X		87		B24X		87	
B25X		21	21	B25X		21	21
B32		62	62	B32		62	62
C02		86		C02		86	
C03	39		39	C03	39		39
C04X	14		14	C04X	14		14
C05	10		10	C05	10		10
C06	4		4	C06	4		4
D01A		200	200				0
D01B		1	1	D01B		1	1
D01C		23	23	D01C		23	23
D01D		13	13	D01D		13	13
D01E		18	18	D01E		18	18
D02		123	123				0
D03		26	26	D03		26	26
D04A		32	32	D04A		32	32
D04B		345	345	D04B		345	345
D05		22	22	D05		22	22
D06		16	16	D06		16	16
D08		42	42	D08		42	42
D09		37	37	D09		37	37
D11	40	67	107	D11	40	67	107
D12	291	117	408	D12	291	117	408
D13	147	3	150	D13	147	3	150
E01A		75	75				0
E01B	97	622	492				0
E02		112	112				0
E03A		174	103	E03A		174	103
E03B		190	98	E03B		190	98
E04	71	1	72	E04	71	1	72
E05		10	10	E05		10	10
F01		196		F01		196	
F02A		604	280	F02A		604	280
F02B		34	15	F02B		34	15
F03		58		F03		58	
F11	551		426	F11	551		426
F12		121	3	F12		121	3
F13		177		F13		177	
F14		135	98	F14		135	98
F15		33		F15		33	
F16		69	69	F16		69	69
F17		12		F17		12	
F18		51	34	F18		51	34

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
F19		12	6	F19		12	6
F20		145		F20		145	
F21		22	22	F21		22	22
F22A		7	7	F22A		7	7
F22B		6	6	F22B		6	6
F23A		16	16	F23A		16	16
F23B		10	10	F23B		10	10
F23C		1	1	F23C		1	1
F23D		30	30	F23D		30	30
G01		66	66	G01		66	66
G01X		40	40	G01X		40	40
G02X		5	5	G02X		5	5
G03A		131	131	G03A		131	131
G03B		119	114	G03B		119	114
G04		24	24	G04		24	24
G05		23	23	G05		23	23
G06		23	23	G06		23	23
G07		2	2	G07		2	2
G08		24	24	G08		24	24
G08X		29	29	G08X		29	29
G09		43	43	G09		43	43
G10		6		G10		6	
G11A		5		G11A		5	
G11B		7		G11B		7	
G11C		15	15	G11C		15	15
G12		10		G12		10	
G13A		16		G13A		16	
G13B		5	5	G13B		5	5
G14A		6		G14A		6	
G14B		6		G14B		6	
G15		95	95	G15		95	95
G25		60	60	G25		60	60
G26		24	24	G26		24	24
G35		3	3	G35		3	3
H01	3	1	4	H01	3	1	4
H02		9	9	H02		9	9
H06		34	34	H06		34	34
H09		21	21	H09		21	21
H11		27	15	H11		27	15
H11X		17	11	H11X		17	11
H12		6	6	H12		6	6
H12X		31	31	H12X		31	31
H13A		54	40	H13A		54	40
H13AX		52	13	H13AX		52	13
H13B		13	13	H13B		13	13
H13BX		52	52	H13BX		52	52
K01		11	11	K01		11	11
K02		132	132	K02		132	132
L01		39		L01		39	
L02A	368	1	369	L02A	368	1	369
L02AX	5		5	L02AX	5		5
L02B		275	275	L02B		275	275
L02BX		215	182	L02BX		215	182
L02C		610	138	L02C		610	138

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
L02CX		185	111	L02CX		185	111
L02D		257	218	L02D		257	218
L02E		62		L02E		62	
L02F		185	119	L02F		185	119
L03		31	31	L03		31	31
L04		79	54	L04		79	54
L05AX		9		L05X		9	
L05BX		17		L05BX		17	
L07		5	5	L07		5	5
L201		92	92	L201		92	92
L202		142	93	L202		142	93
L203		695	445	L203		695	445
L204		1519	1179	L204		1519	1179
L205	692	64	756	L205	692	64	756
L206		81	66	L206		81	66
M01		701	663	M01		701	663
M02A	141		141	M02A	141		141
M02C		30	30	M02C		30	30
M04A		260	260	M04A		260	260
M04B		13	13	M04B		13	13
M04C		15	15	M04C		15	15
M05A	34			M05A	34		
M05B	120			M05B	120		
M05C	24		24	M05C	24		24
M05D	76		53	M05D	76		53
M05E	21		21	M05E	21		21
M05F	39		39	M05F	39		39
M05G	11		11	M05G	11		11
M06		97	68	M06		97	68
M07		21	21	M07		21	21
M08A		98	62	M08A		98	62
M08B		29	29	M08B		29	29
M08C		11	11	M08C		11	11
M08D		27	27	M08D		27	27
M08E		8	8	M08E		8	8
M09		224		M09		224	
M10		71	71	M10		71	71
M12		12	12	M12		12	12
M13		10		M13		10	
M15		28	28	M15		28	28
M16A		10	10	M16A		10	10
M16B	18	68	57	M16B	18	68	57
M18	34	24	58	M18	34	24	58
M19		27	27	M19		27	27
M20		15		M20		15	
M201		74	39	M201		74	39
M202A		117	100	M202A		117	100
M202B		21	18	M202B		21	18
M203		63	43	M203		63	43
M204		282	203	M204		282	203
N01A		37	14	N01A		37	14
N01B		13	13	N01B		13	13
N01C		225	122	N01C		225	122
N01D		14	1	N01D		14	1

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
N01E		71	27	N01E		71	27
N01F		2	2	N01F		2	2
N01G		5	5	N01G		5	5
N01H		49	21	N01H		49	21
N01I		28	2	N01I		28	2
N01J		21	12	N01J		21	12
N02A		24	7	N02A		24	7
N02B		5	5	N02B		5	5
N03		26	26	N03		26	26
O01	8		8				0
O02A	193	69	262				0
O02B		173	173				0
O03		46		O03		46	
O04		32					
O05		100	100				0
O06		33		O06		33	
O07		48		O07		48	
O08		27	27	O08		27	27
O09		10	10	O09		10	10
O10A	14		14	O10A	14		14
O10B		6	6	O10B		6	6
O11A		27	27	O11A		27	27
O11B		39	39	O11B		39	39
O11C	15		15	O11C	15		15
O12	95	1					
O201A		156	76	O201A		156	76
O201B		121	61	O201B		121	61
P201		185		P201		185	
Q06		19	19	Q06		19	19
Q07		13	13	Q07		13	13
Q08		42	42	Q08		42	42
Q09		18		Q09		18	
Q13		81	81	Q13		81	81
Q14A	10	385	309	Q14A	10	385	309
Q14B		146	146	Q14B		146	146
Q15		17		Q15		17	
Q16		8	8	Q16		8	8
R01A	106		78				0
R01B	11		11	R01B	11		11
R02	30						
R04A	52		52	R04A	52		52
R04B	41		33	R04B	41		33
R06A	12		12	R06A	12		12
R06B		21	21	R06B		21	21
R07A		98		R07A		98	
R07B		19	19	R07B		19	19
R12		8	8	R12		8	8
R12X		56	56	R12X		56	56
R15	26	40	66	R15	26	40	66
R16		98	98	R16		98	98
R17X		72	72	R17X		72	72
R18		83		R18		83	
R18X		17		R18X		17	
R19A	38	14	52	R19A	38	14	52

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
R19B	7	5	12	R19B	7	5	12
R19D	11	80	91	R19D	11	80	91
R19DX		24	24	R19DX		24	24
R19E		4	4	R19E		4	4
R19F		11	11	R19F		11	11
R20		50		R20		50	
R22	11	17	28	R22	11	17	28
R23		13		R23		13	
R24A		41	41	R24A		41	41
R25X		34	34	R25X		34	34
R31	120		120	R31	120		120
R31X	67		67	R31X	67		67
R32		31	31	R32		31	31
R33X	11	1		R33X	11	1	
R35A	10			R35A	10		
R35B	16		16	R35B	16		16
R36	12		12	R36	12		12
R37		25	25	R37		25	25
R38	20		20	R38	20		20
R39	3		3	R39	3		3
R40A	32		32	R40A	32		32
R40B	52		52	R40B	52		52
S01		53	53	S01		53	53
S02		135	135	S02		135	135
S03		168	168	S03		168	168
S04		284	255	S04		284	255
S05B		7	7	S05B		7	7
S06	28		28	S06	28		28
S08		81		S08		81	
S10	9			S10	9		
S11	11	14	25	S11	11	14	25
T01	5	14	19	T01	5	14	19
T02	24	9	33	T02	24	9	33
T03		29		T03		29	
T04A	2	264	266	T04A	2	264	266
T04B	744	160	670	T04B	744	160	670
T04C	101		101	T04C	101		101
T04D	9		9	T04D	9		9
T04E	2		2	T04E	2		2
T20	9		9	T20	9		9
T21B	18		18	T21B	18		18
T22		18	18	T22		18	18
T23		28	28	T23		28	28
T23X		54	54	T23X		54	54
T24	90	64	154	T24	90	64	154
T25		6		T25		6	
T25X		26		T25X		26	
T26		15		T26		15	
T27A	427	499	778	T27A	427	499	778
T27AX	104	46	103	T27AX	104	46	103
T27B	540	33	472	T27B	540	33	472
T27BX	227	133	267	T27BX	227	133	267
T27C	64	33	97	T27C	64	33	97
U01A		3	3	U01A		3	3

