Biological Evaluation

for the

Bull Run Roadside Hazard Tree Mitigation Project

WESTERN DIVIDE AND KERN RIVER RANGER DISTRICTS
SEQUOIA NATIONAL FOREST

Prepared By: [signature] Date: 3/24/17
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SUMMARY

This Biological Evaluation analyzes the potential effects of the Bull Run Roadside Hazard Tree Mitigation Project (hereafter, Bull Run Project) to determine its effect on terrestrial species of concern. It is prepared in compliance with the requirements of the FSM 2672.4 and 36 CFR 219.19. The purpose of the project is the timely removal of hazard trees along specific Forest Service roads located within the Cedar Fire vicinity within Kern and Tulare Counties.

Region 5 Forest Service sensitive species with documented or potential occurrence (based on past habitat availability) include the northern goshawk (*Accipiter gentilis*), California spotted owl (*Strix occidentalis occidentalis*), Townsend's big-eared bat (*Corynorhinus townsendii*), pallid bat *(Antrozous pallidus)*, fringed myotis bat (*Myotis thysanodes*), and fisher (*Martes pennanti*). A determination of "May affect individuals, but not likely to lead to loss of viability or a trend leading to Federal listing" was issued for all species based on the effects analysis of the proposed project.

Contents

I. INTRODUCTION

The purpose of this Biological Evaluation (BE) is to review the potential impacts associated with the Bull Run Roadside Hazard Tree Mitigation Project (Bull Run Project) to determine its effect on terrestrial species of concern. The BE will determine whether the proposed action would contribute to a trend toward any Forest Service sensitive species becoming federally listed. This BE was prepared in accordance with the standards established under Forest Service Manual direction (FSM 2672.42).

Sensitive species considered in depth are listed in **Table 1**. Appendix A includes a detailed listing of other Region 5 sensitive species that have the potential to occur within Sequoia National Forest but were eliminated from the need for detailed analysis under this document based on various criteria related to habitat requirements, geographic range or potential effects. See Appendix A for detailed rationale.

Table 1. Species considered in detail for the Bull Run Project.

Common Name	Scientific Name	Status
Northern Goshawk	*Accipiter gentilis*	FS
California Spotted Owl	*Strix occidentalis occidentalis*	FS
Townsend's Big-eared Bat	*Corynorhinus townsendii*	FS
Pallid Bat	*Antrozous pallidus*	FS
Fringed Myotis	*Myotis thysanodes*	FS
Fisher	*Martes pennanti*	FS
FS = Forest Service Sensitive in Region 5		

II. CONSULTATION TO DATE

The US Fish and Wildlife Service IPAC site was consulted to obtain a species list of federally threatened, endangered, proposed, and candidate species with potential to occur within the vicinity of the Bull Run Hazard Tree Mitigation Project area (Consultation Code:08ESMF00-2017-SLI-1285, February 28, 2017). This list fulfills the requirement to provide a current species list, pursuant to Section 7.c. of the ESA, and is updated with USFWS every 90 days. The *Bull Run Roadside Hazard Tree Mitigation Project Biological Assessment* (R.Galloway, March 2017) was completed to address the project effects on federally listed species to meet the legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (19 U.S. C. 1536(c)) as amended. This document was submitted to the U.S. Fish and Wildlife Service (USFWS) requesting formal consultation. A Biological Opinion (08ESMF00-2017-F-1604) was received from the USFWS Sacramento Field Office. Both documents are a part of the project record and are available upon request.

III. CURRENT MANAGEMENT DIRECTION

Direction for sensitive species management is provided in the Forest Service Manual (FSM 2672.1), and the Sequoia Forest Land and Resource Management Plan (LRMP) (USDA 1988) as amended by the Sierra Nevada Forest Plan Amendment FEIS (USDA 2004). Forest Service manual direction ensures through the biological evaluation process that all sensitive species receive full consideration in relation to proposed activities.

Direction to maintain the viability of Region 5 sensitive species is provided by the National Forest Management Act, the Code of Federal Regulations (CFR 219.19), and the Forest Service Manual (FSM 2672). The Sequoia National Forest LRMP as amended provides general direction to utilize administrative measures to protect and improve the status of sensitive wildlife species.

As an agency that manages public lands the Forest Service has a responsibility to minimize hazards that are reasonably anticipated to effect the safety of its users. Current policy regarding health and safety hazard tree abatement for roadways and administrative facilities can be found in the following manual and handbook references:

- Forest Service Manual (FSM) 1535 - Forest Service Roads open to public travel.
- Forest Service Manual (FSM) 2332.1 - Recreation site safety inspection.
- Forest Service Manual (FSM) 7730 Travel Management-Road Operation and Maintenance
- Forest Service Handbook (FSH) 7709.59: Road System Operations and Maintenance Handbook
- 2012 Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region (Angwin et al. 2012)

IV. DESCRIPTION OF THE PROPOSED PROJECT

The Bull Run Project is located on the Western Divide and Kern River Ranger Districts, Sequoia National Forest (**Figure 1**). The project would occur in or partially within Township 24 South, Range 31 East, Sections 13, 25, and 36; Township 24 South, Range 32 East, Sections 7-10, 16-20, and 29-32; Township 25 South, Range 31 East, Sections 2, 3, and 11; and Township 25 South, Range 32 East, Sections 4-10, 15-17, 20 and 21; Mount Diablo Base and Meridian (**Figure 2**). The Bull Run Project is primarily located on the east side of the Greenhorn Mountains within the Bull Run Creek Watershed.

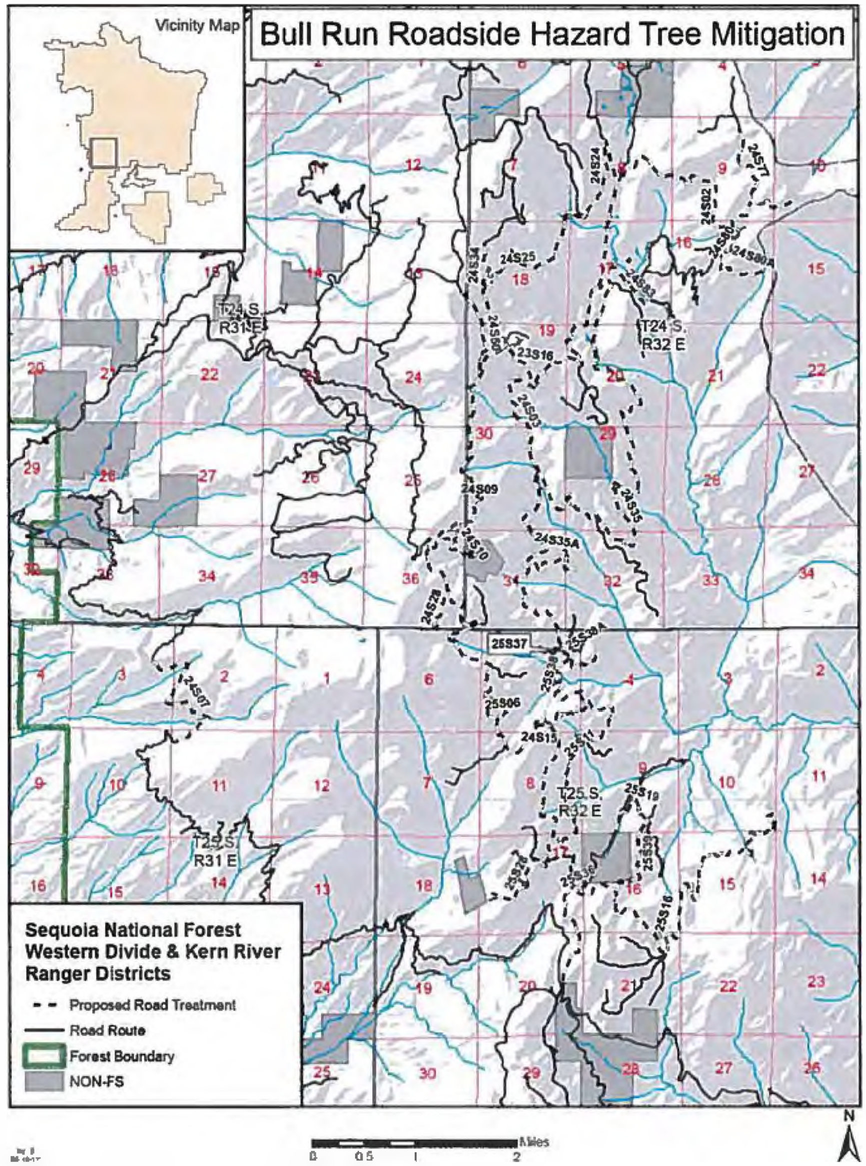

Figure 1. Bull Run Roadside Hazard Tree Mitigation Project and Vicinity Map.

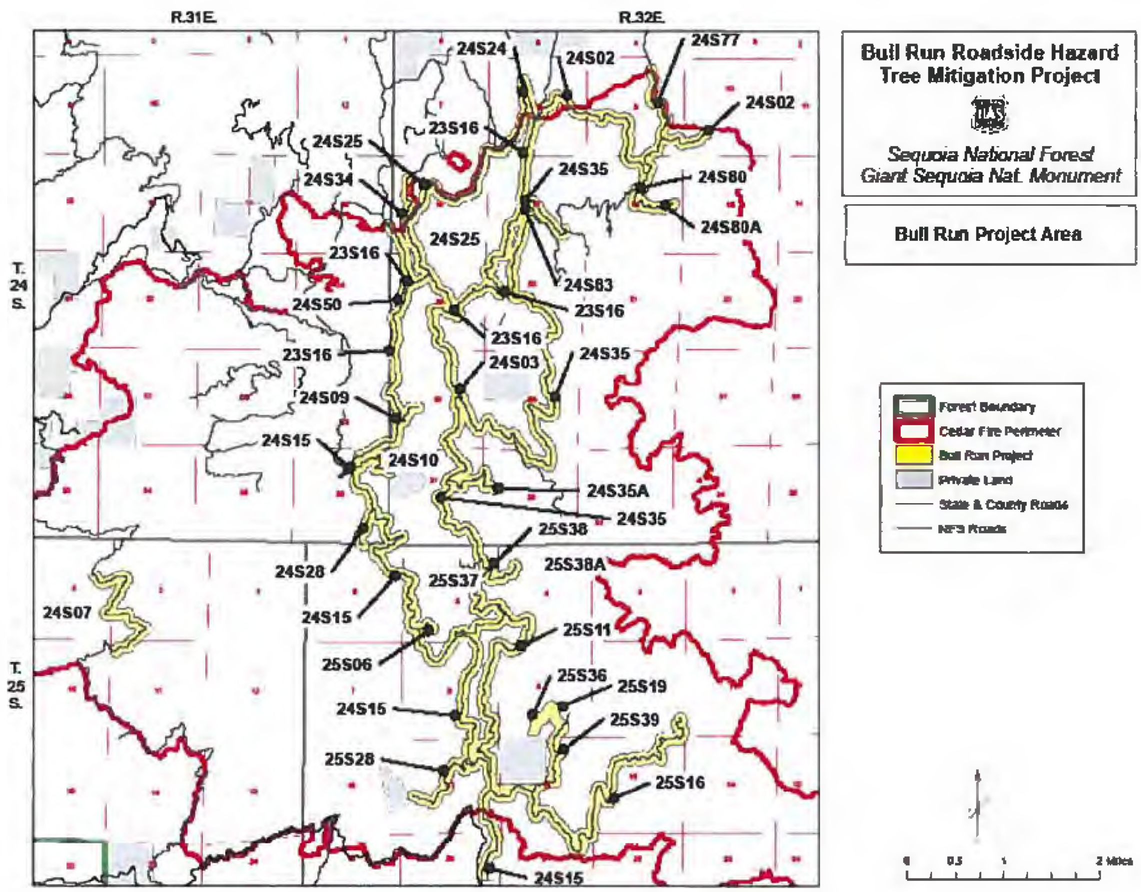

Figure 2. Cedar Fire Perimeter. The roads (yellow lines) proposed for treatments is the project area.

V. PROJECT DESCRIPTION

Purpose and Need

The purpose of this project is to mitigate hazards to public safety posed by dead and dying trees along Forest Service roads in the Cedar Fire perimeter and vicinity, and to perform reforestation work in the area to begin to establish a healthy and resilient ecosystem that provides wildlife habitat.

As hazard trees rot and become structurally weaker, they will begin to fall and have the potential to injure or kill travelers on the road and/or damage the road itself. It is important to address these trees now while they are structurally sound enough to fall them safely. Hazard trees include standing snags, damaged trees, structurally unstable trees and unstable logs that have the potential to strike road users, resulting in injury or death. The Bull Run Project analysis area extends 300 feet to either side of selected roads and encompasses an estimated 3,245 acres. Without the mitigation of these hazards, the Forest Service would have to close a large network of roads for public safety.

There is also a need to remove felled trees and accumulated debris from roadsides. Leaving all the trees in place after felling them would present an unacceptable level of fuel loading beyond levels identified in the Forest Plan. These conditions would further impede the ability of fire personnel to safely access the area in any future wildfire event. Without hazard reduction treatments, debris can be expected to impact roadways in the future. These conditions may facilitate structural damage to the road, clogging of roadside culverts, and contribute to future road failures.

Some felled hazard trees would be left in place to meet Forest Plan direction for large down woody debris. Others would be chipped to provide organic ground cover, and/or piled and burned where excess material exists. Logs in excess of these needs that retain commercial value could be sold.

There is a need to perform reforestation work to revegetate treated areas to stabilize soils, restore a healthy forest ecosystem to the landscape, and improve wildlife habitat. It is important to address this need before brush and invasive weeds become established. Reforestation work would include planting trees and seeding by hand within roadside buffers identified as the analysis area.

The Proposed Action

The Forest Service proposes the following in order to meet the purpose and need for the project:

- Abate tree hazards on 50.2 miles of Forest Service roadway **(Table 2)** by felling dead trees, damaged trees, and structurally unstable trees, identified as hazardous. Most of these would be trees that were killed in the Cedar Fire. However, unburned hazard trees within the area would also be abated.
    - Hazard tree identification would follow Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region.
    - It is expected that hazardous trees within 300 feet of each side of the road would be felled, if it is determined that they could potentially strike within the road's clearing width, or could roll or slide into the clearing width after they have fallen.
    - Trees would be removed using hand tools (such as chainsaws), and/or mechanically using a feller-buncher.
    - Felled trees would be moved off site if they represent an obstruction to use and maintenance within the road's clearing width or if it is determined that their presence would increase future ground fuel loading outside the clearing width.
    - Logs may be chipped, pile burned, or burned on landings in air curtain burners. Logs considered to have commercial value may be sold as saw timber, cull logs,

firewood, chips, posts, and poles. Branches and limbs having commercial value may also be sold as firewood, boughs, and poles.

- Increase organic ground cover in treated areas where ground cover is needed by scattering limbs and branches of felled trees. Materials may also be chipped and scattered.
    - Some logs may be left in place if needed for habitat and to meet our down woody material retention standard as described in the 2004 Sierra Nevada Forest Plan Amendment (USDA 2004, page 51).
    - Perform reforestation activities including planting seedlings and scattering seeds.

Design Features

The following design features would be included:

- Felled hazard trees would remain in place (not removed) within 100 foot of the wetted edge of each side of perennial, intermittent streams, or meadows.
    - Heavy equipment would not be used within this zone, outside of the designed clearing width of each particular road.
        - The clearing width generally averages about four feet beyond the cut slope and fill slope of a road. Any portion of a felled tree that rests within the cut slope or fill slope would be removed if it is determined that they are an obstruction to use and maintenance of the road. Any heavy equipment used to remove road obstructions in this zone will remain on the road.

- All applicable direction from the current Forest Plan, as amended by the 2004 Sierra Nevada Forest Plan Amendment, and the 1990 Mediated Settlement Agreement will be followed.

- To reduce disturbance effects and its impact on annual recruitment of young, a short term limited operating period will be in effect for California spotted owl in PAC TUL0036. Based on the topography and location of the owls a full ¼ mile radius buffer from the activity center will not be applied. Hazard tree reduction activities on road 24S03 from it northern Junction of FS Road 24S16, south to its junction with FS Road 24S35 will not be completed until after July 30th. This timing may be adjusted if field survey conducted by field crews show that young are off the nest and capable of flight.

- A biological monitor will be on site when hazard tree felling actions occur within the TUL0036 PAC.

- Should a northern goshawk nest be detected through any phase of the Bull Run Project, a PAC will be established and subject to a limited operating period if deemed necessary by the District Biologist.

- All applicable Best Management Practices as stated in appropriate specialist reports would be followed.

- Large woody debris (LWD) would be left on the ground to provide quality wildlife habitat in treated areas if lacking based on the 2004 SNFPA; the desired condition for this component is to retain a range of 10 to 20 tons of LWD per acre. Make up any deficiencies with fell hazard trees where needed. Where possible preference will be given to retain down trees/logs with the following conditions:

  1). Select felled hazard trees or existing down logs to meet this standard with the largest size class (dbh) available (do not use trees <12 dbh at midpoint to meet this requirement).

  2). Give preference for the retention of down trees with obvious sign of decadence such as: existing cavities or evidence of secondary excavation, evidence of broken branches, or cracks in the tree bole.

  3). Hazard tree treatments along Forest road 24S03 where it overlaps with spotted owl PAC TUL0036 will retain a range of 25-35 tons of LWD per acre on the ground. Where this component is lacking directionally fell hazard trees contour to the slope, or toward the road. Follow the same preference selection criteria for large woody debris retention as stated in #2 directly above.

Table 2. Sequoia National Forest Road by Number, Name, and estimated Miles treated within the Bull Run Roadside Hazard Tree Mitigation Project area.

Road Number	Road Name	Miles
25S19	Cow Creek	0.5
25S36	Black	0.4
24S02	Baker Point	3.1
24S03	Schultz	1.5
24S07	Sandy Creek	1.8
24S09	Panorama	0.3
24S10	Portuguese Mdw	0.7
24S24	Tobias Mdw	1.3
24S25	Mc Swiney Blvd	2.4
24S28	Sunday Peak	0.4
24S34	Tyler Mdw	0.6
24S35	Schultz Creek	7.8
24S35A	Schultz Creek	0.9
24S50	Greenhorn Mountain	0.9
24S77	East Horse	0.9
24S80	Lower Dry Meadow	0.2
24S80A	Lower Dry Meadow	0.7
24S83	Upper Dry Meadow	0.7
25S06	Tiger Flat C.G	0.2
25S11	Greenhorn East	3.6

Road Number	Road Name	Miles
25S16	Calf Creek	4.5
25S28	Owl Mine	1.2
25S37	Cave	0.2
25S38	Bull Run Basin	1.0
25S38A	Bull Run Basin	0.5
25S39	Silver Strand	1.0
24S15	Portuguese Mdw	7.0
23S16	Sugarloaf	5.9
Total Miles		**50.2**

Existing Environment

The Cedar Fire of August 2016 encompassed approximately 28,511 acres on Forest Service Land and altered much of the forested landscape in the Bull Run Project analysis area (**Figure 2**). Approximately 13,829 acres burned at high severity; 6,265 burned at moderate severity, 4,237 acres burned at low severity and 4,180 acres burned at very low severity or were unburned. Prior to the fire dominant California Wildlife Habitat Relationships vegetation types (CWHR, CDFW 2005) included Sierra mixed conifer, ponderosa pine, red and white fir, sugar pine, incense cedar and black oak, with scattered brush complexes, plantations, and montane meadows. The Cedar Fire ranged from 2,900 to 8,260 feet in elevation. The majority of the Bull Run Project lies within the Cedar fire perimeter along the east side of the Greenhorn Mountains. There are two small road segments that are part of the Project that are just outside the fire perimeter, one at the north end and one at the south end. These road segments were included because the fire personnel needed these portions of road for access to conduct fire activities/operations. On the west slope of the Greenhorn Mountains within the Cedar fire, there is a small "W" shaped road section included. This road segment was included because of fire operations use as well. In total the Bull Run Project ranges in elevation from 5,380 to 7,620 feet in elevation.

VI. SPECIES AND HABITAT ACCOUNTS:

Detailed life history accounts for most species are provided in the Sierra Nevada Forest Plan Amendment FEIS and ROD (USDA 2001), hereby incorporated by Reference. Much of this information is summarized in the section below, but also incorporates recent scientific information, localized data on habitat condition, and habitat use based on prior surveys completed.

The majority of the wildlife species analyzed utilize forest stands which contain a higher percentage of larger size class trees (>12" dbh) and moderate to dense overhead canopy (>40%). Maps 3 and 4 display the available suitable habitat within the Bull Run Project area and what was within the Cedar Fire perimeter before the fire. The pre fire habitat analysis was based on the last vegetation mapping update provided to Sequoia National Forest completed in July 2016 just prior to the to the Cedar Fire. This effort captured changes in habitat availability and its distribution due to an ongoing multi-year drought (2014-2016) and heightened insect activity resulting in high levels of tree mortality. The Cedar Fire began in August of 2016 and further greatly altered stand conditions and habitat availability.

Due to these factors, a combination of methods were used to estimate suitable habitat for this analysis. These included use of the 2016 vegetation update in conjunction with Cedar Fire severity mapping completed after the fire. These images were transposed on one another to depict where habitat remained for each species. Acres were then calculated using GIS to estimate existing habitat, and cross referenced with field reviews and RAVG satellite imagery data conducted after the wildfire. A conservative stance was taken in evaluating suitable habitat remaining. For example, it was assumed that portions of suitable habitat that burned at moderate severity may continue to provide some nesting or den habitat value, although likely of lower quality. Its actual use will depends on the severity of fire, stand location on the landscape, topographic factors such as slope and aspect, closeness to water, the size of burn openings created, and its juxtaposition to islands of habitat that burned with low severity or that remained unburned.

