August 17, 2020

Forest Supervisor Jason Kuiken
Stanislaus National Forest
Attn: SERAL
19777 Greenley Road
Sonora, CA 95370

Submitted electronically via comment portal:
https://cara.ecosystem-management.org/Public/commentInput?Project=56500

Re: Comments on the Scoping Notice for the Social and Ecological Resilience Across the Landscape (SERAL) project

Dear Forest Supervisor Kuiken,

These scoping comments are in response to the Scoping Notice the proposed Social and Ecological Resilience Across the Landscape (SERAL) project on the Stanislaus National Forest. We very much appreciate that your staff posted the GIS data for this project on your website. This allowed us to complete a more thorough review and to provide more detailed comments about our concerns.

I. Overview of SERAL Project

The SERAL project proposes activities over a 116,000-acre project area and includes 38,000 acres of thinning with additional area affected by land disturbing actions throughout the project area. The project is of a size never before contemplated by the Stanislaus National Forest for non-salvage timber harvest. The project also proposes a forest plan amendment that would change in substantial ways how conifer stands and habitat for California spotted owl (CSO) are managed. This proposal is controversial at a high level for two reasons. First, it contemplates permitting logging in a single decision over a very large area. Second, it proposes a substantial forest plan amendment to alter how logging could be conducted in conifer stands that would permit the degradation of important habitat for California spotted owl, a species at risk throughout the bioregion.

Our organizations continue to dedicate resources to working with state and federal agencies to increase the pace and scale of work to achieve forest resilience. There are several aspects of the

proposal that we think have merit. These include the increased use of prescribed fire and creating a network of strategic locations from which to manage beneficial fire and undertake suppression when needed. As noted in our comments below, we do not support these actions without reservation and have specific comments noted below that are aimed at increasing conservation benefit from these actions.

We are deeply concerned and opposed to the forest plan amendment related to California spotted owl. Fundamentally, we expect that conservation for this at-risk species will be the same among national forest on the westside of the Sierra Nevada. The proposed amendment in the SERAL project is proceeding before the CSO strategy developed by the Forest Service (USDA Forest 2019) has been integrated into the revised forest plans for the Sierra and Sequoia National Forests. For reasons described in greater detail below, we ask that the proposed plan amendment be set aside until the final plans on the Sierra and Sequoia National Forests have been adopted. Instead, a project in the SERAL area could be developed following the existing forest plan which was designed to reduce fire risk from extreme events and increase forest resiliency. This would be much less controversial, require less coordination, and likely take less time to complete.

We are also very concerned about the use of "condition-based" management to permit logging over very large areas. This approach fails to identify the site-specific locations where logging would occur and typically does not disclose the site-specific impacts of the logging. There are some actions that may fit a "condition-based" approach for a large landscape. For instance, we are cautiously optimistic that the EIS can appropriately disclose the impacts of undertaking prescribed fire across the project area using a "condition-based" management approach. This is an aspect of the project that we will continue to track to ensure that an activity that we support – use of prescribed fire – is properly evaluated under the National Environmental Quality Act (NEPA). We, however, do not support a condition-based approach for logging (green tree and salvage), as described below.

Finally, we note in our comments below concerns about Wild and Scenic Rivers and other old forest associated species. We ask that the issues we raise be addressed in the refinement of the proposed action and the environmental analysis.

II. Scoping Package Issues of Most Concern

A. California Spotted Owl - Project Specific Forest Plan Amendment

The SERAL project proposes to amend direction in the current Stanislaus Land and Resource Management Plan for the SERAL project area to "incorporate" the strategy for CSO issued by the Forest Service in 2019 (USDA Forest Service 2019). The wording of the amendment is provided in the scoping package Appendix B. The project specific plan amendment also relates to scoping package Appendix A since that appendix includes estimates for the natural range of variation (NRV) and the CSO strategy promotes managing towards NRV. Below we first discuss Appendix A as the foundation for the project specific plan amendment and then Appendix B to address the CSO specific issues.

1. Conservation of CSO Throughout the Bioregion

The CSO strategy was developed to inform forest planning on national forests in the range of CSO in the Sierra Nevada. The Sierra and Sequoia National Forests are the first plans to attempt to incorporate the CSO strategy in their plan revision process. The revised plans are not yet settled or adopted and the process of their revision is still in development, including the development of plan components to conserve CSO. The plan revision process for these plans incudes an objection process which could result in additional substantive changes to the final forest plans and the plan components related to CSO.