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
U01B		26	26	U01B		26	26
U01C		12	12	U01C		12	12
U01D	105	512	545	U01D	105	512	545
U01DX		33	33	U01DX		33	33
U02	3	53	56	U02	3	53	56
U03	75	245	320	U03	75	245	320
V01		20	20	V01		20	20
V02		16	16	V02		16	16
V03		25	14	V03		25	14
V04A		2	2	V04A		2	2
V04B		3	3	V04B		3	3
V05B		6	6	V05B		6	6
V06		4	4	V06		4	4
V10	46	4	50	V10	46	4	50
V12A	9		9	V12A	9		9
V12B	13	3	16	V12B	13	3	16
V13	96	23	119	V13	96	23	119
V13X	21	48	69	V13X	21	48	69
V14A	8	7	15	V14A	8	7	15
V14B	90	292	340	V14B	90	292	340
V14C	7	63	70	V14C	7	63	70
V15	3	58		V15	3	58	
W01		51	51	W01		51	51
W02		226	226	W02		226	226
W03	20	1	21	W03	20	1	21
W04		74	74	W04		74	74
W05A		3	3	W05A		3	3
W05B		5		W05B		5	
W06A		13	13	W06A		13	13
W06B		7	7	W06B		7	7
X01A	8		8	X01A	8		8
X01B	3		3	X01B	3		3
X02	43			X02	43		
X03	58			X03	58		
X04	7		7	X04	7		7
X05	33			X05	33		
X06	58	2		X06	58	2	
X07		43	43	X07		43	43
X08		20		X08		20	
X09	5		5	X09	5		5
X10	8			X10	8		
X12	13	10		X12	13	10	
X13	19		19	X13	19		19
X15	87	29	116	X15	87	29	116
X16		16	16	X16		16	16
X17	40	11		X17	40	11	
X18	19		19	X18	19		19
X19	4		4	X19	4		4
X22		52		X22		52	
X23	353			X23	353		
X24		76		X24		76	
X25		253		X25		253	
X26	52	23	75	X26	52	23	75
X27		34		X27		34	

Alternative 3				Alternative 4			
Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)	Unit	SPLAT (acres)	Non-SPLAT (acres)	Ground Pile (acres)
X40		8	2	X40		8	2
X41	21		21	X41	21		21
X100		22	22	X100		22	22
X101		31	31	X101		31	31
X102		23	23	X102		23	23
X103	6	22	28	X103	6	22	28
X104	4	68	72	X104	4	68	72
X105		14	14	X105		14	14
X106		18	18	X106		18	18
X107	70		70	X107	70		70
X108	183		183	X108	183		183
X109A		28	22	X109A		28	22
X109B		8	8	X109B		8	8
X109C	1	17	18	X109C	1	17	18
X109D	13		13	X109D	13		13
X109E		9	9	X109E		9	9
X110		18	18	X110		18	18
X111X		32	32	X111X		32	32
X112		14	14	X112		14	14
X114X		18	18	X114X		18	18
X115	91	59	150	X115	91	59	150
X116	27	83	110	X116	27	83	110
X117		9	9	X117		9	9
X118		7	7	X118		7	7
X118X		156	156	X118X		156	156
X119X		113	113	X119X		113	113
X120	5	19		X120	5	19	
Y01A	11	25	36	Y01A	11	25	36
Y01B	18		18	Y01B	18		18
Y01C		3	3	Y01C		3	3
Y01D	8	14	22	Y01D	8	14	22
Y02		15	15	Y02		15	15
Y03A		10	10	Y03A		10	10
Y03B	2		2	Y03B	2		2
AA01	34		34	AA01	34		34
AA03	28		28	AA03	28		28
AA04	28			AA04	28		
AA07	10		10	AA07	10		10
AA08	19		19	AA08	19		19
AA09	66			AA09	66		
AA11		12		AA11		12	
AA12	4		4	AA12	4		4
AA13		12		AA13		12	
Total	**8,274**	**22,125**	**22,036**	**Total**	**7,745**	**20,080**	**20,320**

4WD=4 Wheel Drive; ALL=All Vehicles; HLO=Highway Legal Only MVUM=Motor Vehicle Use Map; Temp=Temporary
Blank entries indicate the item does not apply.

E.04 WATERSHED TREATMENTS

Alternative 3 and Alternative 4 include watershed treatments that are not included in Alternative 1. As described in Chapter 2.01, these watershed treatments proposed in areas identified as watershed sensitive areas include mastication and, drop and lop.

Table E.04-1 displays the unit number, mastication acres, and drop and lop acres for each watershed treatment unit as proposed in Alternative 3 and Alternative 4.

Table E.04-1 Watershed Treatments for Alternatives 3 and 4

Alternative 3			Alternative 4		
Unit	Mastication (acres)	Drop and Lop (acres)	Unit	Mastication (acres)	Drop and Lop (acres)
A01B		105			
A05A		70			
A05C		1	A05C		1
A08A		9	A08A		9
E01B		227			
E03A	71		E03A	71	
E03B		92	E03B		92
F01	32		F01	32	
F02A	323	1	F02A	323	1
F02B		19	F02B		19
F11		125	F11		125
F12		118	F12		118
F13		49	F13		49
F14		37	F14		37
F15		10	F15		10
F18		17	F18		17
F19		6	F19		6
F20		25	F20		25
G03B		5	G03B		5
H11		12	H11		12
H11X		6	H11X		6
H13A	14		H13A	14	
H13AX	39		H13AX	39	
L02BX	33		L02BX	33	
L02C	418	54	L02C	418	54
L02CX	47	27	L02CX	47	27
L02D		39	L02D		39
L02F	66		L02F	66	
L202		21	L202		21
M01	35	3	M01	35	3
M05D	23		M05D	23	
M06		29	M06		29
M08A		36	M08A		36
M09		41	M09		41
M16B		29	M16B		29
M20		15	M20		15
N01A		23	N01A		23
N01C		103	N01C		103
N01D		13	N01D		13
N01E	32	12	N01E	32	12
N01H	28		N01H	28	

Alternative 3			Alternative 4		
Unit	Mastication (acres)	Drop and Lop (acres)	Unit	Mastication (acres)	Drop and Lop (acres)
N01I	26		N01I	26	
N01J	9		N01J	9	
N02A		17	N02A		17
Q14A		86	Q14A		86
R01A		28			
R04B		8	R04B		8
S04	20	9	S04	20	9
T04B		234	T04B		234
T27A		148	T27A		148
T27AX		47	T27AX		47
T27B	90	11	T27B	90	11
T27BX	3	90	T27BX	3	90
U01D		72	U01D		72
V03		11	V03		11
V14B		42	V14B		42
W05B		5	W05B		5
X25		29	X25		29
X40		6	X40		6
X109A		6	X109A		6
Total	**1,309**	**2,228**	**Total**	**1,309**	**1,798**

4WD=4 Wheel Drive; ALL=All Vehicles; HLO=Highway Legal Only MVUM=Motor Vehicle Use Map; Temp=Temporary
Blank entries indicate the item does not apply.

E.05 ROAD TREATMENTS

Road treatments, as described in Chapter 2.01, vary between the action alternatives. These treatments include maintenance and reconstruction of existing roads, new construction and development of new temporary roads

Table E.05-1 displays the route number, status, miles, MVUM[10] and road treatments as proposed in the action alternatives.

Table E.05-1 Road Treatments in Alternatives 1, 3 and 4

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01N01	Existing	8.530	ALL, year round	Maintain	Maintain	Maintain
01N01	Existing	0.824	ALL, year round	Reconstruct	Reconstruct	Reconstruct
01N01A	Existing	0.503	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N01E	Existing	0.449	Closed	Reconstruct	Reconstruct	Reconstruct
01N01H	Existing	0.659	ALL, year round	Maintain	Maintain	Maintain
01N01K	Existing	0.597	ALL, year round	Maintain	Maintain	Maintain
01N01L	Existing	0.120	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N02	Existing	1.466	ALL, year round	Maintain	Maintain	Maintain
01N02	Existing	2.666	Closed	Maintain	Maintain	Maintain
01N02B	Existing	0.636	Closed	Maintain	Maintain	Maintain
01N02Y	Existing	1.485	ALL, seasonal	Reconstruct	Maintain	Maintain
01N04	Existing	0.382	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N04B	Existing	0.630	ALL, seasonal	Maintain	Maintain	Maintain
01N04D	Existing	0.525	Closed	Reconstruct	Reconstruct	Reconstruct
01N04Y	Existing	0.504	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct

10 The MVUM (Motor Vehicle Use Map) indentifies public motor vehicle use by Vehicle Class (4 wheel drive, All Vehicles, Highway Legal Only, etc.) and whether the season of use is closed, open year round or seasonal (open April 15 through December 15).