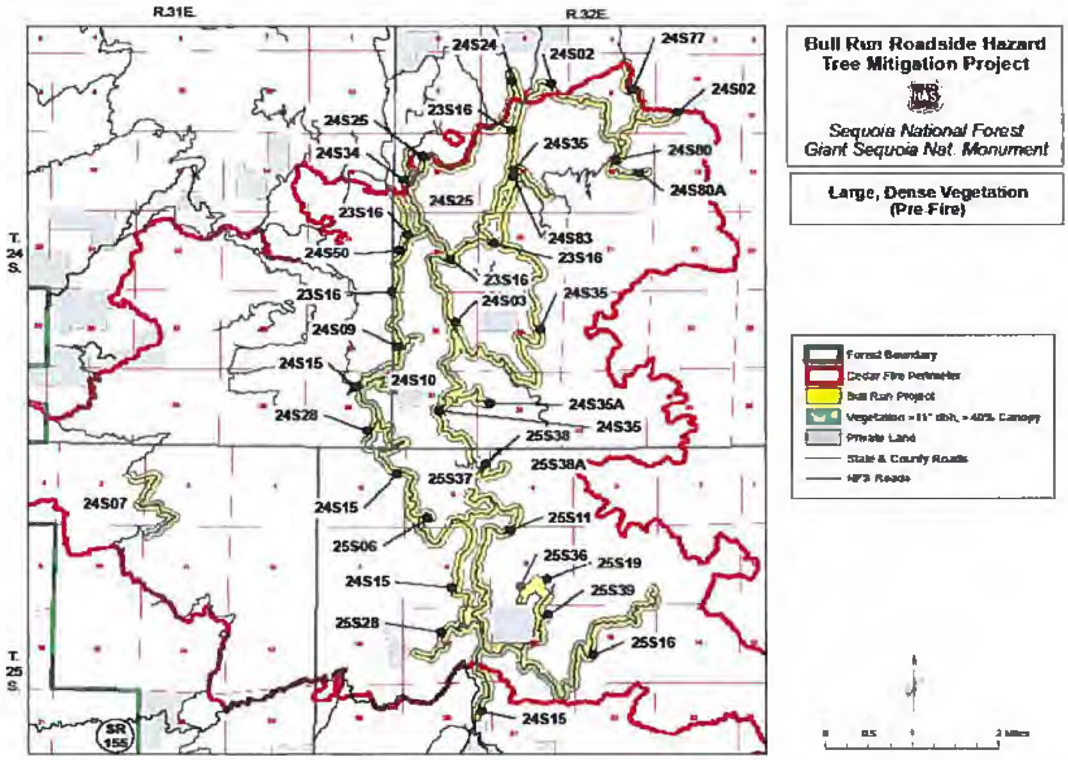

Figure 3. Suitable Habitat (vegetation >11" dbh, > 40% canopy) within the Bull Run Project Analysis Area prior to Cedar Fire.

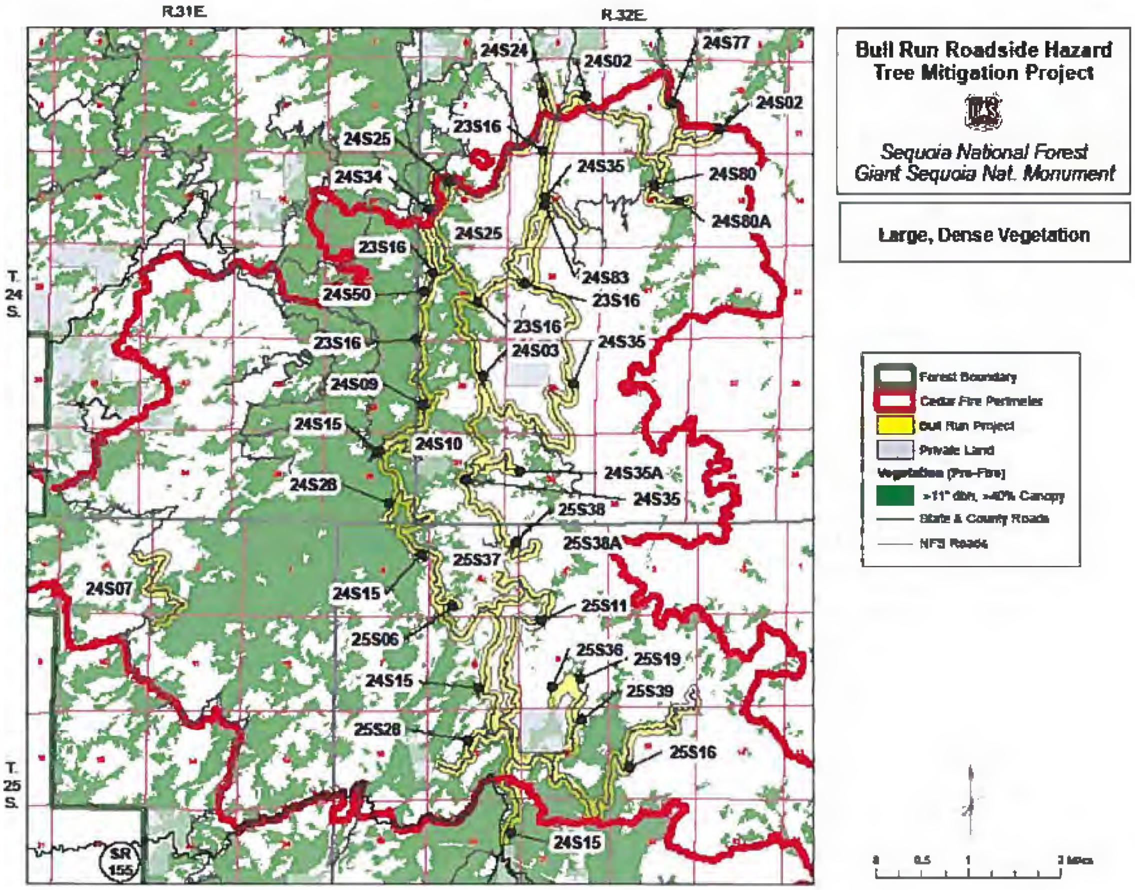

Figure 4. Suitable habitat within and adjacent to project boundary prior to Cedar Fire.

Table 3 provides pre and post fire estimates of suitable habitat within the Cedar Fire perimeter[1] as a whole, and estimates of suitable habitat within the Bull Run Project Analysis area and acres proposed for treatment. The project analysis area was established using a 300' buffer on each side of the road. The actual number of hazard trees removed with any given acre is variable given tree mortality patterns, tree height, and the ability for the tree to be within striking distance of the road. Trees with the inability to strike the road would be left standing.

[1] Values presented include any suitable habitat within the two small road segments included at the north and south end of the project area just outside the fire perimeter previously discussed.

Table 3. Total Acres Burned in the Cedar Fire and Estimated Acres of Suitable Habitat Pre and Post Fire by Species, and proposed treatment acres post fire on Forest Service Land.

		Acres Burned by Fire Severity				
	Total Burn Area Acres	**High**	**Mod**	**Low**	**Very low**	**Acres**
Cedar Fire	29,001	13,914	6,306	4,290	4,491	
Cedar Fire Perimeter	**Habitat Pre-fire**	**High**	**Mod**	**Low**	**Very low**	**Total Suitable Habitat Post Fire**
Goshawk	12,013	5,144	2,456	2,271	2, 141	6,869
Spotted Owl	10,751	4,606	2,134	1,919	2,093	6,145
Bats	10,879	4,647	2,146	1,932	2,145	6,231
Fisher	12,531	5,510	2,550	2,321	2,151	7,021
Bull Run Project Area	**Habitat Pre-fire**	**High**	**Mod**	**Low**	**Very low**	**Suitable Habitat Post Fire and acres proposed for Treatment**
Goshawk	1,053	379	301	273	100	674
Spotted owl	987	350	281	262	94	637
Bats	987	350	281	262	94	637
Fisher	1,068	435	305	244	84	633

Northern Goshawk

Distribution

Northern goshawks are year-round residents in many higher elevation areas of California. The 2001 SNFPA FEIS reported 577 breeding territories within Sierra Nevada National Forests. Current management direction under the 2004 SNFPA (USDA 2004) provides protection of northern goshawk nest sites by delineating a 200-acre protected activity center (PAC). Each PAC is to contain the best habitat available in the largest contiguous patch as possible. At present, the Sequoia National Forest manages 27 northern goshawk Protected Activity Centers (PACs) encompassing an estimated 6,300 acres.

The Forest continues to conduct surveys in suitable habitat in efforts to detect new occurrences of nesting northern goshawks as feasible in relation to proposed projects and/or based on reported sightings. Surveys for the northern goshawk were conducted to protocol in the project area in 2014 and 2015 on the Kern River District with no detections reported. Surveys in the project area on the Western Divide Ranger District were conducted in 2011, 2013, 2015, and 2016. Prior to 2016 no goshawks had been detected. However in July of that year an adult and 2 juveniles were observed on the eastside of the Greenhorn Mountian along the northern boundary of the Cedar Fire perimeter prior to the fire. Several stand searchs were conducted in efforts to determine whether a nest site was present in the suspected area of occupancy, or whether the birds were just foraging in the area from a PAC located outside of the project area further to the north. No nest sites were detected through any of the stand searches completed. In August the Cedar Fire occurred and the area was visited again in late fall post fire. No individuals were detected and it was assumed the area if previously used has been abandoned.

Based on prior survey efforts and a review of the existing forest goshawk GIS layer, no northern goshawk PACs occur within the Cedar Fire perimeter which encompasses the Bull Run Project analysis area. Should a northern goshawk nest be detected in the analysis area, a PAC would be established and subject to a limited operating period if deemed necessary by the District Biologist.

Habitat Preferences and Biology

Preferred habitats utilized by the northern goshawk consists of older-age coniferous, mixed, and deciduous forest habitat. Occupied habitats typically includes stands with a greater representation of large trees which are used for nesting, a closed canopy which provides for protection and thermal cover, and stands which contain a series of open spaces or gaps allowing for maneuverability below the canopy (Hargis et al. 1994; Squires and Kennedy 2006). Snags, downed logs, and high canopy cover appear to be preferred habitat features although many east side Sierran territories are relatively open and have fewer snags. Snags and down logs however are an important component used by numerous goshawk prey species. In addition, many of the species that provide the prey base for northern goshawks are associated with open stands of trees or natural openings containing an understory of native shrubs and grass (Fowler 1988). Northern goshawk demography is known to be strongly influenced by prey availability (Squires and Kennedy 2006).

Nesting habitat is characterized by stands with dense canopy closure (50 to 90 percent) in mature forest with open flight paths under the canopy (McGrath et al. 2003). Nest trees for this species are commonly located on benches or basins surrounded by much steeper slopes (Hargis et al. 1994) and generally occur in live trees exceeding 30" in diameter. Mature trees serve as nest and perch sites, while plucking posts are frequently located in denser portions of the secondary canopy on large down logs. The same nest may be used for several seasons, but alternate nests are common within a single territory and are usually located within ½ mile of each other. The chronology of nesting activity varies annually and by elevation. In general, nesting activities are initiated in February with nest construction, egg laying, and incubation occurring through May and June (Dewey et al. 2003). Young birds hatch and begin fledging in late June and early July and are independent by mid-September.

Habitat models based on best professional opinion contained in the California Wildlife Habitat Relationships (CWHR) database rate the following vegetation types and strata as providing high nesting and feeding habitat capability for northern goshawks: structure classes 4M, 4D, 5M, 5D and 6 in Sierran mixed conifer, white fir, ponderosa pine, montane hardwood-conifer, montane riparian, red fir, Jeffrey pine, lodgepole pine, subalpine conifer, and montane hardwood (California Department of Fish and Game 2005).

Risk Factors

Habitat loss and/or degradation are the primary known threats to the northern Goshawk (Squires and Kennedy 2006). However, collection, habitat fragmentation, disturbance at a specific site, and edge effects were also described by Gaines et al. (2003) as factors that potentially affect northern goshawks. Human disturbance has the potential to cause northern goshawks to abandon nest sites during the nesting (Boal and Mannan 1994) and post fledging period (February 15 through September 15).

In total the Cedar Fire consumed an estimated 5,144 acres of suitable goshawk habitat which burned at high severity. These fire effects have dramatically lowered habitat quality throughout the fire perimeter by reducing overhead canopy cover, removing downed large woody debris and fine ground cover, and by increasing habitat fragmentation (**Figure 5**).

Figure 5. Examples of high severity burn areas within the Cedar Fire perimeter.

Within Bull Run Project

Based on CWHR forest typing and vegetation mapping conducted in July of 2016 (Figure 6) there was a grand total of 12,013 acres of suitable goshawk habitat that occurred in the Cedar Fire perimeter prior to the fire. Post fire, it is estimated that 6,869 acres of suitable habitat remain at low to moderate habitat quality. The Bull Run Project would treat up to 674 acres (10%) of the available post fire habitat for human health and safety purposes along roadways (**Table 3** and **Figure 7**).

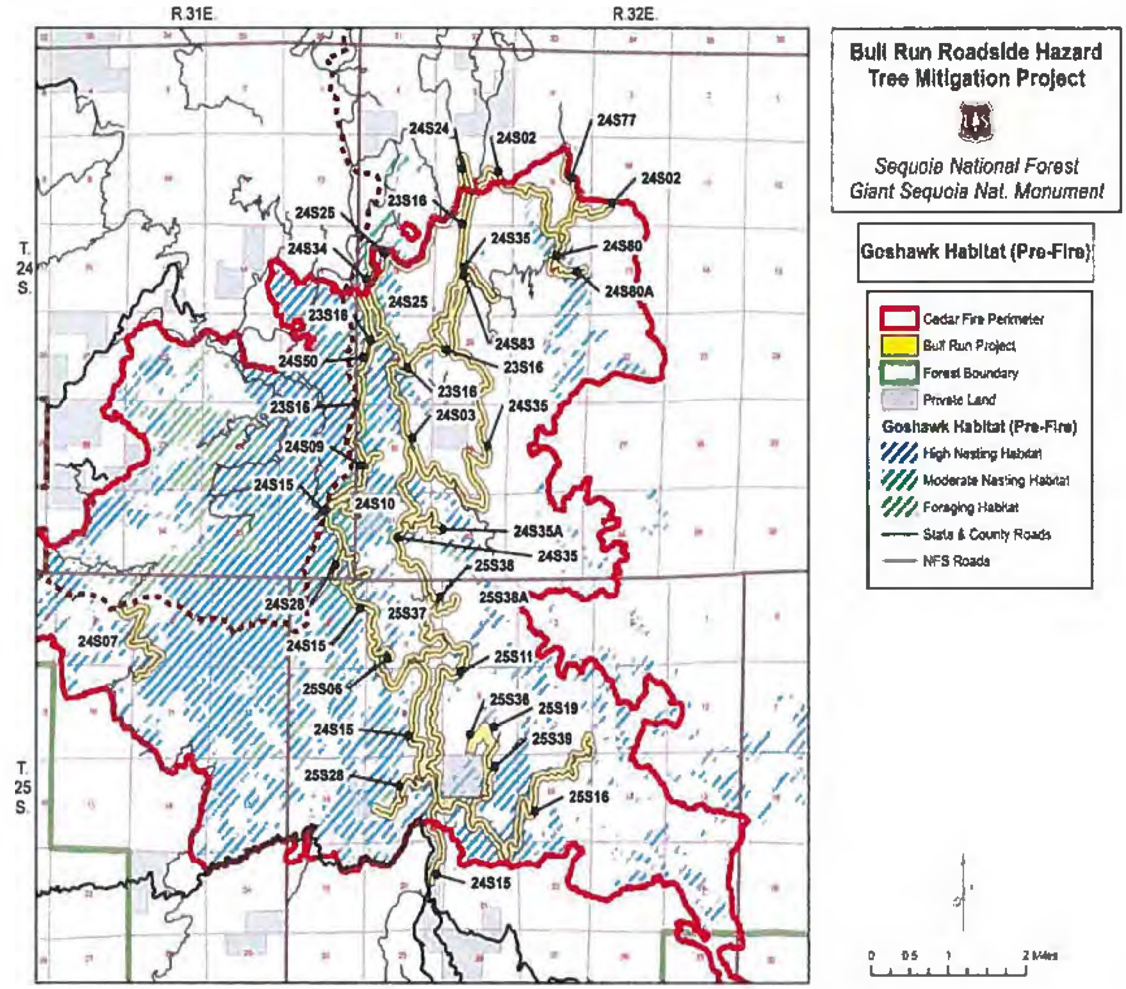

Figure 6. Suitable Goshawk habitat prior to the Cedar Fire.

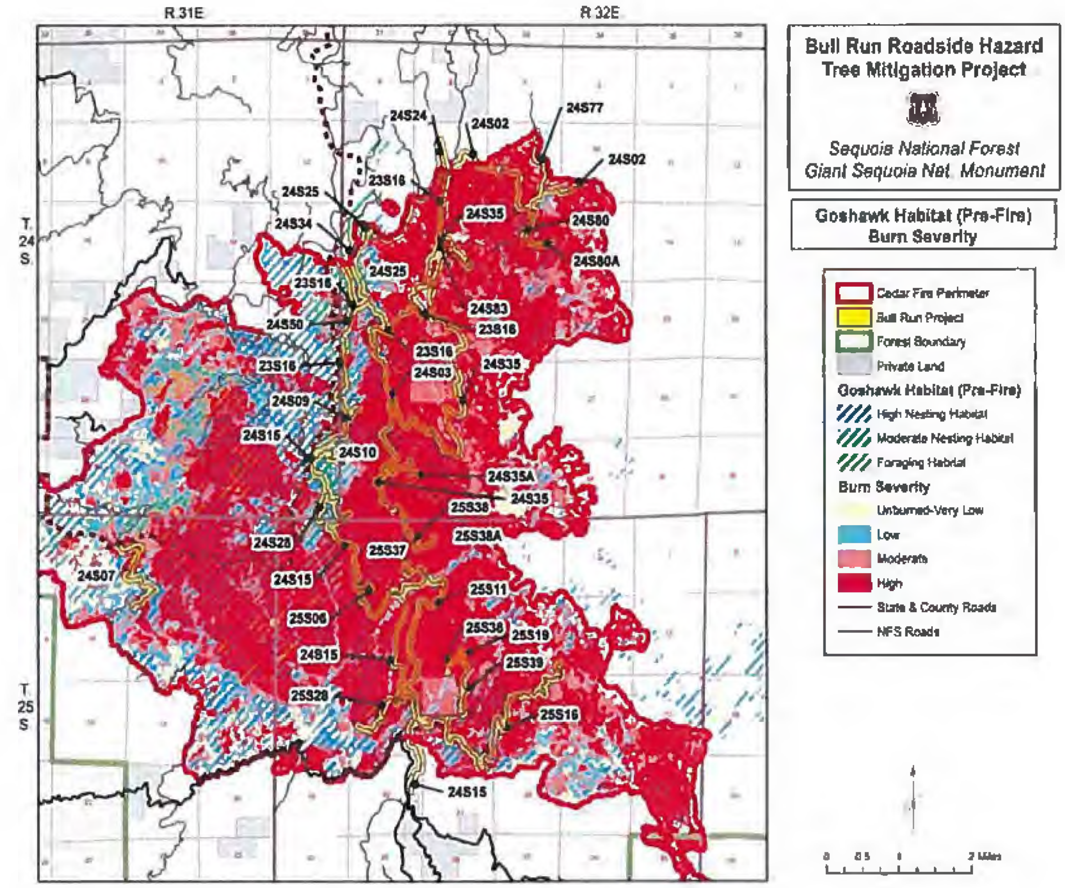

Figure 7. Suitable Goshawk habitat pre-fire overlaid with burn severity mapping conducted post fire. Areas with cross hatching overlapping with unburned, low, and moderate burn severity areas provide the current distribution of suitable habitat remaining.

California Spotted Owls

State Wide Range, Trend and Distribution: The California spotted owl's range includes the southern Cascades south of the Pit River in Shasta County, the entire Sierra Nevada Province of California (extending into Nevada), all mountainous regions of the Southern California Province, and the central Coast Ranges at least as far north as Monterey County (USDA 2001). California spotted owl population size in the Sierra Nevada was estimated in 2006 at 1,865 owl sites, with 1,399 sites on NFS lands, 314 sites on private lands, 14 sites on Bureau of Land Management Lands, 8 on State of California lands, and 1 on Native American lands (USDI, Federal Register May 24, 2006 [Volume 71, Number 100]). These figures were based on a compilation of all known sites recorded over the past 30-40 years, and it is unknown what proportion remains occupied at this time (Keane 2014).

Demographic monitoring from four long term research studies are currently used as the sole empirical data to establish the status and trend of California spotted owl populations in the Sierra

Nevada (1990 to present)(Keane 2014). Three of the demographic studies are being conducted on National Forest System (NFS) lands (Lassen, Eldorado and Sierra National Forests), with the fourth study on National Park Service lands (Sequoia-Kings Canyon National Park).

While these individual demographic studies monitor the rate of change in owl populations through estimates of lambda annually, there is a fair amount of variability due to a variety of factors (Munton et al. 2012, R.J.Guiterrez – http://snamp.cnr.berkely.edu/disscussion). For these reasons the research community relies on a more robust analysis called a Meta-analysis which combines comparable data from all of the demographic studies collected in a similar fashion to gain an increased sample size and a better understanding of population trends. The last Meta-analysis completed by Blakesley et al. (2010) displayed the following results which concluded that with the exception of the Lassen Study area, California spotted owl populations were stable with adult survival rates highest at the Sequoia-Kings Canyon study site:

Lassen NF: mean estimated lambda is 0.973, with a 95% CI ranging from 0.946 to 1.001;

Eldorado NF: mean estimated lambda is 1.007, with a 95% CI ranging from 0.952 to 1.066.

Sierra NF: mean estimated lambda is 0.992, with a 95% CI ranging from 0.966 to 1.018

Sequoia-Kings Canyon: mean estimated lambda is 1.006, with a 95% confidence interval ranging from 0.947 to 1.068.

In December of 2014, a new petition was submitted to the USFWS to list the California spotted owl as threatened or endangered under the Endangered Species Act (Bond and Hanson 2014). The petition cites new published research findings which used data from the existing long term studies previously discussed, additional mark-recapture data collected as part of those studies from 2006-2011, and the use of new applications of statistical methods to evaluate population trends and the probability of population decline. This body of research suggests there is now evidence of population declines on all three long term study areas on National Forest Service lands, and evidence of stable/increasing population trend noted only the National Park study area (Munton et al. 2012, Conner et al. 2013, Gutiérrez et al. 2012, Tempel and Gutiérrez 2013, and Tempel et al. 2014). The causative factors contributing to these population trends, however, are not known (Keane 2014). The USFWS Service has conducted a review of the petition, and found that the proposal may have merit. The USFWS has initiated a review of the status of the species to determine if the petitioned actions are warranted and will issue a 12 month finding considering the most recent and relative scientific information.