We expect that the amended and revised forest plans throughout the bioregion to all have the same plan components to address CSO conservation. The importance of consistent management of this species throughout the bioregion was recognized in the development of the first forest plans, i.e., the "Rainbow Book" and the Spotted Owl Habitat Area (SOHA) strategy (USDA Forest Service 1984), and then in subsequent amendments to make changes related to managing for CSO in the bioregion (USDA Forest Service 1992, USDA Forest Service 2001, USDA Forest Service 2004). We note that guidance for conservation of northern spotted owl and Mexican spotted owl is uniform across their respective bioregions. In contrast, the forest plan amendment being proposed in the SERAL project is occurring prior to completing the forest plan revisions on the Sierra and Sequoia National Forests.

We ask that the plan amendment being proposed in the SERAL project be set aside until the forest planning process has been completed on the Sierra and Sequoia National Forests and the final plans adopted.

2. Appendix A Inappropriately Applies Science Information in Describing NRV

Appendix A contains three tables. Table A.1 defines the natural range of variation (NRV) for two "forest types." Tables A.2 and A.3 use this information in combination with a vegetation map (Map 2) and a map of areas to be thinned (Map 4) to provide "restoration estimates" for "yellow pine/dry mixed conifer" and "fir/moist mixed conifer." Tables A.2 and A.3 convey the belief that management should convert a certain acreage of a specific seral stage to another seral stage. For instance, Table A.2 claims that 9,000 acres of CWHR 5M/5D (high quality nesting and roosting habitat for CSO) should be converted to CWHR 5S/5P (habitat that is not suitable for nesting or foraging). As we will discuss below, the Forest Service misinterpreted data from Stafford and Stevens (2017) and LANDFIRE to develop Table A.1 and Map 2. These errors lead to incorrect "restoration estimates" and, in turn, overestimate the amount of CWHR 5M/5D targeted for conversion to CWHR 5/5P in Tables A.2 and A.3.

The scoping package (p. 4) states:

> Similar to the FRI, the current landscape-scale forest structure was evaluated within the SERAL project area in order to determine departure from NRV. The approximate proportions of different seral stages existing within the Yellow Pine/Dry Mixed Conifer and Fir/Moist Mixed Conifer forest types were assessed, and compared to NRV

> reference conditions as described in GTR-256: Natural range of variation for yellow pine and mixed-conifer forests in the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests, California and GTR-263:Natural range of variation of red fir and subalpine forests in the Sierra Nevada bioregion (Safford and Stevens, 2017; Meyer and North, 2019) [Appendix A, see NRV range, Table A.1].

Utilizing values of NRV for seral stage from Safford and Stevens (2017), Table A.1 provides a conversion or crosswalk of the seral stages from Safford and Stevens (2017) to California Wildlife Habitat Relationship (CWHR) types. The crosswalk applied is incorrect in several ways. This approach fails to recognize that the vegetation definitions from Safford and Stevens (2017) are wholly different than those for CWHR. As described in Safford and Stevens (2017, p. 90):

> The LANDFIRE BpS models predict that, under the presettlement fire regime, 15 to 20 percent of the average YPMC landscape would have been in early seral stages (herbs, shrubs, seedlings/saplings) and young forest, about 35 percent in areas dominated by trees between 12.5 and 53 cm d.b.h. (5 to 21 in), and 45 to 50 percent in areas dominated by trees >53 cm d.b.h. (fig. 13). Furthermore, the BpS models predict that most of the landscape was under open forests of less than 50 percent canopy cover ("open" stages), especially in the yellow pine and dry mixed-conifer types (fig. 13). Dense, older stands ("late closed") are predicted to have occupied around 5 percent of the landscape in the yellow pine and dry mixed-conifer types, but around 20 percent of the moist mixed-conifer type.

The following table displays the criteria used in Safford and Stevens (2017).

Table 1. size and canopy classification used in Safford and Stevens (2017) and LANDFIRE.

Seral Stage	**DBH**	**Canopy cover**
Early (herbs, shrubs, seedlings/saplings)	<5"	
Young forest - open	5" to 21"	<50%
Young forest - closed	5" to 21"	>50%
Mature forest - open	>21"	<50%
Mature forest - closed	>21"	>50%

The criteria used in Safford and Stevens (2017) which is derived from LANDFIRE is quite different from the CWHR system. The crosswalk that the agency uses obscures important wildlife characteristics. The NRV conditions defined in the draft forest plan for the Sierra National Forest consider both Safford and Stevens (2017) and the CHWR classification in Table 2, below.