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01N04Y	Existing	0.247	Closed	Reconstruct	Reconstruct	Reconstruct
01N05	Existing	0.142	ALL, seasonal	Reconstruct	Maintain	Maintain
01N05	Existing	2.209	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N07C	Existing	0.595	ALL, seasonal	Maintain	Maintain	Maintain
01N07Y	Existing	1.567	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N09	Existing	0.830	Closed	Maintain	Maintain	Maintain
01N09	Existing	0.569	Closed	Maintain	Reconstruct	Reconstruct
01N09	Existing	2.438	Closed	Reconstruct	Reconstruct	Reconstruct
01N09Y	Existing	0.356	ALL, seasonal	Maintain	Maintain	Maintain
01N10	Existing	3.677	HLO, seasonal	Maintain		
01N10	Existing	6.274	HLO, year round	Maintain		
01N10A	Existing	0.528	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N10C	Existing	0.140	HLO, year round	Maintain		
01N10E	Existing	0.161	HLO, year round	Maintain		
01N11	Existing	2.060	ALL, year round	Maintain	Maintain	Maintain
01N11Y	Existing	0.125	HLO, seasonal	Reconstruct	Maintain	Maintain
01N11Y	Existing	2.303	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N12	Existing	0.539	ALL, seasonal	Maintain	Maintain	Maintain
01N12	Existing	0.491	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N12Y	Existing	0.279	Closed	Reconstruct	Reconstruct	Reconstruct
01N13	Existing	2.048	ALL, year round	Maintain	Maintain	Maintain
01N13A	Existing	0.378	ALL, year round	Maintain	Maintain	Maintain
01N13B	Existing	0.965	ALL, year round	Maintain	Maintain	Maintain
01N14	Existing	3.758	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N14A	Existing	0.823	HLO, seasonal	Maintain	Maintain	Maintain
01N14F	Existing	0.444	HLO, seasonal	Reconstruct	Maintain	Maintain
01N14G	Existing	0.127	Closed	Reconstruct	Reconstruct	Maintain
01N15	Existing	1.233	Closed	Reconstruct	Reconstruct	Reconstruct
01N15Y	Existing	0.532	Closed	Maintain	Maintain	Maintain
01N16	Existing	0.030	ALL, year round	Maintain	Maintain	Maintain
01N17	Existing	0.212	ALL, year round	Maintain	Maintain	Maintain
01N17	Existing	2.154	ALL, year round	Maintain	Maintain	Maintain
01N17A	Existing	0.104	ALL, year round	Maintain	Maintain	Maintain
01N18	Existing	1.366	ALL, year round	Maintain	Maintain	Maintain
01N18A	Existing	0.170	ALL, year round	Maintain	Maintain	Maintain
01N19	Existing	1.331	ALL, year round	Maintain	Maintain	Maintain
01N19	Existing	0.120	Closed	Maintain	Maintain	Maintain
01N24	Existing	2.243	ALL, year round	Maintain	Maintain	Maintain
01N24	Existing	1.465	ALL, year round	Reconstruct	Reconstruct	Reconstruct
01N24A	Existing	0.099	ALL, year round	Maintain	Maintain	Maintain
01N24B	Existing	0.344	ALL, year round	Maintain	Maintain	Maintain
01N24C	Existing	1.184	ALL, year round	Maintain	Maintain	Maintain
01N25	Existing	0.344	ALL, year round	Maintain	Maintain	Maintain
01N25A	Existing	0.105	ALL, seasonal	Maintain	Maintain	Maintain
01N25B	Existing	0.328	ALL, seasonal	Maintain	Maintain	Maintain
01N25Y	Existing	0.729	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N26	Existing	2.792	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N26	Existing	1.068	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N26A	Existing	0.261	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N26B	Existing	0.412	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N26C	Existing	0.305	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N26D	Existing	0.248	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N26YA	Existing	0.354	Closed	Maintain	Maintain	Maintain
01N27	Existing	0.823	ALL, year round	Maintain	Maintain	Maintain
01N27B	Existing	0.445	ALL, year round	Maintain	Maintain	Maintain
01N28	Existing	0.386	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N28A	Existing	0.119	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01N30	Existing	0.713	ALL, seasonal	Reconstruct	Maintain	Maintain
01N30	Existing	2.096	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N30A	Existing	0.053	Closed	Reconstruct	Reconstruct	Reconstruct
01N31Y	Existing	0.388	ALL, seasonal	Maintain	Maintain	Maintain
01N31Y	Existing	0.544	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N31YA	Existing	0.335	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N31YB	Existing	0.391	Closed	Maintain	Reconstruct	Reconstruct
01N32	Existing	0.274	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N32	Existing	0.647	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N32A	Existing	0.124	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N32Y	Existing	0.116	Closed	Temp Road	Temp Road	Temp Road
01N34	Existing	0.399	Closed	Reconstruct	Reconstruct	Maintain
01N34C	Existing	0.224	Closed	Reconstruct	Reconstruct	Maintain
01N34Y	Existing	1.076	ALL, year round	Maintain	Maintain	Maintain
01N35	Existing	0.933	ALL, year round	Maintain	Maintain	Maintain
01N36	Existing	0.713	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N36A	Existing	0.210	ALL, seasonal	Maintain	Maintain	Maintain
01N37	Existing	1.425	Closed (mitigation)	Reconstruct	Reconstruct	Reconstruct
01N38	Existing	0.255	ALL, year round	Maintain	Maintain	Maintain
01N38	Existing	0.191	Closed	Maintain	Maintain	Maintain
01N38A	Existing	0.028	Closed	Maintain	Maintain	Maintain
01N39	Existing	0.886	ALL, year round	Maintain	Maintain	Maintain
01N39Y	Existing	0.115	Closed	Reconstruct	Reconstruct	Reconstruct
01N39Y	Existing	0.560	Closed	Reconstruct	Reconstruct	Reconstruct
01N40	Existing	0.220	ALL, year round	Maintain	Maintain	Maintain
01N40Y	Existing	1.501	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N40Y	Existing	0.409	HLO, seasonal	Reconstruct	Reconstruct	Maintain
01N40YA	Existing	0.474	Closed		Temp Use - Revert	Temp Use - Revert
01N41	Existing	0.269	ALL, seasonal	Maintain	Maintain	Maintain
01N42Y	Existing	1.143	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N42YC	Existing	0.281	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N43	Existing	5.941	ALL, year round	Maintain	Maintain	Maintain
01N43A	Existing	0.820	ALL, year round	Maintain	Maintain	Maintain
01N43B	Existing	0.628	ALL, year round	Maintain	Maintain	Maintain
01N43C	Existing	0.526	ALL, year round	Maintain	Maintain	Maintain
01N43D	Existing	0.205	ALL, year round	Maintain	Maintain	Maintain
01N43D	Existing	0.052	Closed	Maintain	Maintain	Maintain
01N44	Existing	0.524	ALL, year round	Maintain	Maintain	Maintain
01N46	Existing	0.908	ALL, year round	Reconstruct	Reconstruct	Reconstruct
01N48	Existing	0.831	ALL, year round	Maintain	Maintain	Maintain
01N48A	Existing	0.566	ALL, year round	Maintain	Maintain	Maintain
01N48B	Existing	0.189	ALL, year round	Maintain	Maintain	Maintain
01N49	Existing	1.306	ALL, seasonal	Maintain	Maintain	Maintain
01N49	Existing	0.847	ALL, year round	Maintain	Maintain	Maintain
01N49	Existing	0.145	ALL, year round	Reconstruct	Reconstruct	Reconstruct
01N49A	Existing	0.219	ALL, year round	Maintain	Maintain	Maintain
01N49B	Existing	0.377	ALL, seasonal	Maintain	Maintain	Maintain
01N50	Existing	0.026	ALL, seasonal	Reconstruct	Maintain	Maintain
01N50	Existing	2.945	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N50A	Existing	0.441	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N50C	Existing	1.181	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N51	Existing	0.651	ALL, year round	Maintain	Maintain	Maintain
01N56	Existing	0.145	ALL, seasonal	Maintain	Maintain	Maintain
01N56	Existing	3.087	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N56A	Existing	0.654	ALL, seasonal	Reconstruct	Maintain	Maintain
01N56A	Existing	0.523	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N57	Existing	2.178	ALL, seasonal	Maintain	Maintain	Maintain