Distribution within Sequoia National Forest: Sequoia National Forest represents the southern extent of the spotted owl's range in the Sierra Nevada. At present, the Forest manages a network of 137 spotted owl Protected Activity Centers and 136 Home Range Core Areas (PACs/HRCAs) encompassing an estimated 82,200 acres. Each spotted owl PAC/HRCA includes approximately 600 acres (USDA 2001) comprised by a 300 acre Protected Activity Center (PAC) surrounding the best documented nest/roost site, with an additional 300 acres of suitable habitat provided to complete the HRCA. Over half of the Forest PAC/HRCAs occur within the Western Divide and Kern River Ranger Districts.

Habitat Preference and Biology: In the Sierra Nevada, 80% of documented spotted owl sites occur in mid elevation mixed conifer forests, 10 percent in red fir forests, 7 percent in ponderosa pine/hardwood forests, and 3 percent in other forest types: east-side pine, ponderosa and Jeffrey pine and foothill riparian/hardwood (Verner et.al 1992, USFWS, Federal Register: February 14, 2003 [Volume 68, Number 31]).

Spotted owls are strongly associated with mature coniferous forests with high tree canopy cover (≥70%), a multi-layered canopy, and an abundance of large trees and snags (Forsman et al. 1984, Bias and Gutierrez 1992, Call et al. 1992, Verner et al. 1992, Bond et al. 2004, Chatfield 2005). Foraging habitat consists of a broader range of vegetation types that may include younger, more open habitat (Williams et al. 2011, Roberts and North 2012, Keane 2014). Large coarse woody debris is a key habitat feature for the spotted owl and its prey. It has been suggested that some level of landscape (forest) heterogeneity may be an important consideration for spotted owl management and can improve spotted owl conservation (Williams et al. 2011, Roberts and North 2012).

Spatial Habitat Relationships: Nest/roost habitat (PAC), Core Area, Home Range: Scientific literature suggests that spotted owls select habitat at multiple spatial and temporal scales, with the least flexibility regarding certain habitat attributes noted within the nest/roost stand (Protected Activity Center) and core area, and acceptance of a broader composition in habitat characteristics noted at the larger home range scale (Roberts and North 2012, Keane 2014).

Nest/Roost Stand: Existing research on spotted owl nest and roost ecology has been summarized in GTR-133 "*The California spotted owl: a technical assessment of its current status*" (Verner et al. 1992), and is considered the best-studied aspect of spotted owl biology. Nest and roost habitat is denoted by stands that exhibit a fair amount of structural complexity and which contain a greater representation of large live trees (≥ 24"dbh), multi-storied dense canopy exhibited by trees of different sizes, but dominated by medium-sized trees (12 to 24" dbh), and an availability of large snags and down logs (Verner et al. 1992, Gutierrez et al. 1992 *IN*: Verner et al 1992, USDI 2006, Roberts and North 2012). CWHR size and density classifications at nest sites were determined using plot data for 292 nest sites in the Sierra Nevada (SNFPA FEIS, USDA 2001). Approximately 45% of the sites occurred in CWHR size and density classifications 6, 5D, and 4D (stands with ≥ 60% canopy cover), with an estimated 30% in size and density classifications 5M and 4M (stands with 40% -59% canopy cover), and approximately 15% in stands with less than 40% canopy cover.

For this analysis the spotted owl protected activity center (PAC), is considered representative of the nest stand. This is based on work from Verner et al. (1992) who described activity centers as a place where owls find suitable nesting sites and several suitable roosts, and in which they do a substantial amount of their foraging. Using a sample of spotted owl nest trees from conifer forests in the Sierra Nevada (n=149), the mean area for nest stands was 100 acres with the nest stand plus adjacent suitable stands was estimated at 300 acres (USDA 2001). This information led to the establishment of spotted owl Protected Activity Centers (PAC) as part of the Region-wide conservation strategy for the spotted owl as implemented in the SNFPA (USDA 2001).

Nest stands are typically occupied for breeding and rearing of young from mid-February until October (Verner et al. 1992). Nests occur in cavities, in broken tops or branches, on debris platforms, and on old raptor and squirrel nests (Gutierrez et al. 1992, 1995). Conifers typically selected as nest trees include some of the largest in the stand, averaging 45 inches dbh (Verner et al.1992, Keane 2014). Egg-laying occurs in March or April, with hatching occurring in May or early June. California spotted owls generally exhibit strong site fidelity to their established protected activity centers and broader home range.

Studies show the owl exhibits a sporadic and irregular reproduction pattern, and may not breed or have successful reproduction every year. Some interpret their long life span and noted high survival rates (>0.80) as an evolutionary response mechanism (Noon and Biles 1990, Blakesley and Noon 1999, Steger et al. 1999, Keane 2014), which allows for eventual recruitment of offspring even if recruitment does not occur each year (Franklin et al. 2000). Sites may be vacant for several consecutive years when the population is in decline, but then be reoccupied to support breeding pairs during a population upswing.

Research indicates there are several plausible factors that contribute to high annual variation in spotted owl reproduction. Franklin et al. (2000) for example reported that 43 percent of annual variation in reproduction could be explained by habitat covariates. However, Keane (2014) cited a broader spectrum of research which point to other factors such as weather, owl age/experience, reproduction in the prior year, and the presence of barred owls which have been shown to influence variation in reproduction (Blakesley et al. 2005; Dugger et al. 2005, 2011; Kroll et al. 2010; MacKenzie et al 2012; Olson et al 2004, and Seamans et al. 2001).

Core and Home Range – The "core area" (0.727 mile radius from the nest or roost site) refers to the amount of contiguous habitat a territorial owl or owl pair uses consistently. The core area is larger than the nest stand but smaller than an owl's home range. As discussed, spotted owls exhibit high site fidelity to their nest and roost location. They forage from this central point outward starting at dusk, returning by early dawn. Therefore, researchers suggest that some larger core area around the nest and roost stand provides foraging habitat that is important to each pair's survival and its reproductive success.

The "home range" is a term that refers to a pair or individual's entire use area (1.5 mile radius from the owl activity center). California spotted owl home range sizes in the Sierra Nevada have proved variable and are likely influenced by both habitat quality and prey availability (Keane 2014, Zabel 1992). Research discussed in Verner et al. (1992) suggested that home ranges are smallest in habitats at relatively low elevations that are dominated by hardwoods containing woodrats, intermediate in size in mixed conifer forests in the central Sierra Nevada, and largest for true fir forests in northern Sierra Nevada where flying squirrels are a dominate food item (Verner et al. 1992). Recently Williams et al. (2011) reported that the number of vegetation patches (a measure of habitat heterogeneity) is the best predictor of home range size for California spotted owls in the central Sierra Nevada, with larger home ranges associated with greater habitat heterogeneity. Dugger et al. (2011) suggested that northern spotted owl extinction and colonization rates were negatively associated with the degree of fragmentation of mature habitat across the larger home range.

Telemetry studies on California spotted owls closest to Sequoia National Forest determined a mean breeding pair home range size of approximately 2,500 acres (mixed conifer type)(USDA 2001). It was an assumption of this analysis that the pair will utilize a larger home range size given the effects of the 2016 Cedar Fire. Therefore a 1.5 mile radius circle was used for this part of the analysis.

Keane (2014) discussed these concepts and summarized several recent studies that evaluated nest, core and home range areas based on various radii distances from the nest and roost stand creating a circular area of consideration (0.5 mile, 0.727 mile, 1.5 mile etc.) to describe "associations between habitat and spotted owl occurrence, occupancy, and demographic parameters (survival, reproduction, habitat fitness) (Blakesley et al. 2005; Dugger et al. 2005, 2011; Franklin et al. 2000; Gaines et al. 2010; Irwin et al. 2004; Kroll et al. 2010; Lee and Irwin 2005; McComb et al. 2002; Olson 2004; Seamans and Gutierrez 2007a)". More recent work by Tempel et al. (2014b) also noted similar findings between the area of high-canopy-cover forest and adult survival, and some cases, reproduction and occupancy of territories.

Keane (2014) noted that although the size of the analysis areas varied across studies, habitat associations were generally assessed at similar spatial scales (core or home range scales) around spotted owl nests or roosts, and that vegetation classifications and habitat definitions generally defined for spotted owl habitat included mature stands with large trees and high canopy cover. Collectively these studies all shared many key themes:

- Results consistently reinforce original findings of the strong association between spotted owls and mature forest habitat in core areas around nest sites. Modeling of habitat conditions with survival and occupancy shows that important habitat metrics at the core and home range scale include the total amounts of mature habitat (Blakesley et al. 2005; Dugger et al. 2005, 2011; Franklin et al. 2000; Olson 2004, Tempel et al. 2014).
- Higher spotted owl survival and reproduction are also associated with areas that have a mix of different vegetation types and edge between mature forest and other vegetation types (Dugger et al. 2005, 2011; Franklin et al. 2000; Olson 2004).
- Spotted owl reproduction exhibits high annual variation. In general, this is associated with weather, owl age/experience, reproduction in the previous year, and the presence of barred owls (Blakesley et al. 2005a; Dugger et al. 2005, 2011; Kroll et al. 2010; MacKenzie et al. 2012; Olsen et al 2004; and Seamans et al. 2001).
- Spotted owl population dynamics are likely governed by both habitat and weather."

The thresholds for the amount of suitable habitat needed within the PAC, core and home range area are not well understood. That said, several research studies were utilized which have offered tenative estimates. Bart (1995) suggested that the productivity and survivorship of the northern spotted owl increased with the proportion of suitable habitat found within the home range. His analysis utilized a 1.5 mile radius buffer from the activity center and suggested that survivorship and replacement-rate reproduction depended on having somewhere between 30 - 50 % of the landscape (or individual home range for a single owl pair) occupied by suitable owl habitat.

Lee and Irwin (2005, *IN*: USFWS, Federal Register May 24, 2006 [Volume 71, Number 100]) noted that "reproduction of spotted owls in the southern Sierra Nevada increased with canopy closure because more pairs successfully nested. However, this increase in canopy closure appeared to be more of a minimum threshold requirement than a trend, with only marginal increases in spotted owl reproduction noted as canopy closure increased past the minimum". The latter study suggested that at least 44 percent of a 1,063 acre area (0.727 mile radius area) around the owl activity center was comprised by forests with greater than 40% canopy cover. Once this minimum was met, the relative amount of forest with intermediate (40-70 percent) and dense (> 70%) canopy cover had little measurable effects on reproduction of spotted owls.

Verner et al. 1992 suggested that spotted owl PACs should contain approximately 300 acres of suitable forest habitats with priority given for CWHR size and density classifications 6, 5D, 5M, 4D, and 4M.

Within Bull Run Project

Based on CWHR vegetation typing and the 2016 pre-fire vegetation mapping (**Figure 8**) there was a grand total of 10,715 acres of spotted owl habitat that occurred prior to the Cedar Fire. Post fire, it is estimated 6,145 acres of habitat remain suitable. The Bull Run Project would treat up to 638 acres (or 10%) of the available post fire suitable habitat for human health and safety purposes along roadways (**Table 3** and **Figure 9**). **Figure 10** displays the remaining suitable habitat post fire and its distribution within the Cedar Fire perimeter.

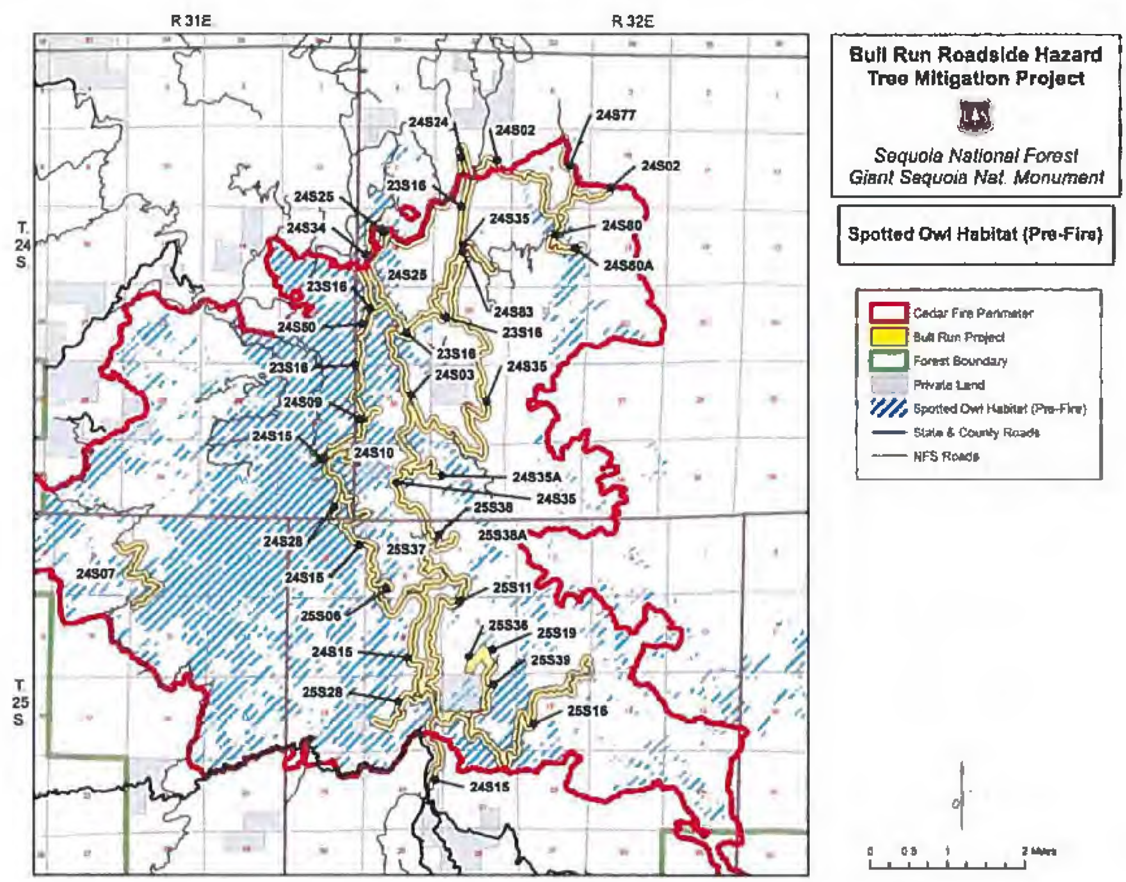

Figure 8. Spotted Owl suitable habitat prior to Cedar Fire.

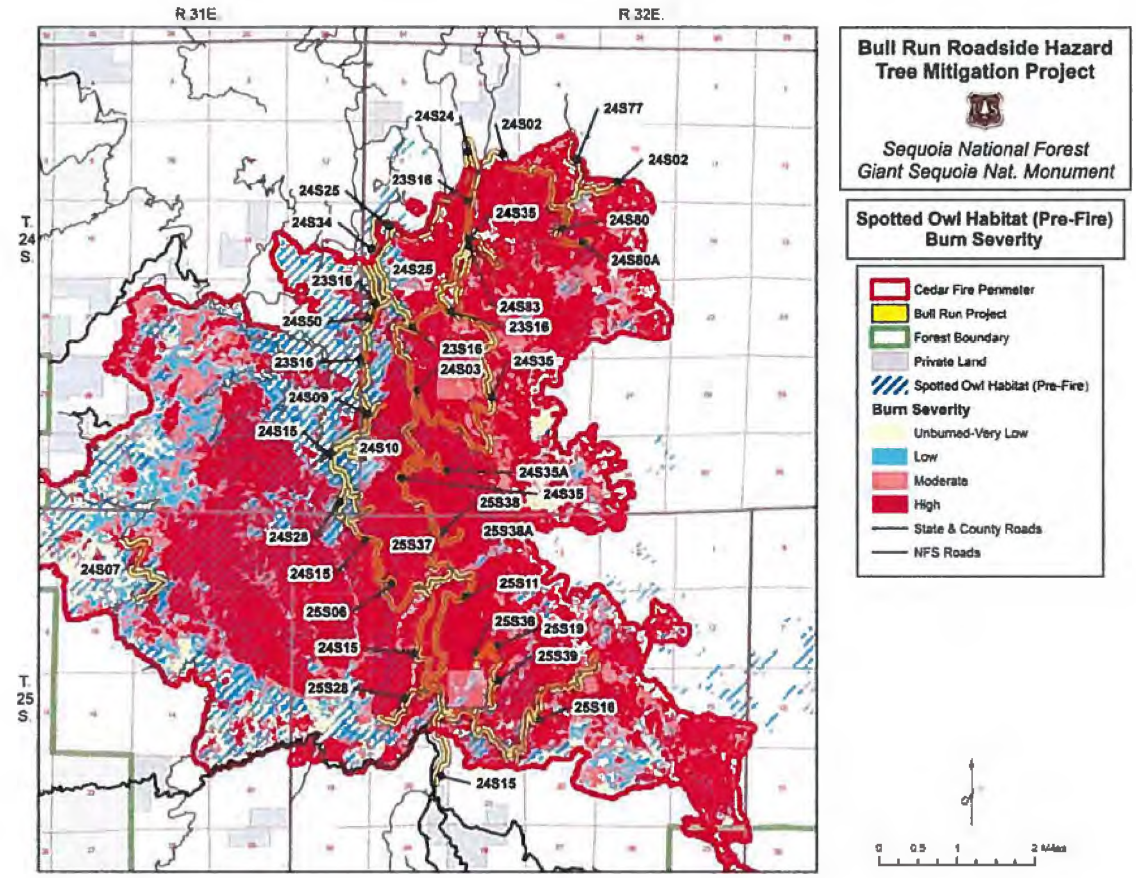

Figure 9. Spotted owl habitat pre fire overlaid with burn severity.

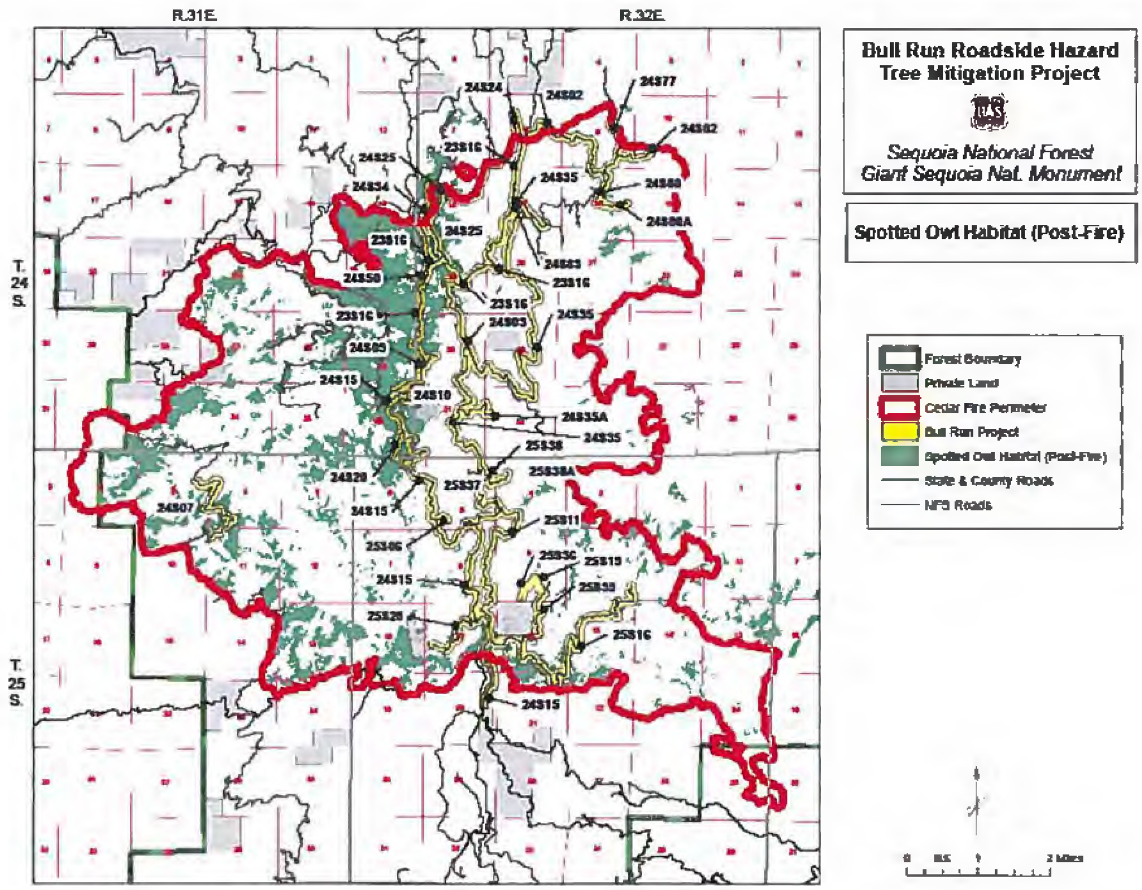

Figure 10. Post fire suitable habitat for spotted owls.

Portions of 10 California spotted owl PACs were impacted to various degrees by the Cedar Fire. The scientific literature suggests that spotted owls select and use habitats with the most frequency near the roost or nest site. There is generally less habitat flexibility at nest/roost stand scale (Protected Activity Center, 300 acres) and the core area scale (0.727 mile radius), with a broader acceptance of a diversified vegetative composition at the larger home range scale (Roberts and North 2012, Keane 2014). Therefore, to determine which spotted owl sites could be impacted from implementation of the Bull Run Project, a 0.727 mile radius from each owl activity center was delineated to form a concentric buffer. If this buffered area overlapped with roadway where hazard trees would be felled or removed it was included as part of this analysis.

For the Bull Run Project, four spotted owl territories were identified for consideration. This included spotted owl IDs TUL0036 and TUL0117 which occur within the Cedar Fire perimeter, and two additional owl sites ((KRN0011 and KRN0039) located to the south of the Cedar Fire perimeter, where a small segment of the 0.727 mile radius overlapped with roads included as part of the Bull Run Project (**Figure 11**).