Table 2. Desired conditions based on NRV. Taken from the draft forest plan for the Sierra National Forest (USDA Forest Service 2018).

Table 1. Percent of seral stage patches (larger than 10 acres) by vegetation type at the landscape scale (tens of thousands of acres)

Vegetation Type/Zone	Early Seral[1]	Small Tree[2]	Open Mature Forest[3]	Intermediate Mature Forest[4]	Dense Mature Forest[5]
Black Oak/ Ponderosa pine	5–20%	1–10%	20–40%	40–60%	0–20%
Ponderosa Pine	5–20%	1–10%	60–90%	10–20%	0-10%
Dry Mixed Conifer	10–20%	1–10%	60–90%	20–40%	0–20%
Moist Mixed Conifer	10–20%	2–15%	10–40%	30–60%	30–60%

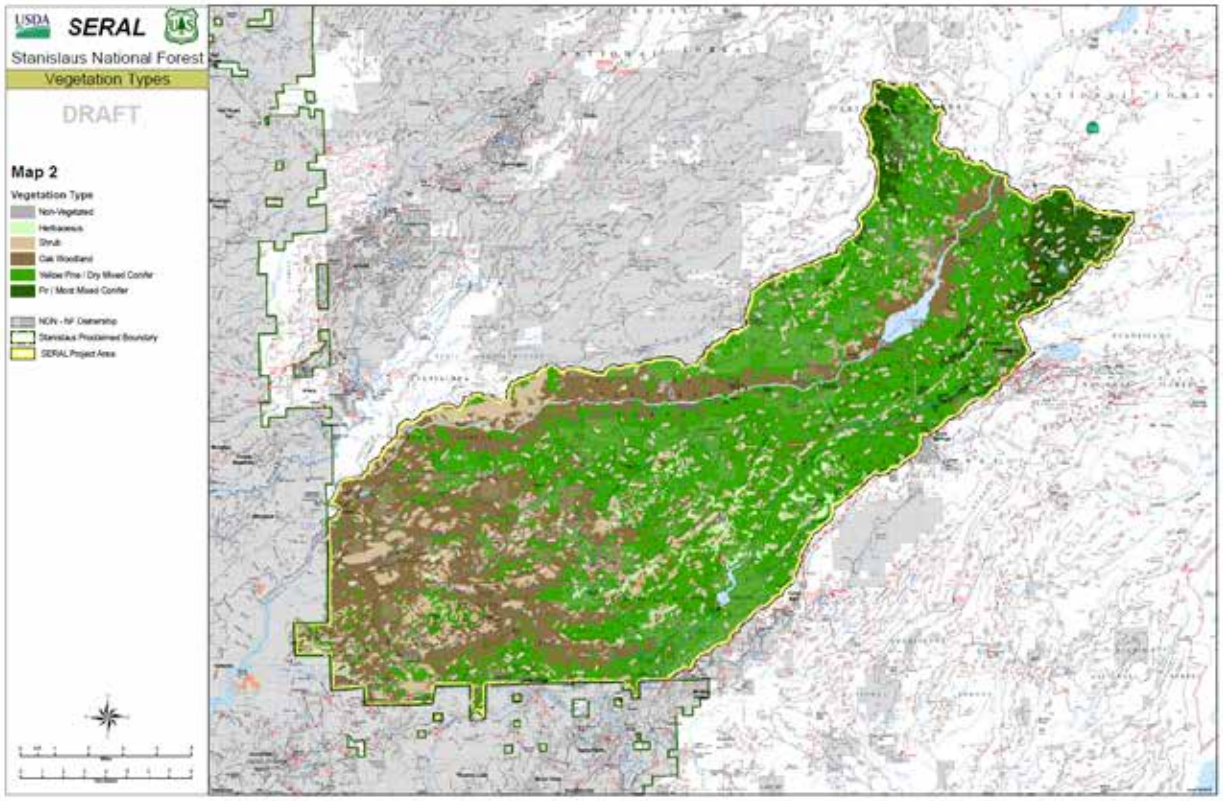
1. Shrub, grass/herb, tree seedlings and saplings.
2. California wildlife habitat relationship system (CWHR)[3] tree size classes 2 & 3.
3. CWHR 4 & 5; 10 to 40% tree cover.
4. CWHR 4 & 5; 40 to 60% tree cover.
5. CWHR 4, 5, & 6, more than 60% tree cover.