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01N58	Existing	1.587	ALL, seasonal	Maintain	Maintain	Maintain
01N58	Existing	0.291	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N58A	Existing	0.393	Closed	Maintain	Maintain	Maintain
01N58B	Existing	0.221	ALL, seasonal	Maintain	Maintain	Maintain
01N59	Existing	0.186	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N60	Existing	0.758	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N60A	Existing	0.346	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N61	Existing	1.776	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N67	Existing	1.055	ALL, seasonal	Maintain	Maintain	Maintain
01N70	Existing	0.459	Closed		Temp Use - Revert	Temp Use - Revert
01N70A	Existing	0.235	Closed		Temp Use - Revert	Temp Use - Revert
01N72	Existing	0.684	Closed	Maintain	Reconstruct	Reconstruct
01N72	Existing	0.428	Closed	Reconstruct	Reconstruct	Reconstruct
01N74	Existing	4.315	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N74A	Existing	0.460	Closed	Reconstruct	Reconstruct	Reconstruct
01N74C	Existing	0.326	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N75	Existing	0.266	Closed	Reconstruct	Reconstruct	Reconstruct
01N76	Existing	2.378	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N77	Existing	0.118	ALL, seasonal	Maintain	Maintain	Maintain
01N78	Existing	0.383	ALL, seasonal	Maintain	Maintain	Maintain
01N79	Existing	3.346	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N79A	Existing	0.513	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N79B	Existing	0.379	ALL, seasonal	Maintain	Maintain	Maintain
01N79B	Existing	0.353	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01N80	Existing	1.449	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N80A	Existing	0.335	Closed	Reconstruct	Reconstruct	Reconstruct
01N82	Existing	0.300	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N83	Existing	0.021	ALL, seasonal	Maintain	Maintain	Maintain
01N83	Existing	1.934	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N83	Existing	0.105	Closed	Reconstruct	Reconstruct	Reconstruct
01N86	Existing	1.072	Closed	Reconstruct	Reconstruct	Reconstruct
01N88	Existing	0.631	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N89	Existing	0.522	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N91	Existing	0.280	Closed	Reconstruct	Reconstruct	Reconstruct
01N94	Existing	0.259	ALL, seasonal	Maintain	Maintain	Maintain
01N94	Existing	0.294	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N94A	Existing	0.403	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N96	Existing	4.940	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N96E	Existing	0.525	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01N97	Existing	5.012	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01N97C	Existing	0.113	Closed	Reconstruct	Reconstruct	Reconstruct
01N97D	Existing	0.064	Closed		Temp Use - Revert	Temp Use - Revert
01S01	Existing	0.138	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct
01S01	Existing	0.619	Closed	Reconstruct	Reconstruct	Reconstruct
01S01Y	Existing	0.066	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S01Y	Existing	0.587	Closed	Reconstruct	Reconstruct	Reconstruct
01S01YA	Existing	0.167	Closed	Reconstruct	Reconstruct	Reconstruct
01S01YB	Existing	0.585	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S02Y	Existing	0.151	Closed	Reconstruct	Reconstruct	Reconstruct
01S03	Existing	0.445	HLO, year round	Maintain	Reconstruct	Reconstruct
01S03B	Existing	1.025	Closed	Reconstruct	Reconstruct	Reconstruct
01S04	Existing	2.964	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S04A	Existing	0.851	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S05	Existing	4.003	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S05A	Existing	0.651	Closed	Reconstruct	Reconstruct	Reconstruct
01S06	Existing	2.688	Closed	Maintain	Maintain	Maintain
01S06B	Existing	0.104	HLO, year round	Maintain	Maintain	Maintain

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01S08	Existing	1.460	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S08Y	Existing	0.949	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S08YA	Existing	0.105	Closed	Reconstruct	Reconstruct	Reconstruct
01S09	Existing	2.029	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S11	Existing	0.286	ALL, seasonal	Maintain	Maintain	Maintain
01S11	Existing	0.711	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01S11	Existing	2.118	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S11A	Existing	0.555	ALL, seasonal	Maintain	Maintain	Maintain
01S11A	Existing	0.311	ALL, seasonal	Reconstruct	Reconstruct	Maintain
01S11F	Existing	0.575	ALL, seasonal	Maintain	Maintain	Maintain
01S11Y	Existing	1.449	Closed	Reconstruct	Reconstruct	Reconstruct
01S12G	Existing	0.363	ALL, seasonal	Maintain	Maintain	Maintain
01S12G	Existing	0.413	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S12H	Existing	0.581	ALL, seasonal	Maintain	Maintain	Maintain
01S12H	Existing	0.185	ALL, seasonal	Reconstruct	Maintain	Maintain
01S13	Existing	15.934	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S13C	Existing	2.001	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S13Y	Existing	1.223	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S14	Existing	5.912	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S14M	Existing	0.428	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01S15Y	Existing	3.059	Closed	Reconstruct	Reconstruct	Reconstruct
01S15YA	Existing	1.357	Closed	Reconstruct	Reconstruct	Reconstruct
01S15YB	Existing	0.181	Closed	Reconstruct	Reconstruct	Reconstruct
01S16Y	Existing	0.699	HLO, seasonal	Maintain	Maintain	Maintain
01S16Y	Existing	1.169	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S18Y	Existing	0.669	Closed	Reconstruct	Reconstruct	Reconstruct
01S19	Existing	0.544	ALL, seasonal	Maintain	Maintain	Maintain
01S19	Existing	2.149	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S19A	Existing	0.987	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S19B	Existing	0.011	Closed	Maintain	Reconstruct	Reconstruct
01S19B	Existing	0.523	Closed	Reconstruct	Reconstruct	Reconstruct
01S19C	Existing	0.238	ALL, seasonal	Maintain	Maintain	Maintain
01S19Y	Existing	0.208	HLO, seasonal	Maintain	Maintain	Maintain
01S19Y	Existing	0.263	HLO, seasonal	Reconstruct	Maintain	Maintain
01S20Y	Existing	0.220	HLO, seasonal	Maintain	Maintain	Maintain
01S20Y	Existing	0.433	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S21Y	Existing	0.878	ALL, seasonal	Maintain	Maintain	Maintain
01S23	Existing	3.029	ALL, seasonal	Maintain	Maintain	Maintain
01S23D	Existing	0.351	ALL, seasonal	Maintain	Maintain	Maintain
01S23E	Existing	0.228	Closed	Maintain	Maintain	Maintain
01S23H	Existing	0.078	Closed	Maintain	Maintain	Maintain
01S23X	Existing	0.571	Closed	Maintain	Maintain	Maintain
01S23Y	Existing	0.661	HLO, year round	Maintain	Maintain	Maintain
01S24	Existing	0.514	ALL, seasonal	Maintain	Reconstruct	Reconstruct
01S24	Existing	2.846	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S24	Existing	0.032	Closed	Maintain	Reconstruct	Reconstruct
01S24A	Existing	1.075	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S25	Existing	0.630	ALL, seasonal	Maintain	Maintain	Maintain
01S25	Existing	2.256	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S25A	Existing	2.369	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S25C	Existing	0.145	ALL, seasonal	Maintain	Maintain	Maintain
01S25C	Existing	0.476	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S25D	Existing	0.518	ALL, seasonal	Maintain	Maintain	Maintain
01S25E	Existing	0.238	ALL, seasonal	Maintain	Maintain	Maintain
01S25F	Existing	0.519	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S25Y	Existing	0.469	ALL, seasonal	Maintain	Maintain	Maintain
01S25Y	Existing	0.465	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01S25YA	Existing	0.255	Closed	Reconstruct	Reconstruct	Reconstruct
01S26	Existing	1.945	HLO, seasonal	Maintain	Maintain	Maintain
01S26	Existing	2.924	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S26B	Existing	0.409	Closed	Reconstruct	Reconstruct	Reconstruct
01S26C	Existing	0.684	HLO, seasonal	Maintain	Maintain	Maintain
01S26E	Existing	0.205	HLO, seasonal	Maintain	Maintain	Maintain
01S28Y	Existing	0.320	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S30	Existing	1.243	HLO, seasonal	Maintain	Maintain	Maintain
01S30B	Existing	0.554	Closed	Maintain	Maintain	Maintain
01S32	Existing	0.176	ALL, seasonal	Maintain	Maintain	Maintain
01S32	Existing	0.257	ALL, seasonal	Reconstruct	Maintain	Maintain
01S32	Existing	1.651	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S36	Existing	1.366	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S36B	Existing	0.198	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S39Y	Existing	0.889	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S39YA	Existing	0.102	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S41	Existing	1.435	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S41A	Existing	0.517	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S48	Existing	0.520	ALL, year round	Maintain	Maintain	Maintain
01S48Y	Existing	0.716	ALL, seasonal	Maintain	Maintain	Maintain
01S49	Existing	2.379	ALL, year round	Maintain	Maintain	Maintain
01S49Y	Existing	0.111	Closed	Reconstruct	Reconstruct	Reconstruct
01S51	Existing	2.236	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S51B	Existing	0.711	Closed	Reconstruct	Reconstruct	Reconstruct
01S52	Existing	0.149	HLO, year round	Maintain		
01S53	Existing	0.313	HLO, seasonal	Maintain	Maintain	Maintain
01S53	Existing	0.763	HLO, seasonal	Maintain	Reconstruct	Reconstruct
01S54	Existing	2.085	Closed	Reconstruct	Reconstruct	Reconstruct
01S57	Existing	1.960	HLO, seasonal	Maintain	Maintain	Maintain
01S58	Existing	2.472	Closed	Maintain	Maintain	Maintain
01S58B	Existing	0.521	Closed	Maintain	Maintain	Maintain
01S58D	Existing	0.082	Closed	Maintain	Maintain	Maintain
01S58F	Existing	0.700	Closed	Maintain	Maintain	Maintain
01S58G	Existing	0.073	Closed	Maintain	Maintain	Maintain
01S60	Existing	1.925	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S62	Existing	0.096	Closed	Reconstruct	Maintain	Maintain
01S62	Existing	1.326	Closed	Reconstruct	Reconstruct	Reconstruct
01S62A	Existing	0.388	Closed	Reconstruct	Reconstruct	Reconstruct
01S62Y	Existing	0.715	Closed	Maintain	Reconstruct	Reconstruct
01S62YA	Existing	0.296	Closed	Maintain	Reconstruct	Reconstruct
01S63Y	Existing	0.134	Closed	Maintain	Reconstruct	Reconstruct
01S63Y	Existing	2.250	Closed	Reconstruct	Reconstruct	Reconstruct
01S63YA	Existing	0.138	Closed	Reconstruct	Reconstruct	Reconstruct
01S64	Existing	1.595	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S66	Existing	1.796	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S66A	Existing	0.340	ALL, seasonal	Maintain	Maintain	Maintain
01S68	Existing	0.403	Closed	Reconstruct	Reconstruct	Reconstruct
01S68Y	Existing	0.634	Closed	Reconstruct	Reconstruct	Reconstruct
01S69	Existing	1.260	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S70	Existing	1.097	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S70	Existing	1.636	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S70A	Existing	0.339	Closed	Reconstruct	Reconstruct	Reconstruct
01S70B	Existing	0.416	ALL, seasonal	Maintain	Maintain	Maintain
01S71	Existing	1.649	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S72Y	Existing	1.158	ALL, seasonal	Maintain	Maintain	Maintain
01S73Y	Existing	0.845	Closed (mitigation)	Maintain	Maintain	Maintain
01S74	Existing	0.311	Closed	Maintain	Maintain	Maintain