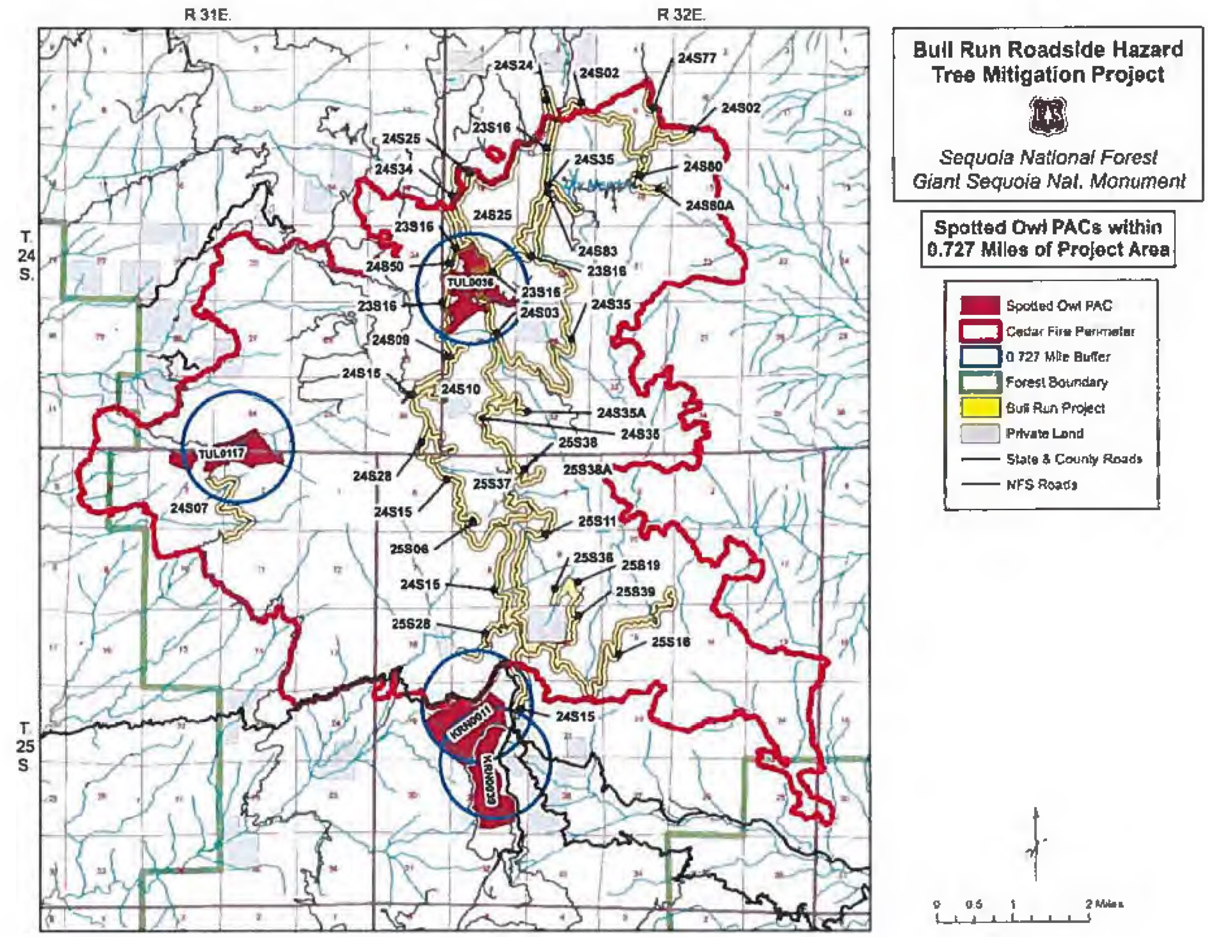

Figure 11. Spotted Owl PACs considered as part of the Bull Run Project Analysis

Historic and contemporary survey data for each owl site are provided in **Table 4**. Survey data for PACs TUL0036 and KRN0011 show consistent pair occupancy within years where surveys occurred. Both were surveyed in early spring of 2017, with pair occupancy noted. Based on observed behavior it is apparent that the pair at TUL0036 has nested. The nest tree was located and does not occur within the roadside hazard removal zone (i.e. 300 feet on each side of the road). Surveys conducted within KRN0011 in 2017 have not detected nesting activity to date. PACs TUL00117 and KRN0039 are relatively new sites discovered in 2014 and 2015 respectively.

Table 4. California spotted owl PACs and documented occupancy status.

		Spotted Owl PAC Id#			
Surveys	**Year of Survey**	**TUL0036**	**TUL0117**	**KRN0011**	**KRN0039**
Historic	1990	M		NS	
	1991	M, F		P	
	1992	NS		None	
Contemporary	2005	NS		M, U	
	2006	NS		P-R-yng	
	2007	NS		P	
	2008	NS		P	
	2009	NS		P	
	2011	None		NS	
	2013	None		NS	
	2014	P-R-inn	P-R-yng 1 (first year detected) – PAC created	P	
	2015	P-R-yng 2	NS	P	
	2016	P, R-Inn	NS	P-R-?	P-R-yng 1 (first year detected) PAC created
	2017	P-R -?	Survey pending	P-Non-?	Survey pending

M = Male , F= Female, P= Pair, M, F = Male and female detected, U = spotted owl adult detected - sex unknown, NS = Not Surveyed, **None** = No spotted owls detected, **P-R-yng 1** = Pair occupancy, nesting confirmed - reproduction confirmed (1 young observed), **P- R-yng 2** = Pair occupancy, nesting confirmed – reproduction confirmed (2 young observed), **P, R-inn** = Pair occupancy, nesting unknown-reproduction unknown. **P-R-?** = Pair occupancy-nesting confirmed-reproduction unknown or failed. P-Non-R =Pair occupancy non-nesting inferred.

Spatial Scale Baselines:

Table 5 and **Figure 12** display the acres and distribution of suitable habitat at three scaled areas of analysis from each owl activity center (PAC, 0.727 mile radius, and 1.5 mile radius). Pre and post fire estimates for suitable habitat (acres) and its representative percent of the total scaled area are displayed. Based upon the July 2016 mapping update, the analysis suggests there were minimal decreases in available habitat noted at the PAC scale for three of the PACs suggesting limited effects from the drought and/or insect mortality at that scale. The exception to this was PAC TUL0117 which showed only 67 acres retained at the PAC scale prior to the Fire. TUL0117 is a relatively low elevation site which encompasses a mix of oak woodland and scattered pine habitat types. The low elevation pine belt was particularly hard hit in the drought with high levels of tree mortality observed Forest wide.

Subsequent analysis at these same scales following the Cedar Fire shows some loss of suitable habitat at various levels for each of the owl sites depending on its location and the spatial scale addressed. At the 1.5 mile radius scale all four owl sites addressed were estimated to retain enough suitable habitat at that level to provide for a home range based on Bart's estimates. However, at the 0.727 radius and PAC scales, only 3 of the 4 owl sites addressed likely to maintain enough habitat to provide for long term occupancy and reproduction.

Table 5. Acres of suitable habitat* (July 2016 updated veg layer) on Forest Service Land pre and post fire at three specified scales of analysis (PAC, 0.727, 1.5 mile radius). Red font displays estimated post fire acres of suitable habitat and its representative percent of total scale area.

Owl PAC ID		PAC Acres Desired - 300 Acres	Core Area - Acres suitable habitat and its representative percent (%) within a 0.727 mile radius circle (1063 acres). Desired range >44%, or a minimum of 467 acres (Lee and Irwin 2005).	Home Range - Acres suitable habitat and its representative percent (%) within a 1.5 mile radius circle (4,524 acres). Desired range for suitable habitat 30-50% (1,357 – 2,262 acres or greater) (Bart 1995)
TUL0036	Pre-fire	293	631 (59%)	2272 (50%)
	Post-fire	201	453 (43%)	1800 (40%)
TUL0117	Pre-fire	67**	250 (24%)	2314 (51%)
	Post-fire	44	150 (14%)	1369 (30%)
KRN0011	Pre-fire	296	821 (77%)	3034 (67%)
	Post-fire	296	802 (76%)	2714 (60%)
KRN0039	Pre-fire	299	991 (93%)	3519 (78%)
	Post-fire	299	991 (93%)	3420 (76%)

*Suitable habitat = CWHR 4M, 4D, 5M, 5D. **This PAC located in low elev. Oak pine woodland where the higher amounts of drought mortality was observed prior to the fire.

With TUL0036 it is possible that this pair may continue to occupy their home range. While lower values occur at the PAC and 0.727 mile radius than desired, there may be enough habitat available to provide for continued occupancy for some period of time. In other wildfires on Sequoia National Forest (2002 McNally Fire and the 1990 Stormy Fire) historic spotted owl pairs were able to persist at least over the short term. In the McNally Fire for example two pairs were banded and radio collared 4 year post fire. Surveys conducted for one of the pairs prior to the study documented nesting in several years directly post fire, and owls were known to forage in high severity portions of the burn. However, as brush became more prevalent and fully occupied the site, the pair appears to have abandoned the site. The second pair was also detected in several consecutive years post fire, but later the female from that pair moved to the southwest and became the mate for a male in a different territory that was unburned by the fire.

Within the 1990 Stormy Fire the pair known as TUL0036 actually shifted their location to the north from their previously documented activity center. Upon this finding the PAC was redrawn to incorporate the best available habitat which had burned with lower fire intensity or was unburned. This represents the current location of the PAC as shown in Figure 12. Several research studies suggest that spotted owls can persists in landscapes where fire has actively changed habitat conditions, ranging from stand replacing fire to low or unburned conditions.

KRN0011 and KRN0039 have the same amount of suitable habitat when contrasting pre and post fire effects at the PAC scale. With regards to the other two scales, acreage estimates suggest values are within the desired range for both the 0.727 mile radius (>44%) and the 1.5 mile radius scales (>30%) (**Table 5**). Both KRN0011 and KRN0039 PACs are located outside of the Cedar Fire perimeter and therefore had no appreciative impact.

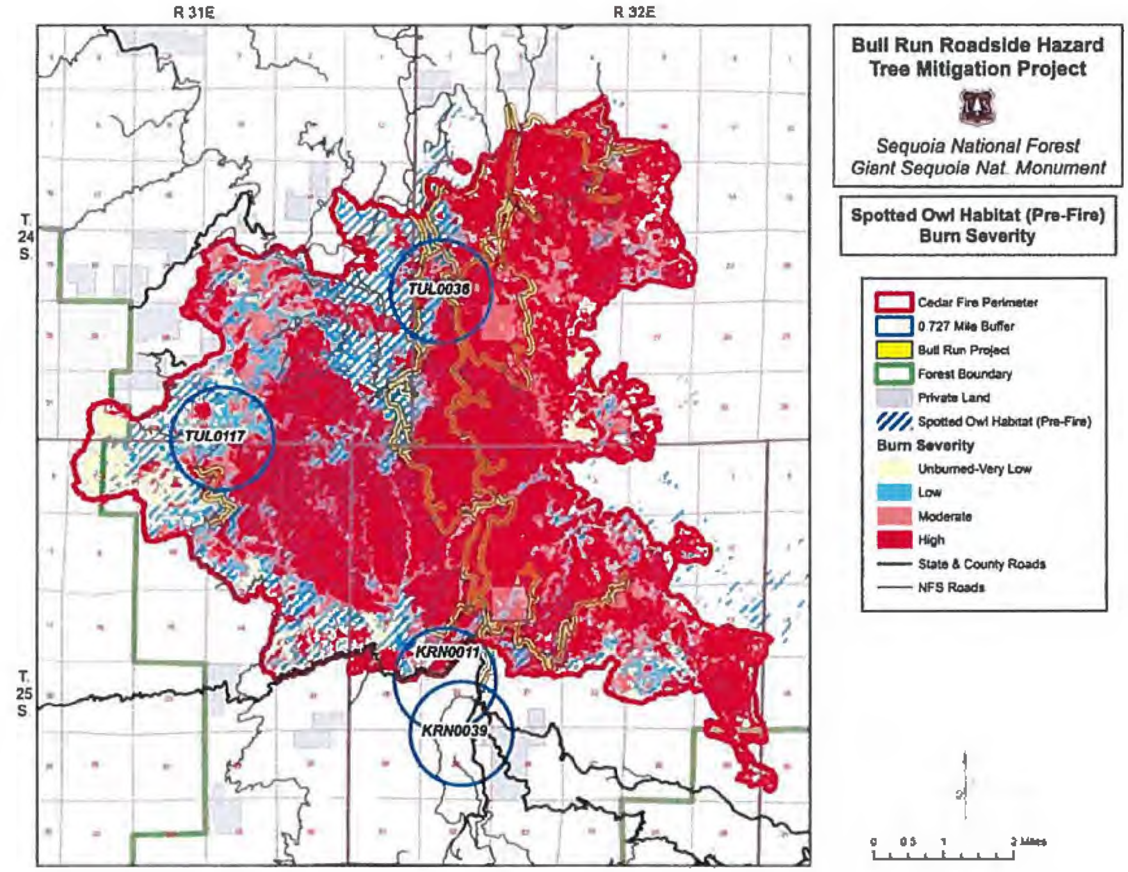

Figure 12. CWHR forest vegetation types with size and density classification 4M, 4D, 5M, 5D pre fire considered suitable for nesting and foraging, overlaid with the Cedar Fire burn severity mapping using the 0.727 mile scale of analysis for reference.

Further analysis of post fire conditions suggest that some areas which burned at moderate fire severity may be unsuitable for breeding purposes but remain suitable for forging habitat. **Table 6** displays acres of pre-existing suitable habitat and the estimated canopy loss percentages for that habitat based on RAVG data, in collaboration with **Table 7** which displays acres of suitable habitat by burn severity within the three different scales for PAC TUL0036. RAVG data can more closely estimate canopy loss. Based on this analysis where canopy loss was noted to exceed more than 50% loss, it was no longer considered suitable habitat. The majority of the road areas proposed for treatment under the Bull Run Project exceeded >50% canopy loss based on RAVG data[2] and were noted with high and moderate burn severity based on Cedar Fire mapping. Therefore, it is likely evident that some of the moderate severity habitat is no longer suitable habitat given these conditions.

Table 6. Suitable Habitat acres by Canopy loss in Percent Categories Post Fire by Spotted Owl ID and Analysis Scale (RAVG data 2016).

		Acres by Percent Canopy Loss						Total
Owl ID	Scale	>75%	50%-75%	>25%- 50%	0%-25%	0%	outside	
TUL0036	PAC	106	25	34	72	55	0	292
	0.7 mile buffer	205	43	58	149	176	0	631
	1.5 mile buffer	532	82	117	401	982	159	2272
TUL0117	PAC	29	7	2	10	20	0	68
	0.7 mile buffer	111	19	15	55	50	0	250
	1.5 mile buffer	1012	107	106	290	583	215	2313
KRN0011	PAC	0	0	0	0	0	296	296
	0.7 mile buffer	24	9	14	45	71	658	821
	1.5 mile buffer	365	67	78	210	229	2083	3032
KRN0039	PAC	0	0	0	0	0	299	299
	0.7 mile buffer	0	0	0	0	0	991	991
	1.5 mile buffer	70	31	38	108	88	3184	3519

Table 7. Suitable Habitat Acres by Burn Severity within three scales of analysis (PAC, 0.7 mile and 1.5 mile) by spotted owl ID, and retained suitable habitat post fire.

			Acres of Suitable Habitat By Burn Severity					Total
Owl ID	Scale	Suitable habitat pre-fire	High	Moderate	Low	Very Low unburned	outside	Suitable habitat post-fire
TUL0036	PAC	293	92	95	85	21	0	201
	0.7 mile buffer	631	178	171	178	104	0	453
	1.5 mile buffer	2272	472	357	544	780	150	1800
TUL0117	PAC	67	23	18	12	14	0	44
	0.7 mile buffer	250	100	61	57	32	0	150
	1.5 mile buffer	2314	945	366	298	490	215	1369
KRN0011	PAC	296	0	0	0	0	296	296
	0.7 mile buffer	821	18	42	52	50	650	802
	1.5 mile buffer	3034	321	256	211	164	2083	2714

[2] RAVG data estimates the actual canopy cover lost based on aerial satellite imagery after wildfire. The process delivers a suite of products within 45 days following containment of a wildfire that burnt at least 1,000 acres of National Forest lands. **https://www.fs.fed.us/postfirevegcondition/whatis.shtml**

			Acres of Suitable Habitat By Burn Severity					Total
Owl ID	Scale	Suitable habitat pre-fire	High	Moderate	Low	Very Low unburned	outside	Suitable habitat post-fire
KRN0039	PAC	299	0	0	0	0	299	299
	0.7 mile buffer	991	0	0	0	0	991	991
	1.5 mile buffer	3519	50	30	102	59	3420	3420

Prey dynamics: Spotted owls detect their prey by sight and sound, generally pouncing on their prey from an elevated perch or capturing it mid-air. Their diet varies geographically (Gutierrez et al. 1995). For example spotted owls in the Sierra Nevada Province prey mainly on northern flying squirrels (*Glaucomys sabrinus*) whereas owls in the Southern California Province prey almost exclusively on dusky-footed woodrats (*Neotoma fuscipes*) (Verner et al. 1992). On the Eldorado National Forest the primary dietary component varies by elevation: flying squirrels in upper elevation (red fir) stands, ground squirrels and gophers in mid-elevation (Sierran Mixed Conifer) stands, and woodrats in lower elevation (conifer/oak forest) stands (Eldorado National Forest spotted owl demography crew unpubl. data). Other prey species in the Sierra Nevada include "deer mice (*Peromyscus maniculatus*), voles (*Microtus* spp.), bats, amphibians, insects (which are consumed with the highest frequency but represent a much lower percentage of the diet by mass), ground and tree squirrels, chipmunks (*Tamias* spp.), and some species of bird" (summarized by Verner et al. 1992 and Gutierrez et al. 1995).

Keane (2014) reviewed recent telemetry studies that focused on spotted owl use of foraging habitat. Findings from this review consistently indicated that spotted owls used a broader range of vegetation conditions for foraging in comparison to nesting and roosting habitats. It is thought this wider use is partially driven by the abundance and availability of important prey species (Ganey et al. 2003, Glenn et al. 2004, Irwin et al. 2007, and Williams et al. 2011). Roberts and North (2012) suggested that forest heterogeneity across the landscape can improve spotted owl viability. "Spotted owl survival and reproductive rates were higher in owl territories that included a mosaic of vegetation types infused within late-successional forest (Franklin et al. 2000), presumably because there was a greater diversity or abundance of prey within this mosaic (Ward et al. 1998, Zabel et al. 1995)".

Risk Factors: Potential threats and stressors to this species include high severity stand-replacing fires, expansion of barred owls (*Strix varia*), loss of large trees and dense canopy cover, habitat fragmentation, climate change, and disease.

Wildfire and post fire logging: California spotted owls in the Sierra Nevada have evolved in forested landscapes shaped by fire processes and other human activities. Both the lack of fire and increased levels of uncharacteristically large scale fire events exhibiting high fire intensity may contribute negative influences to the spotted owl and its habitat.

In a synthesis of recent available scientific research on California spotted owls, Keane (2014) concluded that spotted owls continue to occupy landscapes that have experienced low- to moderate-severity fire as well as some mixed high severity fire. However, the effects of varying fire severities on spotted owl demographics (e.g., survival, reproduction) across multiple spatial and temporal (short term versus long term) scales are not well understood and the current research presents mixed results.

Much of the most comprehensive work involving spotted owl response to fire landscapes suggest that fires of low to moderate severity have the least impact on continued site occupancy, and retain a greater subset of desirable stand features in remnant forests post fire. High severity (catastrophic) fire has been identified as a potential threat to the California spotted owl in past reviews (Verner et al. 1992, Federal Register, USDI 2006). Large-scale stand-replacing fires can be detrimental to spotted owls, at least in the short term, possibly because these large areas do not contain habitat features important to spotted owls (Anthony & Clark 2008). High severity fires that kill most or all of the living trees effectively reduces the availability of preferred nesting and roosting habitat (mature coniferous forests with high tree canopy cover ≥70%), multilayered canopies, and an abundance of large trees and snags) that can take centuries to regrow.

The 2011 annual report of the Plumas Lassen study (PLS) released in June of 2012 investigated the response of spotted owls to various wildfires which occurred within their study area (Keane et al. 2012). This included the 2007 Moonlight-Antelope Complex Fire (MACFA) where approximately 52% of the fire burned at high intensity, and the 2008 Cub-Onion Fire (COCFA) in which only 11% burned at high intensity. PLS conducted California spotted owls surveys during the breeding period across the landscape for two consecutive years following the fires.

Prior to the MACFA there were 23 PACs located in the fire perimeter that had extensive baseline survey data. In the two years following the fire, surveys documented changes to the vegetation and amounts and distribution of California spotted owl habitat within the MACFA as a result of high severity wildfire. Results from this analysis suggested that the immediate post-fire landscape in this instance were likely not to support territorial California spotted owls. The majority of territorial spotted owls observed were located in the buffer area surrounding the fire perimeter. Their data noted that single male spotted owls detected across the burned landscape may have been present because of previous site fidelity or perhaps were opportunistically utilizing a flush of prey in the first year following the fire. Three detections of individual spotted owls just within the perimeter of the burn suggested that some owls were able to exploit the edge between the burned and unburned habitat for foraging. In contrast, the results for the COCFA landscape and distribution patterns suggested that spotted owls were able to persist in the post-fire landscape of low -moderate severity wildfire with similar abundance and spacing as had been observed in unburned forest outside the burned areas (Keane et al. 2012).

In southwest Oregon, Clark (2007) and Clark et al. (2011) found that annual survival rates were lower in northern spotted owls inhabiting burned areas or displaced by the wildfire as compared to owls that inhabited areas outside the burn perimeter. Clark (2007) observed that although 23 northern spotted owls used all types of fire severity, within burned areas owls strongly selected low severity or unburned areas with minimal overstory canopy mortality. In this burned landscape, owl high-use areas were characterized by lower fire severity and greater structural diversity. Clark (2007) and Clark et al. (2011) also found that post-fire salvage logging reduced owl habitat quality.

Some research would indicate that high severity fire can be beneficial for spotted owls when it occurs in small scale (50-100 acres) patches. For example Bond et al. (2002) hypothesized that wildfires have little short term impacts on spotted owls reporting that northern, California, and Mexican spotted owl survival, site fidelity, mate fidelity, and reproductive success at 11 territories one year after fires seemed uninfluenced by the fires. Four of the territories were mapped as having experienced low-to moderate-severity fire and four experienced high severity fire that burned >30% of the territories. In as separate study Bond et al. (2009) reported that spotted owls selectively foraged in high severity burned areas post wildfire. These study findings however were based on a small sample size (7 owls) over a short duration (12 weeks) four years after the fire event. Since the completion of this brief study, survey observations detected at least one of their banned study owls within a different territory, with a new mate, located in habitat away from high severity burn patches (R. Galloway, personal observation).