This is a more appropriate interpretation and crosswalk of seral stage from the NRV literature and CWHR because it takes into account both the variety of conditions associated with wildlife habitat in the CWHR system and incorporates a range of conditions on the landscape. We find it is still deficient though since it fails to convey the need to increase tree size and increase the proportion of habitat types with large tree structures, i.e., CWHR 5. Proper incorporation of the CWHR system is especially key to this forest plan amendment, since it is focused on addressing the habitat needs of California spotted owl and more appropriately categorizes spotted owl habitat based on the science literature regarding habitat quality, use, and demography (see research summary in Appendix A of these comments). CWHR habitat types would also need to be properly incorporated into the SERAL forest plan amendment since the data that is used to assess conditions and determine habitat quality is based on CWHR.

3. Estimation of Restoration Need is Based On An Incorrect Characterization of Forest Types Across the Project Area

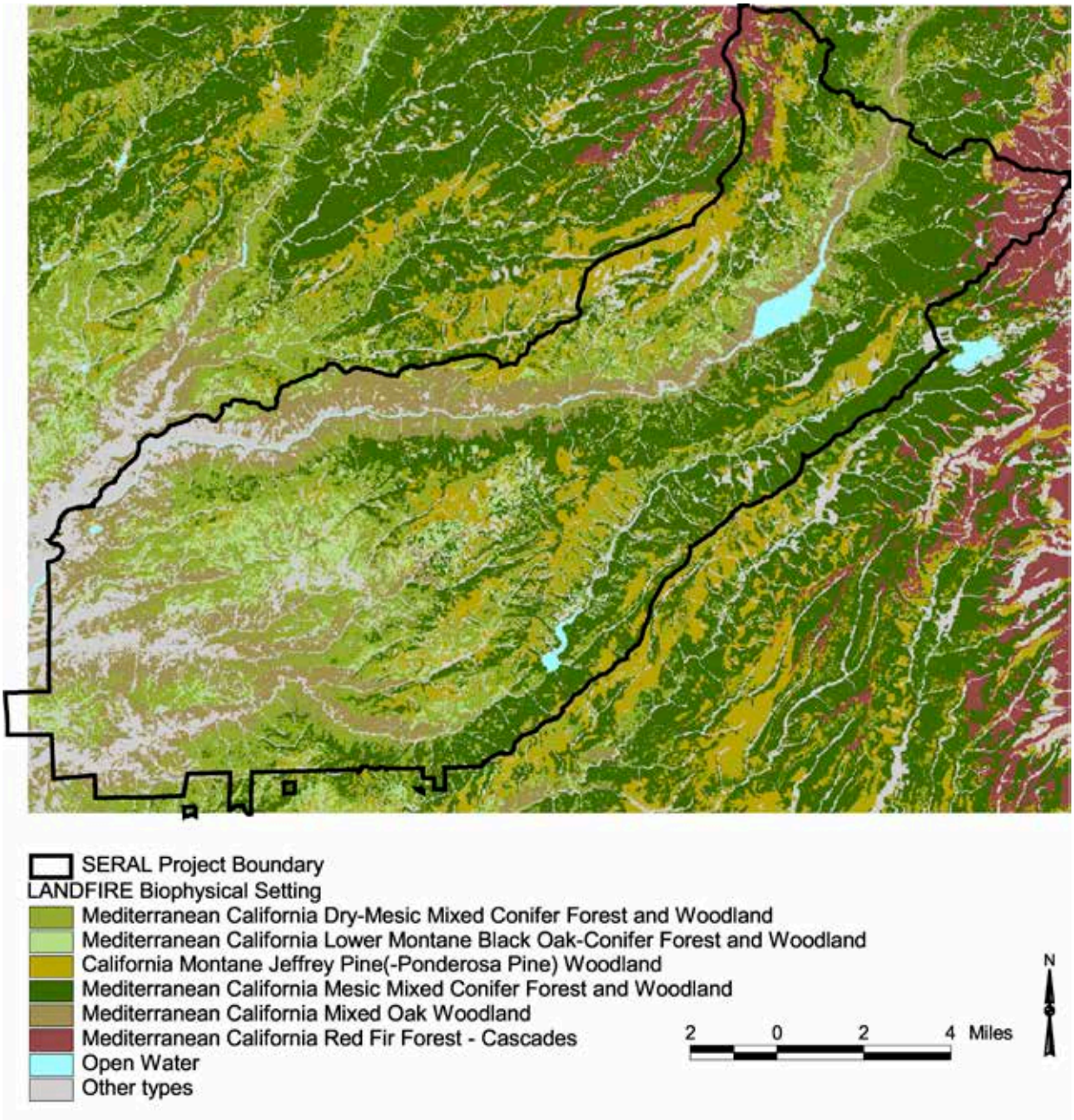
The scoping package includes a map of forest types (Figure 1, below). According to this map, the project area is dominated, especially in the eastern half, by what is depicted as “yellow pine/dry mixed conifer” forest type. There is no discussion of the methods or criteria for deriving this map. Furthermore, the map is inconsistent with Safford and Stevens (2017) from which the NRV values were derived.