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
01S74	Existing	0.729	Closed	Reconstruct	Reconstruct	Reconstruct
01S75	Existing	1.098	ALL, seasonal	Maintain	Maintain	Maintain
01S75A	Existing	0.365	ALL, seasonal	Maintain	Maintain	Maintain
01S75Y	Existing	1.559	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S75YA	Existing	0.688	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S75YB	Existing	0.324	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S76	Existing	1.654	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S77	Existing	1.122	Closed	Reconstruct	Reconstruct	Reconstruct
01S77A	Existing	0.205	Closed	Reconstruct	Reconstruct	Reconstruct
01S77B	Existing	0.266	Closed	Reconstruct	Reconstruct	Reconstruct
01S78	Existing	4.045	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S78A	Existing	0.806	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S79	Existing	0.088	Closed	Maintain	Reconstruct	Reconstruct
01S79	Existing	1.833	Closed	Reconstruct	Reconstruct	Reconstruct
01S79A	Existing	0.188	Closed	Reconstruct	Reconstruct	Reconstruct
01S80	Existing	1.935	ALL, seasonal	Maintain	Maintain	Maintain
01S80	Existing	0.874	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S80A	Existing	0.545	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S81	Existing	1.904	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S81A	Existing	0.577	Closed	Reconstruct	Reconstruct	Reconstruct
01S82	Existing	0.127	HLO, seasonal	Maintain	Maintain	Maintain
01S82	Existing	1.264	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S84	Existing	0.198	Closed	Reconstruct	Reconstruct	Reconstruct
01S85	Existing	1.680	ALL, seasonal	Maintain	Maintain	Maintain
01S88	Existing	0.278	Closed	Maintain	Maintain	Maintain
01S89	Existing	2.130	ALL, seasonal	Maintain	Maintain	Maintain
01S94	Existing	0.757	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
01S96	Existing	1.517	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S96A	Existing	0.223	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
01S98Y	Existing	0.104	Closed	Maintain	Maintain	Maintain
01S98YA	Existing	0.067	Closed	Maintain	Maintain	Maintain
01S98YA	Existing	0.033	Closed	Maintain	Maintain	Maintain
01S99Y	Existing	0.105	Closed	Maintain	Maintain	Maintain
02N03	Existing	0.544	ALL, seasonal	Maintain	Maintain	Maintain
02N04	Existing	1.078	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
02N04Y	Existing	0.432	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N05	Existing	1.660	ALL, seasonal	Maintain	Maintain	Maintain
02N05	Existing	2.131	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N05A	Existing	0.302	ALL, seasonal	Reconstruct	Maintain	Maintain
02N05A	Existing	2.266	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N05C	Existing	1.032	Closed	Reconstruct	Reconstruct	Reconstruct
02N05X	Existing	0.030	Closed	Maintain	Maintain	Maintain
02N06	Existing	4.489	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N06Y	Existing	0.776	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N06Y	Existing	0.386	Closed	Temp Road	Temp Road	Temp Road
02N08Y	Existing	1.621	ALL, seasonal	Maintain	Maintain	Maintain
02N08Y	Existing	2.671	ALL, seasonal	Maintain	Reconstruct	Reconstruct
02N08YA	Existing	0.354	ALL, seasonal	Reconstruct	Reconstruct	Maintain
02N08YB	Existing	0.416	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N08YB	Existing	0.739	Closed	Reconstruct	Reconstruct	Reconstruct
02N08YB	Existing	0.048	Closed	Reconstruct		
02N08YD	Existing	1.218	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N10B	Existing	0.757	Closed	Maintain	Maintain	Maintain
02N10Y	Existing	0.025	HLO, seasonal	Maintain	Maintain	Reconstruct
02N10Y	Existing	4.168	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
02N10YA	Existing	0.280	Closed	Reconstruct	Reconstruct	Reconstruct
02N11	Existing	4.757	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
02N11	Existing	4.076	ALL, year round	Maintain	Maintain	Maintain
02N11	Existing	0.917	ALL, year round	Reconstruct	Reconstruct	Reconstruct
02N11B	Existing	0.097	Closed	Maintain	Maintain	Maintain
02N11C	Existing	0.451	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N11D	Existing	0.196	ALL, year round	Maintain	Maintain	Maintain
02N11E	Existing	0.758	Closed	Maintain	Maintain	Maintain
02N11F	Existing	0.595	ALL, year round	Maintain	Maintain	Maintain
02N11F	Existing	0.410	Closed	Maintain	Maintain	Maintain
02N12	Existing	0.746	ALL, seasonal	Reconstruct	Maintain	Maintain
02N12	Existing	0.100	ALL, seasonal	Reconstruct		
02N13	Existing	1.132	ALL, seasonal	Maintain	Maintain	Maintain
02N13	Existing	1.113	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N13	Existing	0.309	Closed	Maintain	Maintain	Maintain
02N15	Existing	1.251	ALL, seasonal	Maintain	Maintain	Maintain
02N16	Existing	1.260	ALL, seasonal	Maintain	Maintain	Maintain
02N16A	Existing	0.425	ALL, seasonal	Maintain	Maintain	Maintain
02N18	Existing	1.471	HLO, seasonal	Reconstruct	Reconstruct	Maintain
02N20	Existing	1.438	ALL, seasonal	Maintain	Maintain	Maintain
02N20A	Existing	0.259	ALL, seasonal	Maintain	Maintain	Maintain
02N22	Existing	1.282	HLO, year round	Reconstruct	Reconstruct	Reconstruct
02N22A	Existing	0.756	ALL, seasonal	Maintain	Maintain	Maintain
02N23	Existing	0.972	ALL, seasonal	Maintain	Maintain	Maintain
02N23A	Existing	0.331	Closed	Maintain	Maintain	Maintain
02N24	Existing	1.623	ALL, seasonal	Reconstruct	Maintain	Maintain
02N24	Existing	1.661	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N24A	Existing	0.758	Closed		Temp Use - Revert	Temp Use - Revert
02N29	Existing	2.259	ALL, seasonal	Maintain	Maintain	Maintain
02N29	Existing	2.123	ALL, seasonal	Reconstruct	Maintain	Maintain
02N29	Existing	1.493	ALL, seasonal	Reconstruct	Reconstruct	Maintain
02N29A	Existing	0.567	ALL, seasonal	Reconstruct	Reconstruct	Maintain
02N29Y	Existing	0.953	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N30	Existing	0.397	Closed	Reconstruct	Maintain	Maintain
02N30	Existing	0.471	Closed	Reconstruct	Reconstruct	Reconstruct
02N31	Existing	0.945	Closed	Maintain	Maintain	Maintain
02N31Y	Existing	0.663	ALL, seasonal	Maintain	Maintain	Maintain
02N31YA	Existing	0.514	ALL, seasonal	Maintain	Maintain	Maintain
02N31YB	Existing	0.068	ALL, seasonal	Maintain	Maintain	Maintain
02N32	Existing	2.792	ALL, seasonal	Maintain	Maintain	Maintain
02N33	Existing	1.145	ALL, seasonal	Maintain	Maintain	Maintain
02N40	Existing	2.526	ALL, seasonal	Maintain	Maintain	Maintain
02N40	Existing	0.359	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N41	Existing	0.356	ALL, seasonal	Reconstruct	Reconstruct	Maintain
02N43	Existing	0.327	ALL, seasonal	Maintain	Maintain	Maintain
02N43	Existing	0.231	ALL, seasonal	Reconstruct	Maintain	Maintain
02N43	Existing	1.501	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N44	Existing	1.430	HLO, year round	Maintain	Maintain	Maintain
02N44A	Existing	0.151	HLO, seasonal	Maintain	Maintain	Maintain
02N45	Existing	0.354	ALL, seasonal	Maintain	Maintain	Maintain
02N46	Existing	0.081	Closed	Maintain	Maintain	Maintain
02N46	Existing	1.320	Closed	Reconstruct	Reconstruct	Reconstruct
02N46A	Existing	0.097	Closed	Maintain	Maintain	Maintain
02N48	Existing	1.512	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N48A	Existing	0.490	ALL, seasonal	Reconstruct	Maintain	Maintain
02N52	Existing	1.692	ALL, seasonal	Maintain	Maintain	Maintain
02N52	Existing	0.332	Closed	Maintain	Maintain	Maintain
02N52A	Existing	0.109	Closed	Maintain	Maintain	Maintain
02N52A	Existing	0.427	Closed	Maintain	Maintain	Maintain