Roberts et al. (2011) estimated that California spotted owls studied in Yosemite National Park had similar detection, density, and occupancy rates between randomly selected unburned sites (16) and recently burned (<15 years since burn) sites (16) that had predominantly burned at low-to moderate- severity. Jenness et al. (2004) found no statistical relationship between fire with mixed severity effects and Mexican spotted owl occupancy and reproduction in Arizona and New Mexico, but the authors caution that higher occupancy and reproduction in unburned sites may not have been detected as statistically substantial because of small sample size, lack of information on temporal and spatial variability in owl occupancy rates, and high variability in burn extent and severity.

In a comparison of owl occupancy dynamics in burned versus unburned sites in the Sierra Nevada, Lee et al. (2012) found that the probability (model mean-averaged) of colonization and local extinction did not differ substantially between burned and unburned sites and the authors concluded that fire has no substantial effect on occupancy dynamics. The authors also found that owls continued to occupy sites (a distinct area in which a single or territorial owl or pair had been detected) where almost one third (32%) of suitable habitat had been burned at high severity.

They hypothesize that there may be a critical spatial threshold (proportion of a site) above which a burn at high severity could adversely affect spotted owl occupancy. Collectively, a large number of studies of fire effects on owls suggest the presence of large trees and high overstory canopy closure are the most important pre- and postfire conditions associated with spotted owl occupancy (Roberts and North 2012).

Keane (2014) also discussed findings of Lee et al. (2013) which noted "no statistically significant effects of wildfire or salvage logging on California spotted owls in the mountains of southern California. Although not statistically substantial, occupancy rates declined by 0.062 in burned sites in the first year after wildfire, and postfire salvage logging reduced occupancy by an additional 0.046 relative to burned sites without salvage logging. Differences in occupancy between unburned versus burned and burned-salvage logged sites increased over time. Colonization was positively associated, and extinction negatively associated, with the amount of suitable habitat within 203-ha core areas around owl sites, and extinction probability was substantially higher when >50 ha of suitable habitat burned at high severity within burned sites compared to unburned sites (Lee et al. 2013)".

Barred Owls: Barred owls are an increasing risk factor for California spotted owls in the Sierra Nevada. Barred owls have been able to replace or displace northern spotted owls over large parts of their range (Keane 2014). Barred owls can hybridize with spotted owls and possibly out-compete spotted owls given their more generalist prey base and smaller home range. Barred owls were first recorded within the range of the California spotted owl in 1989 on the Tahoe National Forest. Two sparred owls (hybrids of spotted and barred owls) were reported in the Eldorado National Forest during 2003 – 2004 (Seamans et al. 2004), and one of these sparred owls is still present on the study area. Barred owls were first recorded in the southern Sierra Nevada in 2004 (Steger et al. 2006). Ongoing research has documented 73 records of barred or sparred owls in the Sierra Nevada to date, with the majority of records from the northern Sierra Nevada (Tahoe, Plumas, and Lassen National Forests). Of note, five new records of barred owls were documented in the Stanislaus and Sierra National Forests in 2012, and one detection noted on Sequoia National Forest in June of 2017 indicating further range expansion of barred owls in the southern Sierra Nevada. Barred owl numbers are likely higher than documented in the Sierra Nevada, as there have been no systematic surveys for them to date.

Climate Change: Keane (2014) reviewed the potential effects of climate change on the spotted owl and noted that across their range they exhibit population-specific demographic relationships with local weather and regional climates (Glenn et al. 2010, Glenn et al. 2011, Peery et al. 2012, LaHaye et al. 2004). Keane (2014) also noted findings from Seamans and Gutiérrez (2007b) who reported that temperature and precipitation during incubation for the California spotted owl most affected reproductive output, and conditions in winter associated with the Southern Oscillation Index (SOI) most affected adult survival on the Eldorado National Forest. Weather variables explained a greater proportion of the variation in reproductive output than they did for survival. Further, these two weather variables were also included in the best models predicting annual population growth rate (Seamans and Gutiérrez 2007b). MacKenzie et al. (2012) found that SOI or other weather variables explained little variation in annual reproduction for this same population of owls. Keane (2014) suggested that future responses to climate change are likely to be governed by complex interactions of factors that directly affect spotted owls and their habitat, as well indirect factors that can affect habitat (e.g., insect pests, disease, increased fire risk, etc.). Carroll (2010) recommended that dynamic models that incorporate vegetation dynamics and effects of competitor species in addition to climate variables are needed for rigorous assessment of future climate change on spotted owls.

Disease: Little information exists on disease prevalence in California spotted owl populations, and or the effects of disease on individual fitness or population viability. Blood parasite prevalence sampling for California spotted owls in the northern Sierra Nevada documented that 79 percent of individuals were positive for at least one infection. West Nile Virus can have high and acute species-specific mortality rates in many raptor species (owls, hawks, and their relatives) (Gancz et al. 2004, Marra et al. 2004). Some researchers have suggested this virus may pose some future risk to the species. Keane (2014) however discussed that none of the 141 individual California sp otted owl blood samples collected from the southern (Sierra National Forest, Sequoia-Kings Canyon National Park) or northern (Plumas and Lassen National Forests) Sierra Nevada from 2004 – 2008 have tested positive for WNV antibodies, which would indicate exposure and survival (Hull et al. 2010).

Townsend's big-eared bat

State Wide Range, Distribution, and Trend: The Townsend's big-eared bat (*Corynorhinus townsendii)* occurs throughout the west and is distributed from the southern portion of British Columbia south along the Pacific coast to central Mexico and east to the Great Plains, with isolated populations occurring in the south and southeastern United States. Historically the Townsend's big-eared bat was found throughout California as a scarce, but widespread species (Barbour and Davis 1969). It is typically found from low desert (sea level) to mid-elevation montane habitats, with only occasional sightings reported up to 10,800 feet (Philpott 1997; CWHR 2008).

Population trends have been reportedly declining across the state (Pierson and Rainey 1998; Pierson et al. 1999; Miner and Stokes 2005). However, recent research suggests that absence at historic sites, and subsequent reports of population declines, may be a result of insufficient survey effort, especially where multiple potential roosts are available (Ellison et al. 2003a; Sherwin et al. 2003). Furthermore, statistical inferences about this species cannot be made for populations in the western United States (Ellison et al. 2003a). As such, Ellison and others (2003a) suggest caution in interpreting the population declines in California. It is clear that further research and population monitoring is needed to determine trends in the state.

With the above caution in mind, Pierson and Rainey (1998) reported on Townsend's big-eared bat populations in California. They reported substantial changes over the last 40 years in Townsend's big-eared bat total individuals (54 percent decline), maternity colonies (52 percent decline), available roosts (45 percent decline), and average colony size (33 percent decline). Pierson and others (Pierson and Rainey 1998; Pierson et al. 1999) did report that there was unmistakable evidence that some roosts were deliberately destroyed and bats were killed. The Mother Lode country (central Sierra Nevada Mountains and foothills) historically has been known as the "heart of concentration" (Pierson and Rainey 1996), along with the Colorado River area.

Limited inventories conducted on Sequoia National Forest for the Townsend's big-eared bat suggest a scattered presence of this species. The greatest abundance has been noted primarily at abandoned silver and tungsten mines in low elevation areas of the Kern River drainage, and in the Windy Gulch Cave Complex. Recent field reconnaissance solely for the purpose of identification of bat species has not been conducted within the Tobias Project. However, one previous historic survey was completed within the Deep Creek Cave by Brown (1997, unpublished survey report). The survey noted the presence of *Corynorhinus* guano in a few secluded spots, and that the cave had historic records of the species. At the time of the survey the entrance of the cave was covered by a solid metal door. Despite this there was evidence of human entry suggesting it as a popular site for recreational cavers. A new bat friendly gate was installed in 2001 to allow for better bat access to the cave, and to limit human disturbance to the site. Several surveys for bat species were conducted in 2003, in portions of the McNally Fire which also resulted in detections of Townsend's big-eared bat.

Species Biology and habitat preferences: Habitat associations for this bat species include desert, native prairies, coniferous forests, mid-elevation mixed conifer, mixed conifer-hardwood forests, riparian communities, active agricultural areas and coastal habitat types (Kunz and Martin 1982, Pierson et al. 1991). Roost structure is believed to be more important than the local vegetation (Gruver and Keinath, 2006; Pierson and Rainey 1998) and the presence of suitable caves or cave-like structures defines the distribution of this species more so than does suitable foraging habitat (Barbour and Davis 1969; Pierson and Rainey 1998; Piaggio 2005; Gruver and Keinath 2006. The majority of the project area provides suitable foraging habitat for the Townsend's big-eared bat estimated at 10,826 acres.

The most critical habitat feature for roost sites and maternity colonies are cave and cave-like roosting structures such as: mines, attics in buildings, lava tubes, and bridges. Townsend's big-eared bats use roosts to hide, rest, and save energy (Woodruff and Ferguson 2005). Day roosts are used for resting and hiding during the active season; night roosts are for short-term use to rest, digest food, and seek shelter or safety (ibid.). Maternity, or nursery roosts, are day roosts used by females to care for young during the active season (ibid.). Lastly, winter roosts, or hibernacula, are locations where bats overwinter and are safe from predators, are cold (yet above freezing), and are unlikely to be disturbed (Woodruff and Ferguson 2005).

Mating typically occurs from November to February after bats have entered their hibernaculum for the winter (Barbour and Davis 1969; Burt and Grossenheider 1980; Jameson and Peeters 1988; Kunz and Martin 1982; Zeiner et al. 1990). After delayed implantation and a 56-100 day gestation period females give birth to a single pup in May or June (ibid.). In western North America, almost all spring and summer concentrations of Townsend's big-eared bats are females that have returned to their natal site to give birth and raise their young (Pierson and Rainey 1998). Young are weaned in six weeks, and can fly two-and-a-half to three weeks after birth (Barbour and Davis 1969; Burt and Grossenheider 1980; Jameson and Peeters 1988; Kunz and Martin 1982; Zeiner et al. 1990). Caves and mine tunnels are most commonly used as maternity sites, as well as for winter hibernacula. Males leave the nursery colony after the first summer and typically roost alone (Pierson and Rainey 1998).

Winter hibernating colonies are composed of mixed-sexed groups and may range from a single individual to several hundred animals (Piaggio 2005), during October through April (Zeiner et al. 1990). The Townsend's big-eared bat hibernates most commonly in caves and mines where temperatures are 12-13 degrees Celsius or less, and generally above freezing. Individuals may move during winter in response to temperature change (Barbour and Davis 1969). Townsend's big-eared bats utilize well-ventilated, cold caves and mine tunnels as hibernacula, in particular locations from which they can hang from the ceiling (Gruver and Keinath, 2006; Pierson and Rainey 1998). In addition to caves and mine tunnels, bridges and old buildings may be utilized as roosts (Barbour and Davis 1969; Pierson and Rainey 1998).

Townsend's big-eared bats do not migrate long distances (Barbour and Davis 1969; Humphrey and Kunz 1976; Dobkin et al. 1995; Woodruff and Ferguson 2005). In central Oregon, Dobkin and others (1995) observed big-eared bats moving 24 kilometers between hibernacula and foraging areas and from two to eight kilometers from day roosts to foraging areas. Woodruff and Ferguson (2005) reported big-eared bats traveling five kilometers from roosting to forging sites during the summer. Lactating females will travel between five and 13 kilometers (Woodruff and Ferguson 2005). Townsend's big-eared bats change roosts throughout the season (Fellers and

Pierson 2002; Sherwin et al. 2000), which may complicate survey efforts (Sherwin et al. 2003). Even in cool climates, Townsend's big-eared bats may change roosts in the winter (Woodruff and Ferguson 2005).

Moths are the primary prey of Townsend's big-eared bats. Piaggio (2005) reports moths making up over 90 percent of its diet. Barbour and Davis (1969) report finding no other insect order being consumed by Townsend's big-eared bats. Pierson et al. (1999) summarized other research that includes consumption of other invertebrate orders in small amounts. Small moths, beetles, and a variety of soft-bodied insects also are taken in flight using echolocation, or by gleaning from foliage (Jameson and Peeters 1988; Zeiner et al. 1990). This bat forages relatively close to its roosts sites (Gruver and Kenaith 2006).

Flight is slow and maneuverable, with the species capable of hovering (Zeiner et al. 1990; Gruver and Kenaith 2006) and perhaps gleaning insects off foliage (Gruver and Kenaith 2006). Foraging usually begins well after dark (Kunz and Marten 1982). This bat will forage above and within the canopy (Pierson et al. 1999), often along forest edges and riparian areas (Piaggio 2005), and seems to be well adapted to a moderately cluttered canopy (Gruver and Kenaith 2006). As stated, foraging habitat includes a wide variety of vegetation types. Suitable foraging habitat in California includes agricultural types, dense forests, desert scrub, moist coastal forests, oak woodlands, and mixed conifer-deciduous forests (Pierson and Rainey 1998), in particular along habitat edges (Fellers and Pierson 2002). Habitat connectivity between roosting and foraging sites may be important for this species, especially because individuals tend to avoid open spaces (Gruver and Kenaith 2006).

Risk Factors: The largest emerging threat to all cave-roosting species is white-nose syndrome. There is a grave concern that it could spread to the western states and California. As of October 2011, the U.S. Fish and Wildlife Service currently records suspected detections in Oklahoma (http://www.fort.usgs.gov/wns/). This disease has rapidly spread throughout the eastern US and Canada since its discovery in 2006.

A major threat to Townsend's big-eared bats is disturbance or destruction of roost sites, in particular hibernacula and nursery sites (Pierson et al. 1999; Piaggio 2005; Woodruff and Ferguson 2005; Bradley et al. 2006). Visitation during critical periods can adversely affect bats in those sites, often leading to reduced populations (Pierson et al. 1999). In such an event, rousing from torpor uses valuable fat reserves which are needed to sustain physiological processes throughout the hibernation period. A single visit may result in abandonment of the roost (Barbour and Davis 1969; Zeiner et al. 1990). Low fecundity (one pup/year) and high first year mortality means disturbance at a hibernacula or nursery roost can be potentially detrimental, although by limiting disturbance, populations can recover in part because survival rate in subsequent years is higher (Pierson et al. 1999).

Mine closures, often with the intent to protect human safety, can eliminate access to roosts and hibernacula (Miner and Stokes 2005). Reactivation of mines may eliminate cave roosts and hibernacula, or cause disturbance such that bats will abandon a site (Pierson et al. 1999).

Pallid bat

State Wide Range, distribution and Trend: The pallid bat is a locally common species of low elevations in California. It is broadly distributed except for the high Sierra Nevada from Shasta to Kern Counties, and the northwestern corner of the State from Del Norte and western Siskiyou Counties to northern Mendocino County. The species occurs on all Sierra Nevada national forests. There have been few bat surveys throughout Sequoia National Forest but pallid bats are presumed present in low density within their elevation range.

Habitat Preferences and Biology: The pallid bat occupies a wide variety of habitats ranging from rocky arid deserts to grasslands, shrublands, woodlands, and forests from sea level up to mixed conifer forests. They are most abundant in the arid Sonoran life zones below 6,560 feet (Barbour and Davis 1969, Hermanson and O'Shea 1983, Pierson et al. 2001), but on rare occasion noted to occur up to 10,000 feet in the Sierra Nevada. Data suggests a stronger association with low to mid elevation oak habitat (both oak savannah and black oak), mixed deciduous/coniferous forest, and both coast redwood and giant sequoia forests (Pierson and Heady 1996, Pierson et al. 2006). They are yearlong residents in most of their range and hibernate in winter near their summer roost (Zeiner et al.1990). Occasional forays may be made in winter for food and water (Philpott 1997).

The pallid bat tends to be a roosting habitat generalist that utilizes many different natural and manmade structures (USDA 2001). Day roosts may vary but are commonly found in rock outcrops, crevices, tree hollows, mines, caves and a variety of human-made structures (bridges, buildings). Tree roosting has been documented in large conifer snags, inside basal hollows of coastal redwoods and giant sequoias, and bole cavities in oaks. Cavities created by broken branches of black oak are very important and there is a strong association with black oak for roosting. Roosting sites must protect bats from high temperatures as this species is intolerant of roosts in excess of 104 degrees Fahrenheit. Pallid bats are also very sensitive to roost site disturbance (Zeiner et al. 1990, Philpott 1997). Night roosts are usually more open sites and may include open buildings, porches, mines, caves, and under bridges (Philpott 1997, pers. comm. Sherwin 1998, Pierson et al. 1996). The pallid bat is nocturnal and after sunset it emerges from the day roost to forage.

Mating takes place between late October and February. Pallid bats reproduce in nursery colonies of up to several hundred females, but generally fewer than 100. After a period of delayed fertilization, gestation occurs between April and June. On average 2 young are born between April and July, predominately May and June.

Prey Resources: Pallid bats are thought to prefer open habitat for foraging. They feed primarily on large, ground-dwelling arthropods, particularly beetles, Jerusalem crickets and scorpions (Pierson et al. 2006). Large moths and grasshoppers are consumed to a lesser degree. Pallid bats appear to be more prevalent within edges, open stands, particularly hardwoods, and open areas without trees (CWHR 2005).

Risk Factors: The largest emerging threat to all cave-roosting species is white-nose syndrome. There is a grave concern that it could spread to the western states and California. As of October

2011, the U.S. Fish and Wildlife Service records suspected detections as far west as Oklahoma (http://www.fort.usgs.gov/wns/). This disease has rapidly spread throughout the eastern US and Canada since its discovery in 2006.

Habitat threats include loss of foraging habitat due to urban expansion in low elevation habitat (Philpott 1997; Ferguson and Azerrad 2004; Rambaldini 2005; Miner and Stokes 2005; Pallid Bat Recovery Team 2008) and loss of riparian habitat in arid areas.

Fringed Myotis Bat

State Wide Range, distribution and Trend: The fringed myotis is found in western North America from south-central British Columbia to central Mexico and to the western Great Plains (Natureserve 2012). In California, it is distributed statewide except the Central Valley and the Colorado and Mojave Deserts (CWHR 2008).

In California, the species is found throughout the state, from the coast (including Santa Cruz Island) to approximately 6,900 feet in elevation in the Sierra Nevada. The majority of known occurrences are on the west side of the Sierra Nevada (Angerer and Pierson draft). Museum records suggest that while *M. thysanodes* is widely distributed in California, it is one of the rarest species detected (Pierson et al. 1996). Available museum records offer documentation for only six maternity sites: two in Kern County (including the type locality at Old Fort Tejon), and one each in Marin, Napa, Tuolumne, and Tulare counties. Investigation of four of these sites since 1990 has shown that while the roosts are still available this species is no longer present at any of these sites (Angerer and Pierson draft).

According to Forest Service records, the fringed myotis is found on the Angeles NF, Eldorado, NF, Los Padres NF, Mendocino, NF, Modoc NF, Plumas, NF, Shasta-Trinity, NF, the Sierra NF, and the Tahoe NF. State records (CWHR 2008) available add the Cleveland NF, Inyo NF, Klamath NF, Lake Tahoe Basin, Lassen NF, San Bernardino NF, Sequoia NF, Six Rivers NF, and Humboldt-Toiyabe NF.

Habitat Preferences and Biology: The fringed myotis bat occurs in dry woodland (e.g. oak and pinyon-juniper most commonly, Cockrum and Ordway 1959, Jones 1965, O'Farrell and Studier 1980, Roest 1951), hot desert-scrub, grassland, sage-grassland steppe, spruce-fir, coniferous and mixed deciduous/coniferous forests, including multi-aged sub-alpine, Douglas fir, redwood, and giant sequoia (O'Farrell and Studier 1980, Pierson and Heady 1996, Pierson et al. 2006, Weller and Zabel 2001). To generalize, this species is found in open habitats that have nearby dry forests and an open water source (Keinath 2004). Based on CWHR classification of vegetation types associated with the fringed myotis bat, there is estimated at 1,084 acres of suitable habitat prior to the fire.

This species has been associated with a variety of roost site types and structures. These include rock crevices, caves (Baker 1962, Easterla 1966, 1973), mines (Cahalane 1939, Cockrum and Musgrove 1964), buildings (Barbour and Davis 1969, O'Farrell and Studier 1980), bridges, and both live and dead trees. Day and night roosts in trees occur under bark, in tree hollows, and in snags of medium to large diameter (Keinath 2004; Weller and Zabel 2001). Studies conducted in

California, Oregon, and Arizona, have documented 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, were surrounded by reduced canopy closure, and were under bark (ibid.).

This species often forages along secondary streams, in fairly cluttered habitat. It also has been captured over meadows (Pierson et al. 2001). The fringed myotis bat is known to fly during colder temperatures (Hirshfeld and O'Farrell 1976) and precipitation does not appear to affect emergence (O'Farrell and Studier 1975). Post-lactating females have been known to commute up to 13 km (8 miles) with a 930 meter (3,100 feet) elevation gain between a roost and foraging area (Miner and Brown 1996). Keinath (2004) found that travel distances from roosting to foraging areas may be up to five miles.

The fringed myotis consumes primarily beetles, and is supplemented by moths and fly larvae (Keinath 2004) captured in the air and on foliage (CWHR 2008). In a study conducted in New Mexico, Black (1974) concluded the species appeared to be a beetle strategist. In western Oregon (Whitaker et al. 1977), the dominant prey item in the diet of three out of four animals examined was moths (Lepidopterans). The diet also included phalangids (harvestmen), gryllids (crickets), tipulids (crane flies), and araneids (spiders). The feces of one individual captured on the upper Sacramento River in California contained predominantly coleopterans (beetles) and Hemipterans (bugs) (Rainey and Pierson 1996). Relatively heavy tooth wear on animals examined in a five year study on the Sacramento River would suggest that in this area the species feeds primarily on heavy bodied insects, such as Coleopterans and Hemipterans. The presence of non-flying taxa in the diet of the Oregon animals suggests a foraging style that relies at least partially on gleaning (Angerer and Pierson draft).

Risk Factors: 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. There is grave concern that it could spread to the western states and California. As of October 2011, the U.S. Fish and Wildlife Service currently records suspected detections in Oklahoma (http://www.fort.usgs.gov/wns/). This disease has rapidly spread throughout the eastern US and Canada since its discovery in 2006.

M. thysanodes appears to be highly dependent on tree roosts within forest and woodland habitats. In some forested settings, *M. thysanodes* appears to rely heavily on tree cavities and crevices as roost sites (Weller 2005), and may be threatened by certain timber harvest practices. For example, Chung-MacCoubrey (1996) in Arizona found that this species prefers large diameter (18-26 inch dbh) conifer snags.