Figure 1. Map 2 of “vegetation types” from SERAL scoping package.



Safford and Stevens (2017) base their NRV estimates on LANDFIRE and determined that “BpS models 610270 (Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland), 610280 (Mediterranean California Mesic Mixed Conifer Forest and Woodland), and 610310 (California Montane Jeffrey Pine–Ponderosa Pine Woodland) best represented dry mixed conifer, moist mixed conifer, and yellow pine, respectively (see http://www.landfire.gov for BpS descriptions)” (Safford and Stevens 2017, p. 89). LANDFIRE provides mapped data of these forest types. Figure 2, below, depicts these and other types that are present in the project area.

Figure 2. Existing vegetation type from LANDFIRE.



The LANDFIRE data (Figure 2) clearly shows that the eastern half of the project area is dominated by "Mediterranean California Mesic Mixed Conifer Forest and Woodland" with lesser amounts of the other two types considered by Safford and Stevens. The vegetation map in the scoping package inappropriately depicts the majority of the project area as "yellow pine/dry mixed conifer." This leads to incorrect "restoration estimates" in Tables A.2 and A.3 (Appendix A of scoping package) and over estimates the amount of CWHR 5M/5D (large tree, moderate to dense canopy) that the agency states should be converted to CWHR 5S/5P (large tree, sparse to poor canopy).

We examined the LANDFIRE types used by Safford and Stevens to evaluate the CWHR size and density for these the types in the project area. Across the project area (about 116,000 acres) these three types occupy about 68,000 acres. Table 3 summarizes the total amounts and the CWHR types.

Table 3. Area (acres) in the project of the three LANDFIRE biophysical settings used by Safford and Stevens (2017) to characterize yellow pine-mixed conifer. Proportion of project area in large tree habitat types (CWHR 5).

LANDFIRE Biophysical Setting	**Safford and Stevens (2017)**	**Area (acres)**	**Large tree-closed (CWHR 5M/5D)**	**Large-tree all (CWHR 5X/5P/5S/5M /5D)**
California Montane Jeffrey Pine-Ponderosa Pine Woodland	Yellow pine	12,077	18%	18%
Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	Dry mixed conifer	23,989	11%	11%
Mediterranean California Mesic Mixed Conifer Forest and Woodland	Mesic mixed conifer	32,314	33%	34%

The total large tree component of the three types in the project area is well below the estimated amounts for historical forests (see Safford and Stevens (2017) p. 91: "...Franklin and Fites-Kaufman's (1996) estimate of around 55 percent of assessment area conifer forests in "old-growth" status before Euro-American arrival....."). The CSO strategy (USDA Forest Service 2019) also identifies the development and conservation of forest with large structures and intermediate to closed canopies as critical to sustaining this species.

This seral stage evaluation results in a very different conclusion about "restoration estimates" for the project area. Because the area of vegetation types with large trees (CWHR 5) are lower than desired, the focus in these areas should be to improve resilience to extreme wildfire and not convert these areas to open (< 40 canopy cover) stands. Management to achieve more open, large treed stands (CWHR 5S/5P) should focus on reducing density and promoting the growth of smaller sized stands (CWHR 4M/4D) in areas where this habitat type is not required to support species associated with mature forests. Management to enhance growth of the smallest trees (CWHR 2 and 3) that appear from our review to exceed the desired ranges for seral stage in all three vegetation types is another area to focus management to increase the amount of open, large treed stands over time.

We ask that you revise Map 2 included with the scoping package to utilize the mapped data from LANDFIRE for the three biophysical settings that were the basis for Safford and Stevens (2017). We also ask that this revised map be used in conjunction with the NRV values presented

in the draft forest plan for the Sierra National Forest and the stated desired condition in the CSO strategy to increase habitat types with large tree structures to develop restoration estimates.