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
02N53	Existing	1.211	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N53A	Existing	0.343	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N54	Existing	0.482	ALL, seasonal	Maintain	Maintain	Maintain
02N54	Existing	0.154	ALL, seasonal	Reconstruct	Maintain	Maintain
02N54	Existing	2.793	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N56	Existing	3.438	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N56	Existing	0.289	Closed	Reconstruct	Reconstruct	Reconstruct
02N57	Existing	0.294	ALL, seasonal	Maintain	Reconstruct	Reconstruct
02N57A	Existing	0.070	ALL, seasonal	Maintain	Reconstruct	Reconstruct
02N58	Existing	0.695	Closed	Maintain	Maintain	Maintain
02N59	Existing	1.775	ALL, seasonal	Maintain	Maintain	Maintain
02N60	Existing	1.034	ALL, seasonal	Maintain	Reconstruct	Reconstruct
02N60	Existing	0.293	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N61	Existing	0.876	Closed	Reconstruct	Reconstruct	Maintain
02N62	Existing	2.769	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N66	Existing	0.307	ALL, seasonal	Maintain	Maintain	Maintain
02N66	Existing	2.669	ALL, seasonal	Maintain	Maintain	Maintain
02N69	Existing	0.077	ALL, seasonal	Maintain	Maintain	Maintain
02N76	Existing	0.631	ALL, seasonal	Reconstruct	Reconstruct	Maintain
02N76	Existing	0.861	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N77	Existing	0.202	Closed	Reconstruct	Reconstruct	Reconstruct
02N77Y	Existing	0.500	ALL, seasonal	Maintain	Maintain	Maintain
02N78	Existing	0.596	ALL, seasonal	Maintain	Reconstruct	Reconstruct
02N81	Existing	0.315	ALL, seasonal	Reconstruct	Maintain	Maintain
02N81	Existing	1.758	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N81A	Existing	0.161	Closed	Reconstruct	Reconstruct	Reconstruct
02N82	Existing	1.421	ALL, seasonal	Maintain	Maintain	Maintain
02N84	Existing	0.618	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N85	Existing	1.354	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N87	Existing	0.130	Closed	Maintain	Maintain	Maintain
02N94	Existing	0.158	ALL, seasonal	Reconstruct	Maintain	Maintain
02N94	Existing	1.873	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02N98	Existing	0.102	Closed	Maintain	Maintain	Maintain
02N98A	Existing	0.259	Closed	Maintain	Maintain	Maintain
02S01	Existing	1.512	HLO, seasonal	Maintain	Maintain	Maintain
02S01	Existing	3.596	HLO, seasonal	Maintain	Reconstruct	Reconstruct
02S01A	Existing	0.916	HLO, seasonal	Maintain	Maintain	Maintain
02S01C	Existing	0.309	HLO, seasonal	Maintain	Maintain	Maintain
02S01D	Existing	0.507	Closed	Reconstruct	Reconstruct	Reconstruct
02S07	Existing	2.881	Closed (mitigation)	Maintain	Maintain	Maintain
02S07A	Existing	0.665	Closed	Maintain	Maintain	Maintain
02S15Y	Existing	1.007	ALL, seasonal	Maintain	Maintain	Maintain
02S19Y	Existing	0.334	ALL, seasonal	Maintain	Maintain	Maintain
02S19Y	Existing	1.367	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S19YA	Existing	0.506	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S19YB	Existing	0.309	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S25	Existing	2.068	ALL, seasonal	Maintain	Maintain	Maintain
02S25	Existing	1.362	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S25B	Existing	0.390	Closed	Reconstruct	Reconstruct	Reconstruct
02S30	Existing	0.259	other public road	Reconstruct	Reconstruct	Reconstruct
02S30A	Existing	0.179	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
02S30C	Existing	0.568	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S30E	Existing	0.463	ALL, seasonal	Maintain	Maintain	Maintain
02S35Y	Existing	0.334	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
02S35YA	Existing	0.064	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
02S38Y	Existing	0.383	ALL, seasonal	Maintain	Maintain	Maintain
02S40	Existing	1.359	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
02S50Y	Existing	0.727	HLO, seasonal	Maintain	Maintain	Maintain
02S51Y	Existing	1.901	ALL, seasonal	Maintain	Maintain	Maintain
02S51YA	Existing	0.554	ALL, seasonal	Maintain	Maintain	Maintain
02S60	Existing	1.934	ALL, seasonal	Maintain	Maintain	Maintain
02S60B	Existing	0.506	ALL, seasonal	Maintain	Maintain	Maintain
02S60C	Existing	0.214	ALL, seasonal	Maintain	Maintain	Maintain
02S62	Existing	5.598	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S62B	Existing	0.661	ALL, seasonal	Maintain	Maintain	Maintain
02S64	Existing	1.612	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S65	Existing	0.864	ALL, seasonal	Maintain	Maintain	Maintain
02S65	Existing	1.261	ALL, seasonal	Reconstruct	Maintain	Maintain
02S65	Existing	1.247	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S65A	Existing	0.356	Closed	Reconstruct	Reconstruct	Reconstruct
02S65D	Existing	0.216	Closed	Maintain	Maintain	Maintain
02S66Y	Existing	1.823	ALL, seasonal	Maintain	Maintain	Maintain
02S66YA	Existing	0.085	ALL, seasonal	Maintain	Maintain	Maintain
02S68	Existing	1.814	Closed (mitigation)	Reconstruct	Reconstruct	Reconstruct
02S68A	Existing	0.254	Closed	Reconstruct	Reconstruct	Reconstruct
02S68B	Existing	0.176	Closed	Reconstruct	Maintain	Maintain
02S68B	Existing	0.128	Closed	Reconstruct	Reconstruct	Reconstruct
02S72	Existing	0.465	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S87	Existing	0.009	Closed	Maintain	Reconstruct	Reconstruct
02S87	Existing	1.077	Closed	Reconstruct	Reconstruct	Reconstruct
02S88	Existing	0.783	ALL, seasonal	Maintain	Maintain	Maintain
02S88	Existing	0.287	ALL, seasonal	Reconstruct	Maintain	Maintain
02S88	Existing	1.308	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S89	Existing	4.948	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
02S93	Existing	2.518	ALL, seasonal	Maintain	Maintain	Maintain
03N01A	Existing	0.292	Closed	Reconstruct	Reconstruct	Maintain
03N01C	Existing	0.110	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
03N01C	Existing	0.472	Closed	Reconstruct	Reconstruct	Reconstruct
03N01G	Existing	1.004	ALL, seasonal	Maintain	Maintain	Maintain
03N01K	Existing	0.668	Closed	Reconstruct	Reconstruct	Reconstruct
03N01M	Existing	0.709	ALL, seasonal	Maintain	Maintain	Maintain
03N01N	Existing	0.372	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
03N01N	Existing	0.415	Closed	Reconstruct	Reconstruct	Reconstruct
03N01P	Existing	0.440	HLO, seasonal	Reconstruct	Reconstruct	Reconstruct
03N01Q	Existing	0.198	HLO, seasonal	Maintain	Maintain	Maintain
03N01R	Existing	0.558	Closed	Reconstruct	Reconstruct	Reconstruct
03N01S	Existing	0.360	Closed	Reconstruct	Reconstruct	Reconstruct
03N01T	Existing	0.171	Closed	Reconstruct	Reconstruct	Maintain
03N04Y	Existing	0.497	Closed	Reconstruct	Reconstruct	Reconstruct
03N07	Existing	0.253	ALL, seasonal	Maintain	Maintain	Maintain
03N21	Existing	1.534	ALL, seasonal	Maintain	Maintain	Maintain
03N22	Existing	1.895	ALL, seasonal	Maintain	Maintain	Maintain
03N22A	Existing	1.322	ALL, seasonal	Maintain	Maintain	Maintain
03N45Y	Existing	0.851	ALL, seasonal	Maintain	Maintain	Maintain
03N56Y	Existing	0.134	ALL, seasonal	Maintain	Maintain	Maintain
03N56Y	Existing	0.857	ALL, seasonal	Reconstruct	Maintain	Maintain
03N56Y	Existing	0.275	ALL, seasonal	Reconstruct	Reconstruct	Maintain
03N56Y	Existing	0.155	ALL, seasonal	Reconstruct		
03N56YA	Existing	0.622	ALL, seasonal	Reconstruct	Reconstruct	Maintain
03N83	Existing	5.116	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
03N83	Existing	0.285	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
03N83A	Existing	1.016	ALL, seasonal	Maintain	Maintain	Maintain
03N83B	Existing	0.586	ALL, seasonal	Reconstruct	Maintain	Maintain
03N83C	Existing	1.439	Closed	Temp Use - Revert	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
03N83C	Existing	0.548	Closed	Temp Use - Revert		
03N86	Existing	2.138	ALL, seasonal	Maintain	Maintain	Maintain
11705B	Existing	0.306	Closed	Maintain	Maintain	Maintain
11805A	Existing	0.085	Closed	Temp Road	Temp Road	Temp Road
11806A	Existing	0.473	Closed	Temp Road	Temp Road	Temp Road
11807A	Existing	0.077	Closed	Temp Road	Temp Road	Temp Road
11819F	Existing	0.109	Closed		Temp Road	Temp Road
11821B	Existing	0.304	Closed		Temp Road	Temp Road
11821J2	Existing	0.692	Closed	Reconstruct	Temp Road	Temp Road
11824P2	Existing	0.098	Closed	Reconstruct	Temp Use - Revert	Temp Use - Revert
11833A	Existing	0.228	Closed	Reconstruct	Temp Road	Temp Road
11833D	Existing	0.286	Closed	Temp Use - Revert	Temp Use - Revert	Temp Use - Revert
11833D	Existing	0.174	Closed	Temp Use - Revert		
11833F	Existing	0.087	Closed	Temp Road	Temp Road	Temp Road
11833F	Existing	0.142	Closed		Temp Road	Temp Road
11906G1	Existing	0.029	Closed	Maintain	Maintain	Maintain
11906G2	Existing	0.037	Closed	Maintain	Maintain	Maintain
11906G3	Existing	0.056	Closed	Maintain	Maintain	Maintain
17EV11	Existing	0.906	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
17EV11	Existing	0.331	Closed (mitigation)	Reconstruct	Reconstruct	Reconstruct
17EV11	Existing	0.066	Closed (mitigation)	Reconstruct		
17EV34	Existing	0.265	ALL, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
17EV438	Existing	0.168	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18DC429	Existing	0.077	Closed		Temp Use - Revert	Temp Use - Revert
18DC431	Existing	0.084	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18DC434	Existing	0.039	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV274	Existing	0.795	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
18EV274	Existing	0.711	ALL, seasonal	Reconstruct		
18EV277	Existing	0.094	ALL, seasonal	Temp Use - Revert	Reconstruct	Maintain
18EV400	Existing	0.571	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV402	Existing	0.613	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct
18EV407	Existing	0.224	ALL, seasonal		Temp Use - Revert	Temp Use - Revert
18EV409	Existing	0.525	Closed (mitigation)	Temp Use - Revert	Reconstruct	Reconstruct
18EV409	Existing	0.091	Closed (mitigation)	Temp Use - Revert	Reconstruct	Reconstruct
18EV410	Existing	0.295	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV411	Existing	0.193	ALL, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV420	Existing	0.587	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV422	Existing	0.121	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
18EV422	Existing	0.123	4WD, seasonal	Temp Use - Revert		
18EV427	Existing	0.150	Closed (mitigation)	Temp Use - Revert	Reconstruct	Reconstruct
18EV433	Existing	0.073	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
18EV435	Existing	0.511	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
18EV440	Existing	1.420	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
19DC124	Existing	0.125	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct
19EV117	Existing	0.503	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct
19EV129	Existing	0.229	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
19EV129	Existing	0.671	4WD, seasonal	Temp Use - Revert		
19EV130	Existing	0.392	4WD, seasonal		Temp Use - Revert	Temp Use - Revert
19EV135	Existing	0.550	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
19EV142	Existing	0.171	ALL, seasonal	Reconstruct	Reconstruct	Reconstruct
19EV142	Existing	0.099	ALL, seasonal	Reconstruct		
19EV148	Existing	0.443	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
19EV154	Existing	0.685	Closed		Temp Road	Temp Road
19EV155	Existing	0.517	Closed		Temp Road	Temp Road
19EV213	Existing	0.771	4WD, seasonal	Temp Use - Revert	Reconstruct	Reconstruct
19EV214	Existing	1.263	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct
19EV215	Existing	0.600	4WD, seasonal	Reconstruct	Reconstruct	Reconstruct