Closure of old mines for hazard abatement and renewed mining in historic districts both pose considerable risks to this and other cavern dwelling bat species (Brown and Berry 1991, Altenbach and Pierson 1995, Riddle 1995). One of two *M. thysanodes* mine nursery sites found since 1987 has been destroyed by renewed mining. The colony persists by default, now occupying the lower level of a mine gated as a mitigation site for *Corynorhinus townsendii* (Pierson et al. 1991). Further, improper gating may alter accessibility to and from mines and caves.

Townsend's Bat, Pallid Bat, and Fringed Bat within the Bull Run Project

Collectively the bat species addressed utilize a broad ranges of forest habitat types (Sierra mixed conifer, oaks, etc.) found throughout the analysis area. For the purposes of this analysis it includes forest stands with CWHR size and density classifications of 4D, 4M, 5D and 5M. It is estimated that post fire approximately 6,231 acres of suitable habitat remain. The Bull Run Project would treat up to 638 acres (10%) of the total habitat.

Fisher

Habitat Preferences and Biology

Fishers are meso-carnivores belonging to the mink family (Mustelidae). In the Sierra Nevada, fisher habitat occurs in mid-elevation forests (Grinnell et al. 1937, Zielinski et al. 1997) largely on National Forest System lands, below the elevations of national parks and wilderness areas. In some portions of the southern Sierra Nevada, fishers occur sympatrically with martens (*Martes americana*) 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 (USDA 2006a) 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.

In the southern Sierra Nevada, the preferred habitats include mixed conifer, ponderosa pine and montane hardwoods. Oaks, particularly black oak (*Quercus kelloggii*) appear to be a key component of the habitat (Carroll et al. 1999, Zielinski et al. 2004a). Forest structural characteristics within fisher home ranges are strongly skewed toward mid- to late-seral stands with high canopy cover; large, cavity-forming trees are required for resting and denning habitat (Seglund 1995, Zielinski et al. 2004b, Yaeger 2005). Geographic conditions correlated with core fisher habitat in California include complex topography, steep slopes, and proximity to water (particularly in the southern Sierra Nevada) (Zielinski et al. 2004b, Carroll 2005).

Riparian corridors (Heinemeyer and Jones 1994) and forested saddles between major drainages (Buck 1983) may provide important dispersal habitat or landscape linkages for the species. Riparian areas are important to fishers because they provide concentrations of large rest site elements, such as broken top trees, snags, and coarse woody debris (Seglund 1995).

Purcell, et al. (2009), studied resting structures used by fishers on an area of Sierra National Forest. They determined that canopy cover was the most important variable distinguishing areas used as rest sites by fishers. Large live trees and large snags made up the majority of the rest structures. Trees used as resting sites were often the largest available in the area. Resting sites were on steeper slopes, closer to streams and with smaller and more variable trees than random sites.

Habitat suitable for resting and denning sites is thought to be most limiting to the population; therefore, these habitats should be given more weight than foraging habitats when planning or assessing habitat management (Powell and Zielinski 1994, Zielinski et al. 2004a). Fishers generally use at least one rest site per day, and rarely reuse rest site structures (Kilpatrick and Rego 1994, Seglund 1995, Zielinski et al. 2004a). Zielinski et al. (2004a) argue that retaining and recruiting trees, snags and logs of at least 39 in. dbh, encouraging dense canopies and structural diversity, and retaining and recruiting large hardwoods are important for producing high quality fisher habitat and resting/denning sites.

The following California Wildlife Habitat Relationships (CWHR) types were thought to be important to fishers: generally structure classes 4P, 4M, 4D, 5S, 5M, 5D and 6 in ponderosa pine, montane hardwood-conifer, Klamath mixed-conifer, Douglas-fir, Sierran mixed conifer, montane riparian, aspen, redwood, red fir, Jeffrey pine, lodgepole pine, subalpine conifer, and eastside pine (Timossi 1990) (**Figure 4**). 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. The model has been 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 CWHR 2.1.

Population Genetics

The maintenance of the southern Sierra Nevada fisher population may be critical to conserving fisher populations in the western United States (Zielinski et al. 2004a) because it appears to support unique genetic and behavioral adaptations to extreme environmental conditions for this species. Several studies have revealed genetic patterns that appear to arise from the disjunct nature of fisher population distributions in the Pacific States, and point to reduced genetic diversity in the southern Sierra Nevada population (Drew et al. 2003, Wisely et al. 2004). Wisely et al. (2004) analyzed 19 fisher genetic samples from three different locations to investigate the role of landscape features in fisher genetics in the narrow strip of suitable forested habitat in the southern Sierra Nevada. The study concluded that fisher expansion southward into the west coast mountain chains occurred less than 5,000 years ago, leading to reduced genetic diversity and increased population structure at the southern periphery of its range. This study suggested that dispersal was limited, and thus indicated that aggressive conservation strategies may be needed to preserve the existing southern Sierra Nevada fisher population and reconnect extant populations to the north. Consistent with this genetic analysis, the Kings River was postulated to constitute a major barrier to gene flow, perhaps permeable to just one migrant every 50 generations (Wisely et al. 2004). The number of migrants needed per generation to maintain genetic viability, is highly dependent on the specific demographic and genetics characteristics of the population (Mills and Allendorf 1996) (Vucetich and Waite 1999). Thus, the results reported by Wisely et al. (2004) were cause for concern.

More recently, additional fisher DNA samples from a broad distribution across the entire southern Sierra fisher sub population have been analyzed as part of an on-going doctoral dissertation. A progress report on this work, Tucker et al. (2009) indicated much higher levels of population connectivity in the southern Sierra Nevada. A cluster analysis using the program GENELAND (Guillot et al. 2005) signaled the presence of three intermixing population groupings: one in the far northwest portion of the Sierra National Forest, another encompassing the rest of Sierra National Forest through Sequoia/Kings Canyon National Park, and a southern third on the Sequoia National Forest (Tucker et al. 2009). Preliminary data indicate that at least one individual per generation moves from the northwest Sierra to the central population group, and up to 3.5 individuals per generation are interchanged between the central and southern genetic group (Tucker et al. 2009). Thus, based on this preliminary information, the Kings River does *not* appear to constitute a great barrier to fisher movement, as hypothesized in Wisely et al. (2004).

After analyzing 10 microsatellite loci from contemporary and historical fisher samples, Tucker et al. (2012) concluded that the southern Sierra Nevada fisher population became isolated far before the European settlement of California. This indicates that the southern Sierra Nevada population has persisted despite long-term isolation (over 1,000 years) and small population size. Their results also indicate that the southern Sierra Nevada (including what is now Sequoia National Forest) may have provided a refuge for fisher during the era of European settlement.

Historic and Current Distribution

Grinnell et al. (1937) described the distribution of fishers in California as a continuous arc from the northern Coast Range eastward to the southern Cascades, and then south through the western slope of the Sierra Nevada. 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.

Status and trend monitoring for fishers in the Sierra Nevada was initiated in 2002; the monitoring objective was to be able to detect a 20 percent decline in population abundance and habitat (USDA 2006a). This monitoring includes intensive sampling to detect population trends on the Sierra and Sequoia national forests, where fishers currently are found, and was 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. Fishers have been detected at 112 of 251 (44.6%) sites sampled during the 7 monitoring seasons (Truex 2009). Fishers have not been detected in the northern, central, or eastern Sierra.

Results indicate that fishers are well-distributed in portions of the Sequoia and Sierra National Forests; but occupancy rates are consistently higher on the Sequoia than the Sierra (USDA 2005). Carnivore surveys on the Hume Lake Ranger District have resulted in numerous detections of fishers within and near the Hume Hazard project area.

A recent analysis of the SNFPA Long Term Monitoring data was completed which analyzed a core of 243 sample units from 2002 through 2009 (Zielinski et. al 2013). Findings suggest that over the 8-year period, there was no trend or statistically substantial variations in fisher occupancy rates in the southern Sierra populations. The small population of fishers in the southern Sierra does not appear to be decreasing.

Risk factors:
Threats to the West Coast Distinct Population Segment

The USFWS (2004) identified major threats to fishers in the West Coast Distinct Population Segment, discussed relative to specified factors for listing under Section 4 of the Endangered

Species Act. Only those threats deemed by USFWS (2004) to be "important" to the entire West Coast DPS are summarized in this section. The reader is referred to the Federal Register for the complete USFWS 2004 discussion.

Factor A. The Present or threatened Destruction, Modification, or Curtailment of the Species' Habitats or Range. The extent of past and present timber harvest can fragment fisher habitat, reduce it in size, or change the forest structure to unsuitable for fishers. Both fuels reduction activities and effects of wildfire could result in loss and/or fragmentation of habitat. Development, recreation and roads also pose a threat of habitat loss/fragmentation as well as direct mortality. Research literature suggests that the loss and fragmentation of suitable habitat by roads may have played a role in the reduction of fishers from the central Sierra Nevada and its failure to re-colonize there.

Factor B. Overutilization for commercial, recreational, scientific or educational purposes. Historical trapping resulted in a severe population decline. Current mortalities or injuries from incidental trapping even where fisher trapping has been eliminated could be frequent and widespread enough to prevent population recovery or re-occupation of suitable habitat.

Factor C. Disease or Predation. There is potential for disease outbreaks to occur in these small, isolated fisher populations with devastating effects. Mortality from predation by mountain lion, bobcat, coyote or large raptors could pose a substantial threat to fishers.

Factor D. The inadequacy of existing regulatory mechanisms. Some protections are available, but highly variable from jurisdiction to jurisdiction, and limited. Current regulations fail to provide sufficient certainty that conservation efforts will be implemented or that they will be effective in reducing threats to fishers.

Threats to Fishers in the Southern Sierra Nevada Population

- **Uncharacteristically Severe Wildfire.**

Uncharacteristically severe wildfire is defined as fire occurring beyond the historical range of natural variation in terms of scope, intensity and duration. These stand-replacing fires affect large areas of the landscape, decreasing or removing key fisher structural and habitat elements including large trees, overstory and understory canopy, vegetative diversity, snags, and logs. Landscape permeability for fisher movements at all scales may decrease as a result. As part of the threat evaluation completed for the West Coast Fisher Conservation Assessment (Lofroth et al. 2010), uncharacteristically severe wildfire ranked as high threat in the southern Sierra Nevada geographic area.

Fragmented landscapes created by uncharacteristically severe wildfires are likely to eliminate fisher habitat linkages, either permanently via vegetative type conversion or temporarily until recovery occurs. Landscape permeability to fishers is decreased. This results in detrimental impacts to fisher daily movements and energy balance, creates barriers to dispersal movements, affects the establishment of home ranges, and prolongs or prevents breeding season movements. These impacts may decrease fisher survival. Overall population fitness is affected by individual survival and mortality. Direct mortality as a result of fire may occur in extreme cases depending upon season (e.g. kit loss in reproductive season, loss of adults in fast-moving canopy firestorms either directly or from potential smoke inhalation).

Large trees, snags and logs are used as resting structures (Purcell et al. 2009). Fishers exhibit strong selection for rest and den sites based upon forest structure and canopy cover. Changes in the frequency, abundance, and distribution of these habitat elements may create conditions inimical to successful reproduction, as well as survival of the young to recruitment into the population. Lack of well-distributed escape cover will result in increased predation.

- **Vegetation Manipulation to Reduce Risk of Uncharacteristically Severe Wildfire**

Truex and Zielinski (2005) estimated the change in fisher habitat suitability pre- to post-treatment in fuels reduction projects at two sites in the Sierra Nevada. Four primary treatments were applied for effects assessment: control (no treatment); mechanical harvest (usually including mastication following harvest); mechanical harvest followed by prescribed burning; and an area where prescribed burning was the only treatment. Study areas were the Blodgett Forest Research Station (BFRS) and a satellite site at Sequoia-Kings Canyon National Park (SEKI).

This study generally concluded that fire and fire surrogate treatments have modest but substantial short-term effects to the quality and availability of fisher resting habitat, as well as canopy closure. At BFRS, mechanical as well as mechanical plus fire treatments substantially reduced fisher resting habitat and average canopy closure. At the SEKI site, the late season burn treatment had a large effect on fisher habitat suitability as well as canopy closure. The short-term treatment effects to foraging habitat at both sites were generally minimal. This may be explained by the broad spectrum of foraging habitat parameters, rendering it less likely to be a limiting factor to fisher than resting habitat.

The effect of greatest magnitude was a reduction in canopy closure. All treatments reduced canopy closure. Canopy closure, however, recovers relatively quickly compared to the loss of large dead or live trees. Re-measurements of treatment units in this study in 5 or 10 years will provide information on how quickly the canopy actually recovers.

In areas where fisher habitat suitability is already low or marginal, the predicted effects may have a disproportionately large impact to habitat recovery. On the other hand, the short-term negative effects of the treatments may result in beneficial effects on subsequent stand development.

Another limitation of this study is that it focused upon effects at the individual stand level. As wide-ranging predators, fisher function at larger landscape scales within their habitats. Thus, it is important to analyze the spatial and temporal array of treatments in a landscape context. The more broadly distributed the treatments are over space and time, the lower the likelihood of negative effects in a landscape context.

One last caveat offered by Truex and Zielinski (2005) in interpreting the study results is to recognize that a reduction in habitat suitability does not necessarily equate to <u>loss</u> of suitability. Population level implications to localized reductions in habitat suitability have yet to be studied.

To decrease effects to fisher habitat suitability, the authors recommend planning treatments to maintain elements important to fisher (e.g. large diameter hardwoods).

Prescribed fire treatments may create risks to fishers through the production of heat and smoke. To assess this threat, researchers monitored a female with kits at a den site in the Kings River study area of Sierra National Forest. The female moved her den site twice, apparently in response to the fire and/or activity of firefighting personnel. Sensors placed inside known den trees in the area found them to be well protected from temperature change and measured carbon monoxide levels far too low to cause mortality (Craig Thompson, pers. com. 2012).

The Conservation Biology Institute conducted a computer simulation study of the interactions between fuels management, forest fires, fisher habitat, and the fisher population in the southern Sierra Nevada (Spencer et al. 2008). Their study area included this analysis area. Treating only 2 percent of the treatable landscape every 5 years (or up to 10 percent of the treatable landscape over 20 years) had no substantial effect on fire or fishers at the landscape level, while treating 4 to 8 percent of the treatable landscape every 5 years (or up to 20-32 percent of the treatable landscape over 20 years) was effective in reducing fire and benefiting fishers.

- **Habitat Fragmentation or Loss of Connectivity.**

Habitat connectivity is a key to maintaining fisher within a landscape. Activities 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.

The level of road and trail density and associated noise disturbance may influence how fishers utilize available habitat. Dark (1997) for example studied fishers in a well-roaded study area (i.e. areas without roads did not exist) on the Shasta-Trinity National Forest. The results suggested that fishers were detected more frequently at sites where roads were closed by the use of gates or otherwise designed to discourage vehicular traffic. Fishers used habitats with a greater density of low-use roads, and favored landscapes with more contiguous, unfrequented forests and less human activity. Campbell (2004, In USFWS 2004) noted that sample units examined within the central and southern Sierra Nevada region occupied by fishers were negatively associated with road density.

Vehicular collisions resulting in fisher mortality have been reported in a number of studies. Heinemeyer (1993), for example, noted vehicular collision as a source of fisher mortality. Along a portion of Highway 41 in Sierra National Forest and Yosemite National Park, nine road-killed fishers were found from 2008-2012 (O'Brien et al. 2013). Instances of fisher mortality on the Hume Lake Ranger District have also occurred. Most were associated with long paved stretches of road where vehicles tended to maintain higher speeds (e.g. Highway 180 and Generals Hwy).

Mortality or a Reduction in Fitness from Toxins (e.g. rodenticide)

Rodenticides and other toxicants used at illegal marijuana grow sites may lead to fisher mortality or a loss of fitness (Gabriel et al. 2012). Thirty-three of 40 (83%) fishers tested from the southern Sierra Nevada population were found to have been exposed to an anticoagulant rodenticide. No specific information is available regarding the illegal use of toxicants in the analysis area but it is reasonable to assume they are present and a threat to many wildlife species, including fisher.

Management and Status

The U. S. Fish and Wildlife Service determined that the West Coast population of fisher is warranted for listing under the Endangered Species Act, but precluded due to heavy agency workloads (USFWS 2004), and included it on the list of "Candidate" species. In March 2013, the USFWS opened an information gathering period regarding the status of the fisher throughout the range of its West Coast distinct population segment (DPS).

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. This recommendation initiated a 12-month status review by the California Department of Fish and Game (CDFG) culminating in a determination by the Commission on June 23, 2010, that the listing was not warranted (CDFG 2010). The Forest Service has considered fishers to be a Sensitive Species in the Pacific Southwest Region since 1984 (Macfarlane 1994).

The 2004 Sierra Nevada Forest Plan Amendment requires the establishment of fisher den site buffers that consist of 700 acres of the highest quality habitat in a compact arrangement surrounding verified birthing and kit rearing dens. Fisher den site buffers have a limited operating period of March 1-June 30 for all new projects.

Within the Bull Run Project

Based on CWHR vegetation typing and the 2016 mapping update there was 12,531 acres of habitat within the Cedar fire perimeter prior to the fire (**Figure 13**). This estimate was derived using the CWHR 2.1 as modified for fisher in the southern Sierra, and other high reproductive habitats as denoted CBI, within and adjacent to project area. Post fire estimates for suitable habitat encompass approximately 7,021 acres (**Figure 14**). There are no den sites in the project analysis area as identified on the Sequoia National Forest fisher den site layer. However, fisher detections have been have been recorded around the Greenhorn Summit vicinity, and further to the north on both the west and east slopes of the Greenhorn Mountains.

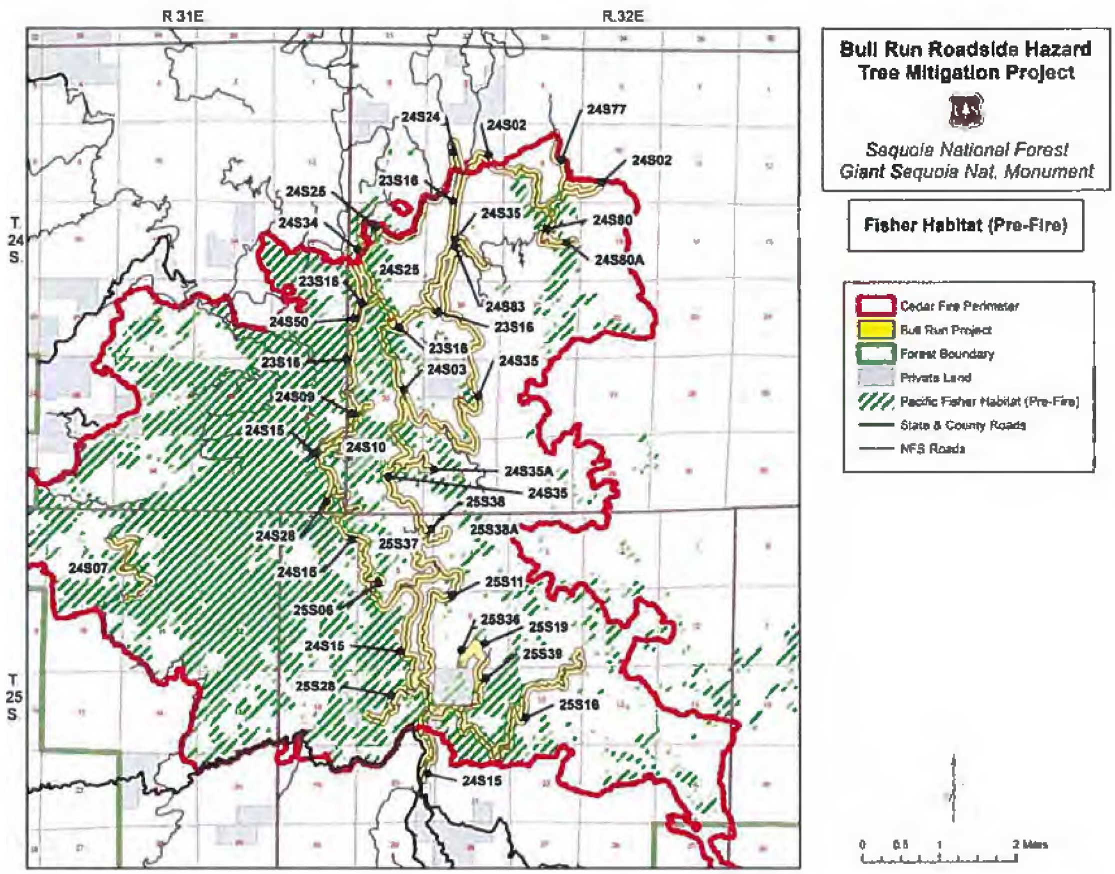

Figure 12. Fisher habitat, (pre fire), according to CWHR 2.1 and high reproductive habitat denoted by CBI within and adjacent to project area.

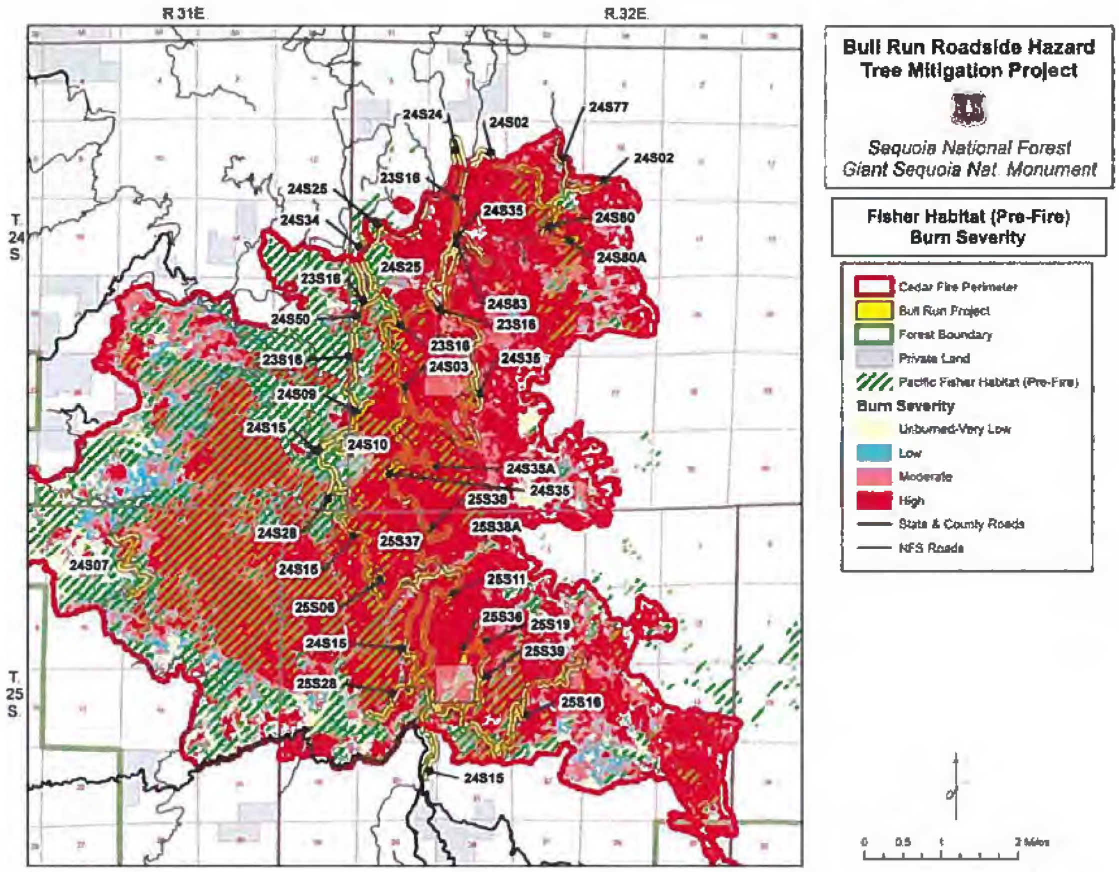

Figure 13. Fisher habitat pre fire overlaid with burn severity and Bull Run Project boundary.

VII. EFFECTS ANALYSIS

Northern Goshawk, California Spotted Owl, Townsend's Big-eared Bat, Pallid Bat, Fringed Myotis, and Fisher:

Determining Direct and Indirect Effects

The effects of implementing the Bull Run Project on species addressed were evaluated through several primary metrics as shown in Table 8 by species.

Table 8. Identified indicators of change for species address within the Bull Run Project.

Species Name	Indicator of Change
Northern Goshawk, California Spotted owl, Townsends big-eared bat, Pallid Bat and Fringed Myotis Bat, and fisher:	**Metric 1. Total suitable habitat available and acres treated[3].**
	Metric 2. Estimated change in important structural characteristics in suitable habitat types: • Change in dense canopy cover. • Change in the availability of snags (≥15" dbh). • Change in the availability of large woody debris.
	Metric 3. Disturbance effects
California Spotted owl[4]	**Metric 4. Acres treated in suitable CWHR Forest Types (4M, 4D, 5M, 5D), and change in relative percent of suitable habitat at various scales of analysis:** • California spotted owl PAC • 0.727 mile radius buffer • 1.5 mile radius buffer
CWHR Size Classes: **1** = < 1 " diameter at breast height (dbh); **2** = 1" - 6" dbh; **3** = 6" - 11" dbh **4** = 11" - 24" dbh; **5** = > 24" dbh; **6** = class 5 trees over a distinct layer of class 4 or 3 trees **CWHR Density Classes:** **S** = 10-24%; **P** = 25-39%; **M** = 40-59%; **D** = 60-100%; **X** = canopy unknown	

METRIC 1: Total suitable habitat (CWHR 4M, 4D, 5M, 5D), acres treated in the project analysis area, and change in relative CWHR score for suitable habitat types.

This metric evaluates existing suitable habitat (acres), proposed treatment acres, and post treatment acres available across the landscape.

METRIC 2: Change of desirable stand characteristics. Scientific research regarding the species addressed under this metric has identified various fine scale structural attributes important based on their use and occurrence in occupied habitats. This metric tracks the anticipated changes in these structural attributes given project implementation. Given that most CWHR forest size and density classes utilized by the suite of species addressed are very similar, for brevity purposes, the results and discussion will be in the same section.

METRIC 3: Acres Treated of CWHR Forest Types (4M, 4D, 5M, 5D), and change in relative percent of suitable habitat at various scales of analysis post treatment. Scales of analysis include: the PAC, 0.7 mile radius scale, and 1.5 mile radius scale. Several research studies suggest that loss or alterations of suitable habitat at various scales closest to existing California spotted owl Protected Activity Centers (PAC) may influence occupancy and reproduction. Analysis will evaluate the change in acres of available suitable habitat as a result of proposed actions by scale.

[3] See habitat descriptions in the species account section of the BE.
[4] No northern goshawk PACs or fisher den buffers occur in the Bull Run Project analysis area. .

Proposed Action

Implementation of the proposed action will remove hazard trees within the 3,245 acre project boundary wherever within striking distance of roads. After tree felling, the resulting limbs and tops would be chipped, or piled and burned. A portion of the downed trees would be left on site to ensure the dead and down woody material requirements for wildlife and soil quality are maintained. The remaining tree boles felled may be removed as fuelwood under the terms and conditions of firewood/fuelwood permits or as a commercial product. Standing dead trees that are within the 300 foot buffer but incapable of hitting the road prism would be left standing. Fire damaged or drought killed trees within the Cedar Fire perimeter that lie outside of the Bull Run Project will not be removed.

Direct and Indirect Effects: California Spotted Owl, Northern Goshawk, Bat species and Fisher (Metrics 1-3):

Loss of Important Habitat Elements (large trees, snags, canopy cover, down woody debris). The Bull Run Project would fell roadside hazard trees along 52 miles of Forest Service system roads to meet public safety requirements. As such, this project is limited in its scope and its distribution across the landscape, and is not anticipated to dramatically contribute to further declines in habitat quality beyond what has already occurred with the 2016 Cedar Fire.

Habitat quality was greatly reduced for the California spotted owl, goshawk, bat species and the fisher from its existing condition due to stand replacing fire effects. These impacts resulted in increased tree mortality, decreased canopy cover, loss of multi-storied stand conditions, decreased levels of large down woody debris, shrub and herbaceous cover, and increased habitat fragmentation. Based on an analysis of suitable habitat pre and post fire, there has been an estimated 56 to 57% decrease in its availability across the landscape depending on the species considered.

Current estimates of suitable habitat remaining by species are as follows: spotted owl 6,145 acres, northern goshawk 6,869 acres, bat species 6,231 acres, and fisher at 7,021 acres (**Table 3**). Habitat distribution and configuration may result in some shifts in travel patterns particularly for ground based species such as the fisher over the short term (7-10 years).

Felling of hazard trees near roadways would impact a relatively small linear strip of habitat (300 feet on each side of the road) throughout the Cedar Fire perimeter, leaving most remnant habitat untreated. **Table 9** displays existing values for habitat by species, acres proposed for hazard reduction, and acres of suitable habitat remaining untreated. It is estimated that treatments will impact between 9 – 11% of the suitable post fire habitat depending on the species, in meeting public health and safety needs. Treated roadways are not anticipated to be rendered unusable and will continue to provide for foraging and disbursal activities to occur.

Impacts to canopy cover along roads has already been impacted to some degree due to the initial road placement and ongoing maintenance activities. Treatment effects proposed in this action in relation to green canopy cover will be limited since only dead or dying trees meeting the hazard tree guidelines would be felled. All existing live trees would be left on site and continue to provide a source of overhead canopy where they exist, thereby retaining an important element for California spotted owl, goshawk, and fisher habitat.

One can assume, similar to Hanson (2013) that fisher may eventually move through the area as it recovers; however, it is unlikely that the high/moderate fire severity areas would be utilized for resting or denning because the canopy cover and brush/understory component is currently no longer present, which in-turn is not considered fisher habitat, as defined by CWHR classification.

Table 9. Existing post Fire habitat, Acres Treated, Percent of Available Habitat, and Acres of Suitable Habitat Remaining Untreated per Species.

Species	Post fire Habitat	Acres suitable habitat proposed for treatment	Percent of total habitat affected	Acres suitable habitat remaining untreated
Goshawk	6,869	674	10%	6,195
Spotted owl	5,928	626	11%	5,302
Bats	6,231	638	10%	5,593
Fisher	7,021	633	9%	6,388

Removal of felled hazard trees as fuelwood or as a commercial product may reduce the amount of standing snags and potentially down woody debris if excess levels are available to wildlife directly adjacent to the road. Loss of this element decreases habitat for prey such the northern flying squirrel and other small mammals and may decrease the availability for hunting perches used by the goshawk and spotted owl.

State-wide reconnaissance flights were conducted to assess tree mortality levels as a result of the severe multi-year drought ongoing prior to the Cedar Fire (2014-2016). These flights encompassed much of the Sierra Nevada and included Sequoia National Forest and the Bull Run Project Area. Reviews of the project area prior to the fire suggested relatively high snag values ranging from 5-40 snags per acre depending on location. Given these conditions and dry summer weather at the time of the fire, almost half of the acres which burned in the Cedar Fire, burned at high severity further increasing snag resources. Therefore, existing snag levels are not considered a limiting factor in this analysis for the species addressed. While it is anticipated that the availability of medium to large snags will decrease along treated roadway in comparison to the overall landscape condition, not all snags will be capable of reaching the roadway due to their location, height, or position on the slope. Therefore this component will continue to be represented even along treated roadways.

The fire resulted in areas with high reductions of large woody debris, as noted in Figure 5.This reduces habitat quality for species and their prey by decreasing hiding cover, and may result in shifts in prey species composition. While portions of the hazard trees felled would be removed, project design features have been included to retain large woody debris on the ground to benefit the species and their prey. Forest Standards include leaving 10-20 tons/acre in the largest size classes available. Higher levels large woody debris will be left adjacent to streams, and in overlap areas with PACs to meet wildlife and hydrology recommendations. The California spotted owl, northern goshawk and fisher, are capable forest hunters which prey upon a diversity of prey items having evolved in wildfire prone ecosystems. Actions to improve large woody debris distribution will improve complexity and structure at the forest floor and serve as hiding cover.

Fuels treatments associated with the Bull Run Project are not anticipated to impact the species addressed and will be conducted under prescribed conditions which give land managers flexibility to retain newly recruited large woody debris, while allowing treatment where needed to remove excessive fuel levels in some areas where felling operations occur.

In summary, the proposed action would maintain or improve large woody debris and snags by retaining large logs and snags outside the hazard tree perimeter, which are unable to reach the road. Outside the Bull Run hazard tree perimeter, all snags would be retained and continue to exceed levels of four snags per acre because of the severity of the fire that has occurred. Similar to owls, the high/moderate mortality areas would be used for foraging and low/very low mortality areas would be used for nesting and foraging.

Disturbance: The proposed project is anticipated to have limited disturbance related effects. The northern goshawk, the California spotted owl and the fisher are considered forest interior species. Habitat near roads was found by Gaines et al. (2003) to represent lower habitat quality due to disturbance related influences, habitat fragmentation, edge effects and collisions. Nest roost and den sites are less likely to occur near roads because of these factors. For example, Phillips et al. (2010) found that California spotted owls nested away from edge habitats. Therefore, hazard tree removal would occur in areas of less valuable habitat than if these structures were lost from the middle of a forested stand.

There is the potential effect that removal of hazard trees within the some areas could remove a den or rest tree for the fisher. It is not known whether the fisher will select or benefit by the presence of the large abundance of snags in the Cedar Fire as a result of the activities. However, the fact that the project area will have thousands of potential rest and den trees across the Cedar Fire area that is not being felled for human health and safety is of benefit to the species.

Dead or dying trees can provide resting and denning habitat for fisher. There will be greater than 200,000 conifer dominated snags, greater than 15 inches dbh retained in the project area after the treatments have been implemented. This amount consists of all snags retained in untreated areas, as well as an average of four snags per acre retained in treated areas according to the design criteria.

In addition, ongoing research is being conducted on the Sierra National Forest to understand how fisher utilize post fire landscapes by monitoring grids using scat detecting dogs. This work is being conducted within both the French and Aspen fires. Results to date show that fisher do not utilize high severity burn areas at least initially post fire, with some evidence of limited foraging occurring along the burn edge (Pers. Comm. K.Purcell 2017). The Bull Run Project focuses its efforts to encompass areas of highest burn severity where low canopy cover and structural attributes needed for resting and denning activity are no longer present.

Bat Species (Townsend's big-eared bat, pallid bat, fringed myotis bat)

Project implementation is anticipated to result in minimaldirect impacts to bat species from felling hazard trees, yarding trees, and transporting trees by roads. Approximately 733 acres would be treated with the Bull Run Project representing only 12% of the available habitat in the Cedar Fire perimeter. Bats utilize a wide variety of substrates for day roosts such as under bark of trees, hollows and cavities in snags, rock crevices, under bridges, historic buildings, caves and mines. The limited extent of hazard tree removal along roads would not dramatically decrease substrates used for these purposes across the landscape. Maternity colonies are know to occur in the project area, and it is most common for pallid and Townsend's bats to use mines, caves, or old buildings because climate is more favorable for these purposes, which would not be impacted by roadside hazard removal actions. The Forest also works to gate mines and caves to reduce disturbance when needed through placement of bat friendly gates.

Buchalski et al. 2013 monitored bat response from the McNally Fire (150,000 acres, 2002) located on Sequoia National Forest. In this study they found no substantial negative effects of fire on bat activity in mixed-conifer forests one year after, supporting the view that forest bat communities are resilient to fire and that fire may enhance foraging opportunities. Therefore, for this analysis, we considered all burned and unburned mature forests, trees and snags (>11 inches dbh, CWHR 4, 5 and 6 classification, M and D canopy closure which is >40%) as a potential sources of pallid bat and fringed myotis roosting habitat.

Buchalski et al (2013) also stated that "the wildfire-landscape mosaic did not affect bat activity in unburned stands of any of the six phonic groups noted. Some stands had up to 30% of the surrounding landscape within a 2 km radius burned with stand replacement fire. Despite this, activity was neither higher (due to immigration or species preferring unburned conditions) nor lower (due to emigration to favored habitat conditions elsewhere), suggesting that bat communities do not respond to forest landscape conditions in a manner similar to that documented for terrestrial birds following fire. Rather, bats are likely foraging and roosting across a much broader spatial scales, resulting in greater resilience to changes at this scale".

Several researchers speculate that bat response and activity associated with forest disturbances such as thinning or wildfire are attributed to increases in foraging habitat quality by reducing the amount of vegetation in the forest canopy and understory (commonly referred to as clutter) that can obstruct flyways effecting echolocation. Previous studies have shown that dense clutter appears to decrease foraging ability and success (Brigham et al. 1997, Erickson et al. 2003, Sleep et al. 2003 and Rainho et al 2010). In respect to wildfires or other fuels treatments involving fire, several studies suggest that this type of disturbance increases abundance of insect prey through post-fire growth of plant species that increase terrestrial insect activity (Lacki et al. 2009, Swengal 2001). It is believed these alterations likely benefit bat foraging

In summary, if these species are flushed during the project activities, we anticipate that the individuals would move from the vicinity of activity and shift to other suitable habitat in the nearby forest environment. Some incidental direct effects may occur to a few individuals, however, it is not anticipated there will be substantial adverse affects to the population as a whole.

Direct and Indirect Effects: California Spotted Owl scaled analysis metric 4

The Cedar Fire reduced the availability of suitable habitat within most spatial scales for several owl sites analyzed (**Table 10**). Large losses of suitable habitat at the roost or nest stand scale (i.e. PAC) and at the 0.727 mile radius core scale, have been associated as a contributing factor influencing occupancy and reproductive productivity over time. Site TUL0036 showed a fairly strong reduction in habitat at the PAC scale due to the fire but some additional research may suggest that owls can tolerate some level of high fire disturbance at the PAC and core scales.

Verner et al. (1992) for example examined a sample of nest trees from conifer forests in the Sierra Nevada (n=149) to define the mean area for nest stands in unburned mixed conifer forests. He determined that the average nest stand was about 100 acres (40 ha); while the mean size of the nest stand plus adjacent suitable stands was about 300 acres (USDA 2001). Lee et al (2013) documented a threshold-type relationship between extinction and colonization probabilities and the amount of forested habitat (conifer or hardwood tree cover types) that burned at high severity within a 203-ha (500 acre) core area around spotted owl nests and roost centroids. Sites where approximately 0–50 ha (0 -123 acres) of forested habitat within the core area that burned at high severity had extinction probabilities similar to unburned sites, but where more than approximately 50 ha of forested habitat burned severely, extinction probability increased approximately 0.003 for every additional hectare severely burned. The range of high severity burn acres between the PAC scale and 92 acre, increasing to an estimated 178 acres at 0.727 scale (Table 7). Extrapolating for a slightly larger core, this would result in a probability increase of 16.5%. At present however this PAC is occupied by the pair.

Approximately 63 acres of current PAC and 127 acres at the 0.727 mile radius scales would be treated to remove hazard trees that lie within strking distance of the road. Hazard tree removal will focus on felling health and safety trees that are already dead, or which have been identified with risk factors indicative of dying trees. As such, their removal is not anticipated to result in substantial losses of live foliage that contributes to overhead canopy, which is one of the strongest habitat factors selected for by the owl. Subsequent removal of dead trees may also lower snag resources, but again, adequate levels will remain away from the road buffer to provde for this needed resource. For these reasons although a limited amount of remnant habitat would be entered, the habitat is not anticpated to be rendered to such an unsuitable condition it cannot be utilized afterward as foraging or dispersal habitat in the future. The road corridor itself previously impacted the habitat and undergoes regular maintenance making it already a lower quality habitat (foraging and dispersal). Mitigations developed for this specific area will require that higher levels of large woody debris be retained (30-40 tons/acre) and left on site. In addition, approriate orders of operation will be implemented to eliminate distrubance effects during peak times of the reproductive cycle.

Data from the 2016 vegetation update showed that the TUL0117 spotted owl site had lower values than desired both at the PAC, 0.727 mile, and 1.5 mile radius scales prior to the fire due to drought mortality (**Table 10**). This owl site occurs at lower elevation containing oakwoodland types with scattered pine and chaparral where tree mortality was high. The Cedar fire worsened habitat conditions further lowering habitat quality. It is highly probable that this pair may have abandoned the site completely but further survey will be needed. Regardless, impacts from hazard removal work would present only negligble impacts to remaining habitat beyond what has already occurred due to the drought. At the PAC scale no treatment would occur with only up to 1 acre treated at the 0.727 mile radius scale. Given the already degraded condition prior to the fire, the continued loss of habitat with the fire, and limited treatment no further apprecitive effect is anticipated to occur.

Table 10. Estimated suitable habitat pre and post fire, suitable habitat acres treated and untreated, and relative percent of suitable habitat retained within each scale.

Owl ID	Scale	2016 Veg update for Suitable habitat pre-fire	Total Suitable habitat post-fire	Acres treated	Untreated suitable habitat	Relative Percent of suitable habitat retained within each scale
TUL0036	PAC	293	201	68	133	44%
	0.7 mile buffer	631	453	127	326	32%
	1.5 mile buffer	2272	1800	288	1512	33%
TUL0117	PAC	67	44	0	44	22%
	0.7 mile buffer	250	150	1	149	14%
	1.5 mile buffer	2314	1369	50	1319	29%
KRN0011	PAC	296	296	0	296	97%
	0.7 mile buffer	821	802	52	750	73%
	1.5 mile buffer	3034	2714	162	2552	56%
KRN0039	PAC	299	299	0	299	100%
	0.7 mile buffer	991	991	5	986	96%
	1.5 mile buffer	3519	3420	77	3343	74%

The remaining two owl sites, KRN0011 and KRN0039, are located to the south of the Cedar Fire. They were considered because the 0.7 mile radius from these owl activity centers overlapped with one segment of roadway proposed for treatment that extends just below the fire perimeter as previously discussed. It is not anticipated that hazard removal actions will have a negative impact on owl habitat at any spatial scale analyzed with these owl sites. None of the hazard removal actions would occur within spotted owl PACs, with only 52 acres and 5 acres, respectively treated at the 0.727 scales, and 162 acre and 77 acres respectively treated at the 1.5 mile scales. Despite these entries values for total suitable habitat at each of the scales are well within desired levels therefore it is expected to maintain habitat conditions suitable for continued owl occupancy and reproduction.

VIII. Cumulative Effects

Introduction - Cumulative Effects

The cumulative effects sections of this document places the proposed activities in context with past, present, and reasonably foreseeable actions which, when considered collectively, may affect habitat. The temporal scale for the analysis is five years into the future, the time frame that future actions can reasonably be predicted. The cumulative effects of past management activities are incorporated within the existing condition last updated in July of 2016. Past vegetation-changing actions or events (for example, fuels treatments and wildland fires) prior to this time period have already been captured by the Forest's GIS vegetation layer. To some degree the changes to the habitat from the Cedar Fire have also been considered in the analysis for the Bull Run Project given the best information available at this time.

For assessment of future projects, the Forest completes a quarterly "Schedule of Proposed Actions" (SOPA) which tracks proposals that are ongoing or have sufficient detail to insure they are reasonably foreseeable. The total list of actions presented on the SOPA is not included here. Some projects have been cancelled or are undergoing revision, with others not included because they have limited scope and intensity and present no appreciative impact on available habitat.

Defining Cumulative Effect Analysis Area – The cumulative effects analysis area varies by species and home range. The smallest extent considered was the Cedar Fire perimeter utilized for the northern goshawk and bat species at 29,025 acres, with larger extents utilized for the California spotted owl (34,170 acres) and the fisher (213,321) acres. Based on the Fisher Conservation Strategy, Core 2 was used as the cumulative effect area for this species (See Fisher Section below).

Northern Goshawk, Bat Species, and California Spotted Owl.
Table 11 and **Table 12** display the acres of existing suitable habitat present within each species cumulative effects analysis area, other foreseeable actions, the anticipated acres of suitable habitat they may treat, and is representative percent when applicable. Within the goshawk and bat cumulative effect analysis area, only one other roadside hazard tree removal project has been identified as a foreseeable action on Forest Service system lands, the *Spear Creek Roadside Mitigation Project* (hereafter, Spear Creek Project). This project is anticipated to enter up to 947 acres of suitable goshawk habitat and an estimated 744 acres of bat habitat. Both the Bull Run and Spear Creek projects are similar in that they address strictly roadside hazard trees with the same criteria for identification and removal. The Bull Run project is primarily located on the east side of the Greenhorn Mountains while the Spear Creek Project addresses the Cedar Fire's effect on the west slope of this mountain range. Collectively up to 23 % and 22% respectively of all available suitable habitats for these species in the fire perimeter could be entered. Once again not all areas identified will need to be treated, and not all trees identified as hazard will be capable of striking the roadbed and would be left on site. Therefore the values presented are worst case scenarios and actual treatment acres may be less. No past or foreseeable projects were identified for private land inholdings within the Forest boundary.