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
1S1806A	Existing	0.152	Closed	Maintain	Reconstruct	Reconstruct
1S1824	Existing	0.361	Closed	Temp Road	Temp Road	Temp Road
1S1907A	Existing	0.388	Closed	Temp Road	Temp Road	Temp Road
1S1920	Existing	0.806	Closed	Temp Road	Temp Road	Temp Road
1S1922D	Existing	0.364	Closed	Temp Road	Temp Road	Temp Road
1S1928A	Existing	0.115	Closed		Temp Road	Temp Road
1S25YB	Existing	0.337	Closed	Reconstruct	Reconstruct	Reconstruct
21709O	Existing	0.284	Closed	Maintain	Maintain	Maintain
21712B	Existing	0.059	Closed	Reconstruct		
21713B	Existing	0.056	Closed	Temp Road		
21721B	Existing	0.176	Closed	Reconstruct	Temp Road	Temp Road
21734D	Decommissioned	0.449	Closed	Reconstruct		
21734D	Existing	0.163	Closed	Reconstruct		
21801E	Existing	0.052	Closed	Maintain	Maintain	Maintain
21802N	Existing	0.199	Closed	Maintain	Maintain	Maintain
21812C	Existing	0.067	Closed	Maintain	Maintain	Maintain
21823M	Existing	0.038	Closed	Reconstruct	Temp Road	Temp Road
21831A	Existing	0.066	Closed	Reconstruct	Temp Road	Temp Road
21907B	Existing	0.237	Closed	Maintain	Maintain	Maintain
21907B	Existing	0.201	Closed		Temp Road	Temp Road
2S1815	Existing	0.510	Closed	Maintain	Maintain	Maintain
A1A	New	0.926	Closed	New Construction	New Construction	
A1B	New	0.111	Closed	New Construction	New Construction	
FR10142	Existing	0.030	Closed	Maintain	Maintain	Maintain
FR11091	Existing	0.073	Closed	Maintain	Maintain	Maintain
FR14878	Existing	0.561	Closed	Reconstruct	Temp Road	Temp Road
FR15090	Existing	0.071	Closed	Maintain	Maintain	Maintain
FR15120	Existing	0.119	Closed	Maintain	Maintain	Maintain
FR15120	Existing	0.035	Closed	Maintain	Maintain	Maintain
FR1981	Existing	0.268	Closed	Maintain	Maintain	Maintain
FR36710	Existing	0.602	Closed	Maintain	Maintain	Maintain
FR3993	Existing	0.065	Closed	Maintain	Maintain	Maintain
FR4100	Existing	0.128	Closed	Temp Road	Temp Road	Temp Road
FR4875	Existing	0.076	Closed	Maintain	Maintain	Maintain
FR5016	Existing	0.124	Closed	Reconstruct	Temp Road	Temp Road
FR5230	Existing	0.678	Closed	Temp Road	Temp Road	Temp Road
FR5310	Existing	0.089	Closed	Reconstruct	Temp Use - Revert	Temp Use - Revert
FR5318	Existing	0.049	Closed	Maintain	Maintain	Maintain
FR5473	Existing	0.231	Closed	Temp Road	Temp Road	Temp Road
FR5474	Existing	0.280	Closed	Temp Road	Temp Road	Temp Road
FR5606	Existing	0.552	Closed	Maintain	Maintain	Maintain
FR5766	Existing	0.151	Closed	Reconstruct	Temp Road	Temp Road
FR5817	Existing	0.469	Closed	Maintain	Maintain	Maintain
FR5818	Existing	0.270	Closed	Reconstruct	Temp Road	Temp Road
FR5819	Existing	0.025	Closed	Reconstruct	Temp Road	Temp Road
FR6469	Existing	0.246	Closed	Maintain	Maintain	Maintain
FR7208	Existing	0.025	Closed	Maintain	Maintain	Maintain
FR7209	Existing	0.039	Closed	Maintain	Maintain	Maintain
FR7209	Existing	0.295	other public road	Reconstruct	Reconstruct	Reconstruct
FR7858	Existing	0.462	Closed	Maintain	Maintain	Maintain
FR7955	Existing	0.050	Closed	Reconstruct	Temp Road	Temp Road
FR7965	Existing	0.205	Closed	Maintain	Maintain	Maintain
FR8430	Existing	0.007	Closed		Maintain	Maintain
FR8449	Existing	0.041	Closed	Reconstruct		
FR8473	Existing	0.171	Closed	Temp Road	Temp Road	
FR8591	Existing	0.048	Closed	Maintain	Maintain	Maintain
FR8592	Existing	0.245	Closed	Temp Road	Temp Road	Temp Road