Table 11. Species specific cumulative effects (CE) analysis area in acres, and suitable habitat treated in past, present or foreseeable actions.

Species		Suitable habitat post-fire		Total post fire suitable habitat	Projects on Forest Service Lands		Projects On Private Land Inholding	Treated acres as Percent of all Suitable habitat
	Cumulative Effect Analysis Area	Forest Service Lands	Private lands		Bull Run Project	Spear Creek Hazard tree		
Goshawk	29,025 acres	6,869	165	7,034	674	947	0	23%
Bat Species		6,231	165	6,396	638	744	0	22%

When evaluating the spotted owl cumulative effects analysis area there were two other foreseeable actions noted. The Spear Creek Project previously discussed and the Summit Healthy Forest Project located just south of the Cedar Fire perimeter. With these entries an estimated 18% of the available habitat will be treated collectively.

Table 12. Spotted Owl Cumulative effects (CE) analysis area in acres, and suitable habitat treated in past, present or foreseeable actions.

Species		Suitable habitat post-fire		Total post fire suitable habitat	Projects on Forest Service Lands treating suitable habitat			Projects On Private land	Percent of total habitat treated
	Cumulative Effect Analysis Area	Forest Service Lands	Private lands		Bull Run Project	Spear Creek Roadside Mitigation Project	Summit Healthy Forest Project		
Spotted owl		9,077	165	9,702	638	639	481	0	18%

The effects of these actions would be similar to those previously discussed in the Bull Run Analysis. Focus is placed on the removal of dead trees with live trees remaining. Canopy cover provided by live trees would remain at existing levels. Large woody debris and near ground cover would be recruited where lacking in treatment areas and protected in conducting any fuel reduction work needed. Retention of woody debris standards from SNFPA (USDA 20014) will be incorporated as a project design feature and vary by resource needs such as wildlife, hydrology, etc. Some decrease in snag availability of mid to large conifers through the removal of hazard trees will occur along roadsides but snag levels will remain above the desired range of variability noted for southern Sierra forest types across the landscape as a whole. Limited additive influences on goshawk and bat habitat quality are anticipated given the dispersed nature of the projects which occur on opposite sides of the Greenhorn Mountains. This will also minimize the potential for disturbance related effects.

While **Table 12** looked at all suitable habitat available and the acres treated by proposed or foreseeable actions within the entire cumulative effects extent for the species, **Table 13** evaluates effects of these entries on each Owl ID at the various scales used in the Bull Run Analysis.

Table 13. Scaled analysis for four spotted owl activity centers within the spotted owl cumulative effects analysis area.

Owl ID	Scale Area of Analysis	Suitable habitat post-fire		Total post fire suitable habitat	Projects on Forest Service Lands treating suitable habitat			Projects On Private land	Total Relative Percent of suitable habitat retained within each scale
		Forest Service Lands	Pvt. Land		Bull Run Project	Spear Creek Project	Summit Healthy Forest project		
TUL0036	PAC	201	0	201	68	0	0	0	44%
	0.7 mile buffer	453	0	453	127	0	0	0	32%
	1.5 mile buffer	1800	0	1800	288	289	0	0	27%
TUL0117	PAC	44	0	44	0	5	0	0	13%
	0.7 mile buffer	150	0	150	1	16	0	0	13%
	1.5 mile buffer	1369	142	1511	50	111	0	0	30%
KRN0011	PAC	296	0	296	0	0	0	0	97%
	0.7 mile buffer	802	36	838	52	0	154	0	59%
	1.5 mile buffer	2714	323	3037	162	0	398	0	55%
KRN0039	PAC	299	0	299	0	0	0	0	100%
	0.7 mile buffer	991	192	1183	5	0	159	0	96%
	1.5 mile buffer	3420	377	3797	77	0	503	0	71%

Based on the analysis of past, present and foreseeable actions, KRN011 and KRN0039 would maintain enough habitat post treatment to meet the desirable levels identified for each of scales (PAC, 0.727 mile radius, and 1.5 mile radius). Available habitat for TUL00117 had declined well below the desired levels as a result of the multi-year drought (2014-2016) that was ongoing just prior to the fire. The Cedar Fire resulted in further incremental losses of habitat. The Bull Run and Spear Creek Projects proposes minimum treatment acres at the PAC or 0.727 mile radius scale along the roadway, which already represents foraging habitat. Post treatment it would remain in a foraging capability condition. The entries therefore are not considered a large additive factor that would influence habitat quality beyond what has already occurred. At the 1.5 mile radius buffer suitable habitat represents approximately 30% of the 1.5 mile radius scale falls within the lower bounding identified by Bart which within the range specified. Beyond the 0.727 mile radius scale, habitat often incorporates greater heterogeneity which would further decrease potential impacts from hazard removal.

Owl ID TUL0036 received impacts from the Cedar Fire lowering suitable habitat availability at every scale. The foreseeable Spear Creek Project does not propose to treat habitat within the PAC or 0.727 mile scale of TUL0036, and therefore would not represent an additive impact to the existing effects already discussed within the Bull Run analysis. The Spear Creek Project would treat an additional 289 acres at the 1.5 mile radius scale. While the analysis shows a decrease at that based on treated acres, its impact once again would be on foraging habitat along roadways having lower suitability. Provisions are being made in all treatment areas to retain all live trees and canopy, to promote large woody debris recruitment were lacking, and to retain snag in treatment areas if they cannot reach the target area. These provisions are anticipated to improve and conserve desirable habitat characteristics and structure. A modified limiting operating period will also be applied to decrease disturbance during peak time periods of the reproductive cycle near the PAC. Regardless of whether hazard trees are removed there is a potential that both the TUL00117 and TUL0036 owls may move from their territories within the next 5 years given the fire effects alone.

Fisher cumulative effects

The cumulative effects analysis area established for the fisher addressed past, current, and foreseeable actions that would occur in the Core 2 Area scale as defined by the Fisher Strategy (Spencer et al. 2016, version 1.0). Suitable habitat was calculated using the July 2016 vegetation mapping, with an updated estimate provided for the Cedar Fire area. Collectively within the Forest boundary, Core Area 2 encompasses an estimated 213,321 acres with 109,919 acres of suitable CWHR 2.1 habitat and 71,662 acres of high value reproductive habitat as defined by CBI. The table below describes the vegetation projects within Core Area 2. The pattern of small, relatively light thinning and fuels reduction projects proposed or approved on National Forest System lands cumulatively affect 4% or less of the available suitable fisher habitat at both the CWHR 2.1 and CBI high value reproductive habitat scales considered.

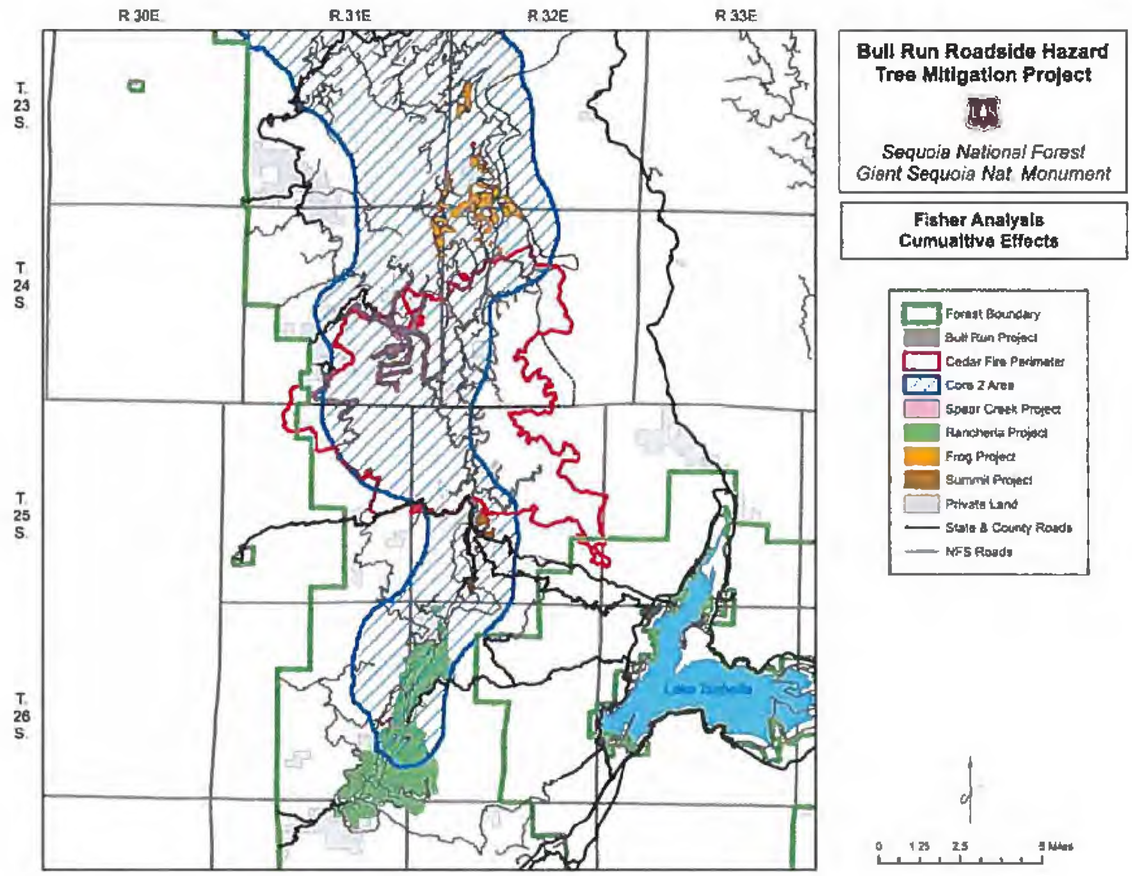

Figure 14. Cumulative Effects Area for the Bull Run Hazard Tree Project.

Table 14. Vegetation treatment projects proposed, pending or completed within the Core Area 2 cumulative effects analysis area by year and activity.

Project Activity	Project Name	Year	Total Project Area Acres	Estimated Acres of CWHR 2.1 habitat treated or proposed for treatment	Estimated Acres of CBI high value reproductive habitat treated or proposed for treatment	Impacts to near ground cover (shrubs, small trees and down woody debris)	Impact to Den and Rest structures	Impacts from Disturbance
Commercial thinning projects (removal of trees >12"dbh but ≤ 30"dbh), and accompanying fuels treatment (pre-commercial thin and Rx burn)	Revision1 to Frog Project	2013 - 2017	1,436	970	520	Woody debris retentions standards incorporated in project design.	Proposal would not remove trees over 30"dbh Some reductions expected in 12-29" dbh size class.	Limited operating period included to reduce disturbance influcnces to fisher during reproductive period.
	Rancheria Forest Restoration	2013	2955	2350	904	Woody debris retention standards from SNFPA were incorporated into project design.	Proposal would not remove trees over 30"dbh. Some reductions expected in 12-29" dbh size class.	Limited operating period included to reduce disturbance influences to fisher during reproductive period.
Hazard Tree Reduction Projects	Summit CE	2017	673	558	371	Some loss in woody debris and near ground cover. Woody debris retention standards incorporated from SNFPA.	Proposal would not remove trees over 30"dbh Some reductions expected in <29" dbh size classes.	Limited operating period included to reduce disturbance influences to fisher during reproductive period.
	Spear Creek	2017	1422	965	619	Some loss in woody debris and near ground cover. Retention of woody debris standards from SNFPA incorporated.	Decrease in snag availability of mid to large conifers through the removal of hazard trees. Limited influence on fisher habitat quality given project location falls along	When possible, a limited operating period will be applied to reduce disturbance influences to fisher during reproductive period.

Project Activity	Project Name	Year	Total Project Area Acres	Estimated Acres of CWHR 2.1 habitat treated or proposed for treatment	Estimated Acres of CBI high value reproductive habitat treated or proposed for treatment	Impacts to near ground cover (shrubs, small trees and down woody debris)	Impact to Den and Rest structures	Impacts from Disturbance
	Bull Run Creek Hazard Tree Abatement Project*	2017	2606	488	333	Some loss in woody debris and near ground cover. Retention of woody debris standards from SNFPA incorporated.	Decrease in snag availability of mid to large conifers through the removal of hazard trees. Limited influence on fisher habitat quality given project location falls along roadside areas.	When possible, a limited operating period will be applied to reduce disturbance influences to fisher during reproductive period.

*Treated acres are different in this table then the rest of the analysis because it only includes roads that overlap with Core 2.

Climate Change

Climate changes will likely cause changes in the distribution of species in the project area. Modeling efforts have projected that forest types and other vegetation dominated by woody plants in California would migrate to higher elevations as warmer temperatures make those areas suitable for colonization and survival. For example, with higher temperatures and a longer growing season, the area occupied by subalpine and alpine vegetation was predicted to decrease as evergreen conifer forests and shrublands migrate to higher altitudes. The precise effects of climate change on individual species are difficult to predict and will not be addressed in the effects analysis.

Rodenticides

Anticoagulant rodenticides and other toxicants used at illegal marijuana grow sites may threaten fisher and "pose equally grave risks" to Pacific marten, California spotted owls, and great gray owls (Gabriel et al. 2012). No specific information is available regarding the illegal use of toxicants in the analysis area but it is reasonable to assume they are present and a threat to many wildlife species. However, we currently lack the information to quantify the threat for this analysis.

Current Activities

Grazing: The analysis area is within the five grazing allotments (Dunlap, cedar Creek, Sandy Creek and Split Mountain). Because grazing is a past, ongoing, and foreseeable future action and because use levels and associated impacts from this activity are not expected to change as a result of implementation of the proposed action, cattle grazing activity is not expected to contribute measurable impacts to habitat quality. Grazing permits for these allotments include specific measures designed to protect key habitat elements.

Recreation and Roads: The analysis area is used regularly by campers, hunters and OHV users. There are approximately 72 miles of Forest Service roads in the cumulative effects analysis area. The miles of road were calculated for miles of road that overlap with the Cedar Fire and Core 2 boundary. These are past, ongoing, and foreseeable future action but use levels and associated impacts from this activity are not expected to change as a result of implementation of the proposed action, recreation is not expected to contribute measurable impacts to habitat quality.

IX. Determinations

REGION 5 FOREST SERVICE SENSITIVE SPECIES

Northern goshawks, California Spotted Owls, Townsend's big-eared Bats, Pallid Bats, Fringed myotis, and Fisher:

Proposed Action

It is my determination that the proposed action of the Bull Run Project **may affect individuals,** but is not likely to result in a trend toward Federal listing or loss of viability of the northern goshawk, California spotted owl, Townsend's big-eared bat, pallid bat, fringed myotis bat, and fisher. The cumulative effects would lead to a short term loss of large trees and snags within the project boundary; however, there is a large portion of the Cedar Fire that will not be treated and snags will be available within those areas. Down woody debris would be retained to the Forest standard of 10 to 20 tons/acre which would be a benefical improvement to current conditions. Existing live tree with canopy cover would not be felled and retain canopy cover where it occurs.

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Appendix A. Forest Service Sensitive Animal Species in Sequoia National Forest (List Updated 6/30/2013)

Species	Status	Habitat	Effects Determination	Rationale
Birds				
Northern goshawk *(Accipiter gentilis)*	FSS, CSSC	Dense mixed conifer forest to open eastside pine	**may affect individuals,** but is not likely to result in a trend toward Federal listing or loss of viability	See analysis and effects determination above.
Western yellow billed cuckoo *(Coccyzus americanus occidentalis)*	FSS, FC, SE	Dense riparian forest. On SQF, only known from Lake Isabella.	No effect	Project area outside known range and lacks suitable habitat.
Little Willow flycatcher *(Empidonax traillii brewsterii)*	FSS,SE	Large meadow complexes with dense willow and standing water, up to 8,000'	No effect	No detections or suitable habitat impacted by the proposed project.
Bald Eagle *(Haliaeetus leucocephalus)*	FSS, SP, SE	Lakes and open water. Nests on large trees.	No effect	Species and habitat not impacted by the proposed action. No potential roost trees near lakes or rivers would be removed.
Great gray owl *(Strix nebulosa)*	FSS, SE	Large meadows & openings 2,500 – 9,000'. Dense forest and large snags for nesting.	No effect	Species and habitat not impacted by the proposed action.
California spotted owl *(Strix occidentalis occidentalis)*	FSS, CSSC	Dense forest (>40% canopy closure), preference for stands with ≥2 layers, but open enough to allow for observation and flying space to attack prey. Substantial amounts of dead woody debris are desirable.	**may affect individuals,** but is not likely to result in a trend toward Federal listing or loss of viability	See analysis and effects determination above.
Mammals				
Pallid bat *(Antrozous pallidus)*	FSS, CSSC	Open habitats, rocky crevices, tree cavities, mines,	**may affect individuals,** but is not likely to	See analysis and effects determination above.

Appendix A. Forest Service Sensitive Animal Species in Sequoia National Forest (List Updated 6/30/2013)				
Species	**Status**	**Habitat**	**Effects Determination**	**Rationale**
		caves, or buildings for maternity roosts. Deep crevices are important for day roosts.	result in a trend toward Federal listing or loss of viability	
Townsend's big eared bat *(Corynorhinus townsendii townsendii)*	FSS, CSSC	Nocturnal, roosts in caves, uses wide variety of habitats although usually mesic areas for foraging.	No effect	May forage near the project area. No maternity roosts documented in the project area. Species and habitat not impacted by the proposed action.
Fringed myotis *(Myotis thysanodes)*	FSS	Optimal habitats are pinyon-juniper, valley foothill hardwood, and hardwood-conifer habitats, but it is found in a wide variety of habitats. Roosts in caves, mines, buildings, crevices in rocks, and snags.	**may affect individuals,** but is not likely to result in a trend toward Federal listing or loss of viability	See analysis and effects determination above.
California wolverine *(Gulo gulo luteus)*	FSS, ST, SP	Remote habitats, sensitive to human presence. 4000' to 13,000' mixed habitats	No effect	No detections noted on the Forest through district surveys or Regional Long Term Forest Carnivore Monitoring conducted as part of the SNFPA. Unlikely to be found near project area due to human access and substantial habitat change resulting from the Cedar Fire.
Pacific marten *(Martes caurina)*	FSS, CSSC	Dense forest (>30% canopy cover), high number of large snags and down logs, close proximity to dense riparian corridors for movement, and an interspersion of small (<1 acre) openings with good ground cover for foraging. Potential	No effect	There are no detections in the area; however, overall it is not marten habitat; therefore, it was dropped from further analysis. (Tucker pers comm 2017).

Appendix A. Forest Service Sensitive Animal Species in Sequoia National Forest (List Updated 6/30/2013)				
Species	**Status**	**Habitat**	**Effects Determination**	**Rationale**
		occupied elevation 4,000-13,000 ft.		
Fisher *(Martes pennanti)*	FSS, FC	Dense forest (>40% canopy cover). High number of large snags and down logs, close proximity to dense riparian corridors for movement, and an interspersion of small (<1 acre) openings with good ground cover for foraging. Potential occupied elevation 3,500-8,000 ft.	**May affect individuals**, but are not likely to contribute to the need for federal listing or result in a loss of viability.	See analysis and effects determination above.
Amphibians				
Yellow blotched salamander *(Ensatina escholtzii croceator)*	FSS, CSSC	Valley foothill/hardwood habitats and conifer, moist habitats and down logs in tributaries of the lower Kern River.	No effect	Project area is outside of known range for this species.
Relictual slender salamander *(Batrachoceps relictus)*	FSS, CSSC	Down logs and moist areas, generally in mixed conifer zone.	No effect	Project area is outside of known range for this species.
Kern Canyon slender salamander *(Batrachoceps simatus)*	FSS, ST	Down logs and moist areas, below 3,500' Limited to Kern Canyon	No effect	Project area is outside of known range for this species.
Fairview slender salamander *(Batrachoceps bramei)*	FSS, CSSC	Down logs and moist areas, ~7,000-8,000'. Limited to Kern Plateau	No effect	Project area is outside of known range for this species.
Foothill yellow-legged frog	FSS, CSSC	Low gradient streams and ponds	No effect	Historically present in the Hume Lake District but no known

Appendix A. Forest Service Sensitive Animal Species in Sequoia National Forest (List Updated 6/30/2013)				
Species	**Status**	**Habitat**	**Effects Determination**	**Rationale**
(Rana boylii)		generally below 6,000'		extant populations near the project area.
Reptiles				
Western (Pacific) pond turtle *(Actinemys marmorata)*	FSS, CSSC	Low gradient ponds and streams with basking sites below 5,000 feet. Can be found up to 1 mile from perennial water.	No effect	Species and habitat not impacted by the proposed action. Project area is above the elevation range of this species.
California legless lizard *(Anniella pulchra)*	FSS, CSSC	Loose, moist soil in chaparral and valley foothill woodland. Generally below 6,000'.	No effect	Project area is outside of known range for this species.
Fish				
Kern brook lamprey *(Lampetra hubbsi)*	FSS, CSSC	Silty backwaters of rivers emerging from the Sierra foothills, including the Kings River. Elevations below 1000'	No effect	Project area is outside of known range for this species.
Hardhead *(Mylopharodon conocephalus)*	FSS, CSSC	Warm water rivers at low elevation	No effect	Project area is outside of known range for this species.
California golden trout *(Oncorhynchus mykiss aquabonita)*	FSS, CSSC	Cold water tributaries of the South Fork of the Kern River above Rockhouse Basin.	No effect	Project area is outside of known range for this species.
Kern River rainbow trout *(Oncorhynchus mykiss gilberti)*	FSS, CSSC	Extant populations in the Kern River above Durrwood Creek, in Rattlesnake and Osa Creeks, and possibly upper Peppermint Creek.	No effect	Project area is outside of known range for this species.
Invertebrates				
Tehachapi fritillary butterfly *(Speyeria egleis tehachapina)*	FSS	Currently limited to the Piute Mountains; utilizes violets as host plants.	No effect	Project area is outside of known range for this species.

Appendix A. Forest Service Sensitive Animal Species in Sequoia National Forest (List Updated 6/30/2013)

Species	Status	Habitat	Effects Determination	Rationale
Listing Status Key: FE= Federally Endangered FT= Fed. Threatened FC= Federal Candidate		FSS= USFS Sensitive Species CSSC=CA Species of Special Concern		SP= State Fully Protected SE= State Endangered ST = State Threatened