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
FR8593	Existing	0.341	Closed	Temp Road	Temp Road	Temp Road
FR8594	Existing	0.246	Closed	Maintain	Maintain	Maintain
FR8597	Existing	0.087	Closed	Temp Road	Temp Road	Temp Road
FR8609	Existing	0.372	Closed	Temp Road		
FR8611	Existing	0.355	Closed	Temp Road	Temp Road	Temp Road
FR8770	Existing	0.102	Closed	Reconstruct	Temp Use - Revert	Temp Use - Revert
FR8781	Existing	0.170	Closed	Temp Road	Temp Road	Temp Road
FR8799	Existing	0.241	Closed	Maintain	Maintain	Maintain
FR8988	Existing	0.222	Closed	Maintain	Maintain	Maintain
FR8990	Existing	0.305	Closed	Temp Road	Temp Road	Temp Road
FR8990	Existing	0.074	Closed	Temp Road		
FR8992	Existing	0.105	Closed	Temp Road	Temp Road	Temp Road
FR9175	Existing	0.476	Closed	Reconstruct	Temp Road	Temp Road
FR9357	Existing	0.154	Closed	Temp Road	Temp Road	Temp Road
FR9377	Existing	0.449	Closed		Temp Road	Temp Road
FR9573	Existing	0.192	Closed	Reconstruct	Temp Road	Temp Road
FR9582	Existing	0.230	Closed	Maintain	Maintain	Maintain
FR9712	Existing	0.014	Closed		Temp Road	Temp Road
FR9713	Existing	0.254	Closed		Temp Road	Temp Road
FR9723	Existing	0.121	Closed	Reconstruct	Temp Road	Temp Road
FR9723	Existing	0.125	Closed		Temp Road	Temp Road
FR9724	Existing	0.165	Closed	Reconstruct	Temp Road	Temp Road
FR9725	Existing	0.135	Closed	Temp Road	Temp Road	Temp Road
FR9726	Existing	0.158	Closed	Temp Road	Temp Road	Temp Road
FR9727	Existing	0.386	Closed	Temp Road	Temp Road	Temp Road
FR9734A	Existing	0.029	Closed	Reconstruct	Temp Road	Temp Road
FR9771	Existing	0.065	Closed	Maintain	Maintain	Maintain
FR9773	Existing	0.801	Closed	Reconstruct	Temp Road	Temp Road
FR9777	Existing	0.123	Closed	Reconstruct	Temp Road	Temp Road
FR9787	Existing	0.052	Closed	Maintain	Maintain	Maintain
FR98493	Existing	0.023	Closed	Temp Road	Temp Road	Temp Road
FR98541	Existing	0.068	Closed	Temp Road	Temp Road	Temp Road
FR98671	Existing	0.218	Closed	Reconstruct	Temp Road	Temp Road
FR99001	Existing	0.361	Closed	Maintain	Maintain	Maintain
FR99002	Existing	0.481	Closed	Maintain	Maintain	Maintain
FR99003	Existing	0.045	Closed	Maintain	Maintain	Maintain
FR99004	Existing	0.114	Closed	Maintain	Maintain	Maintain
FR99005	Existing	0.315	Closed	Maintain	Maintain	Maintain
P11807A-1	Existing	0.088	Closed	New Construction	Temp Road	Temp Road
P17EV11-1	New	1.620	Closed	New Construction		
P1N01-1	Existing	0.406	Closed	Reconstruct	Temp Road	Temp Road
P1N01A-1	Existing	0.400	Closed	Reconstruct	Temp Road	Temp Road
P1N11Y-1	Existing	0.205	Closed	New Construction	Temp Road	Temp Road
P1N60-1	New	0.464	Closed	New Construction		
P1S11-1	New	1.111	Closed	New Construction		
P1S11-2	New	0.465	Closed	New Construction		
P2S30-1	New	0.035	Closed	New Construction		
P3N01-3	Existing	0.112	Closed	New Construction	Temp Road	Temp Road
P3N56Y-1	New	0.194	Closed	New Construction		
PFR8592-1	New	0.073	Closed	New Construction		
PFR8592-1	Existing	0.131	Closed		Temp Road	Temp Road
Temp 1	New	0.658	Closed	Temp Road	Temp Road	Temp Road
Temp 10	New	0.073	Closed	Temp Road	Temp Road	Temp Road
Temp 14	New	0.206	Closed	Temp Road	Temp Road	Temp Road
Temp 14	New	0.188	Closed		Temp Road	Temp Road
Temp 15	New	0.249	Closed	Temp Road		
Temp 16	Existing	0.615	Closed	Temp Road	Temp Road	Temp Road

Route	Status	miles	MVUM	Alternative 1	Alternative 3	Alternative 4
Temp 17	New	0.181	Closed	Temp Road	Temp Road	Temp Road
Temp 18	Existing	0.602	Closed	Temp Road	Temp Road	Temp Road
Temp 19	New	0.152	Closed	Temp Road	Temp Road	
Temp 21	New	0.130	Closed	Temp Road	Temp Road	Temp Road
Temp 23	Existing	0.273	Closed		Temp Road	Temp Road
Temp 24	Existing	0.192	Closed	Reconstruct	Temp Road	Temp Road
Temp 28	New	0.513	Closed		Temp Road	Temp Road
Temp 29	New	0.214	Closed		Temp Road	
Temp 3	New	0.513	Closed	Temp Road	Temp Road	Temp Road
Temp 30	New	0.249	Closed		Temp Road	
Temp 31	New	0.496	Closed		Temp Road	
Temp 32	New	0.321	Closed		Temp Road	Temp Road
Temp 33	Existing	0.226	Closed		Temp Road	Temp Road
Temp 34	New	0.435	Closed		Temp Road	Temp Road
Temp 35	New	0.436	Closed		Temp Road	Temp Road
Temp 36	Existing	0.581	Closed		Temp Road	Temp Road
Temp 37	New	0.301	Closed		Temp Road	Temp Road
Temp 38	Existing	0.124	Closed		Temp Road	Temp Road
Temp 39	Existing	0.285	Closed		Temp Road	Temp Road
Temp 4	New	0.248	Closed	Temp Road	Temp Road	Temp Road
Temp 40	New	1.022	Closed		Temp Road	Temp Road
Temp 41	New	0.204	Closed		Temp Road	Temp Road
Temp 42	Existing	0.161	Closed		Temp Road	Temp Road
Temp 43	Existing	0.074	Closed		Temp Road	Temp Road
Temp 44	Existing	0.280	Closed		Temp Road	Temp Road
Temp 45	Existing	0.210	Closed		Temp Road	Temp Road
Temp 46	New	0.227	Closed		Temp Road	Temp Road
Temp 47	New	0.366	Closed		Temp Road	Temp Road
Temp 48	Existing	0.448	Closed		Temp Road	Temp Road
Temp 49	New	0.262	Closed		Temp Road	Temp Road
Temp 5	New	0.179	Closed	Temp Road		
Temp 50	Existing	0.100	Closed		Temp Road	Temp Road
Temp 51	Existing	0.739	Closed		Temp Road	Temp Road
Temp 52	Existing	0.377	Closed		Temp Road	Temp Road
Temp 53	New	0.183	Closed		Temp Road	Temp Road
Temp 54	New	0.242	Closed		Temp Road	Temp Road
Temp 55	New	0.155	Closed		Temp Road	Temp Road
Temp 56	New	0.487	Closed		Temp Road	Temp Road
Temp 57	Existing	0.031	Closed		Temp Road	Temp Road
Temp 58	New	0.213	Closed	Temp Road	Temp Road	Temp Road
Temp 59	New	0.163	Closed	Reconstruct	Temp Road	Temp Road
Temp 6	New	0.619	Closed	Temp Road		
Temp 60	Existing	0.591	Closed		Temp Road	Temp Road
Temp 61	New	0.179	Closed		Temp Road	Temp Road
Temp 7	New	0.092	Closed	Temp Road	Temp Road	Temp Road
Temp 8	New	0.197	Closed	Temp Road	Temp Road	Temp Road
Temp 9	New	0.174	Closed	Temp Road	Temp Road	Temp Road
TR333	Existing	0.455	Closed	Temp Road	Temp Road	
TR62328	Existing	0.286	Closed		Temp Road	Temp Road
TR62331	Existing	0.149	Closed	Reconstruct	Temp Road	Temp Road

4WD=4 Wheel Drive; ALL=All Vehicles; HLO=Highway Legal Only MVUM=Motor Vehicle Use Map; Temp=Temporary
Blank entries indicate the item does not apply.