4. The Scoping Package Fails to Establish the Need to Change the Forest Plan

A forest assessment is used to establish the need for change in the amendment or revision process. The section in the scoping package on this topic (p. 17) merely states the belief that a change in the forest plan is needed, but provides no specific analysis to support the changes that are proposed. The scoping package simply refers to the CSO strategy as establishing the need to change, but the CSO strategy itself provides no such analysis of the need to revise existing direction. As far as we know, an analysis that the existing direction in the forest plans cannot accomplish the stated goals of creating a more resilient landscape and support conservation of California spotted owl has not been completed for this landscape.

An analysis of the need to change the forest plan must be completed to inform the project specific forest plan amendment. This analysis also forms, in part, the basis of the environmental analysis required to evaluate the proposed changes.

5. Best Available Science Information Has Not Been Provided for the Project-Specific Forest Plan Amendment

Forest plan amendments must be based on the best available science information. (BASI; 36 CFR 219.3) As noted in our comments above about NRV values and restoration estimates presented in Appendix A, the information about the project-specific plan amendment is either not based on BASI or not based on science information at all. We also find that the "recommendations" taken from the CSO strategy are also not based on the best available science information and often lack a science-based rationale to support their adoption. This is especially the case for the actions listed under Approach 1 in the section "Approaches and Recommended Conservation Measures" from the CSO strategy (USDA Forest Service (2019), pp. 25-29).

The following are a few examples of the lack of science support for the recommendations in the CSO strategy and by extension the project-specific forest plan amendment proposed in SERAL.

> **Surveys:** The Stanislaus National Forest was amended by the Sierra Nevada Forest Plan Amendment (SNFPA, USDA Forest Service 2004). The amendment required that surveys be completed when "proposed vegetation treatments are likely to reduce habitat quality in suitable California spotted owl habitat with unknown occupancy" (SNFPA, p. 54). The science-based rationale is provided in the CASPO Report (USDA Forest Service 1992) and protocol documents related to northern spotted owl (USDI Fish and Wildlife Service 2012). The SERAL project-specific amendment only requires that surveys be completed in suitable nesting and roosting habitat and leaves unaddressed surveys in areas that would reduce the quality of foraging habitat. No science citations or science-based rationale is provided for this change. Lack of clarity about this change is also compounded by the fact that the project-specific plan amendment does not define

"nesting and roosting habitat" causing there to be uncertainty about where surveys must be completed.

Designation of protected activity center (PAC): The SNPFA required PACs to be delineated around all owls exhibiting territorial behavior; this includes territorial singles and pairs. The SERAL project-specific forest plan amendment directs the designation of PACs for territorial owl pairs only and does not include territorial singles. The proposed plan amendment would leave unprotected by a PAC owl pairs that are not territorial and single birds that are territorial. Spotted owls are long lived, and tend to stay in a central location. Pairs that are not territorial and birds that are single and territorial are more likely to become territorial pairs and successfully nest compared to the floater population because they are currently occupying habitat (Gutiérrez et al. 2017). For similar reasons, conservation measures for northern spotted owl include: 1) identifying activity centers for territorial singles and any detected pair; and 2) habitat guidelines in the territory around these activity centers (USDI Fish and Wildlife Service 2009 and 2012). Neither the CSO strategy document nor the SERAL project-specific forest plan amendment provide any discussion or science information to indicate the basis for the change or if the recommended change in criteria will improve owl conservation.

Providing suitable habitat within a spotted owl territory: The SNFPA directs that suitable habitat be provided within 1.5 miles of the activity center in as compact arrangement as possible and identifies the target habitat in descending order of priority (USDA Forest Service 2004, p. 39). Habitat suitability in these areas, called Home Range Core Areas (HRCAs), is to be maintained following certain guidelines to protect large trees structures, snags, down wood, and higher cover preferred by spotted owls while increasing resilience to wildfire and other threats (USDA Forest Service 2004, p. 46). This is similar to the approach adopted to conserve northern spotted owl (USDI Fish and Wildlife Service 2009). Without establishing a science basis that relates to conservation biology, the SERAL plan amendment and the CSO strategy propose or recommend basing conservation on delineating a circular territory of a size based on the nearest neighbor distance. There is extensive evidence that spotted owls do not confine their habitat use to circular territories (see for example Jones et al. 2016 and Blakey et al. 2019), Despite this, the CSO strategy recommends conservation based on a circular home range that was adopted by scientists as an analysis convention to evaluate habitat conditions around activity centers (see discussion in Seamans and Gutiérrez 2007). The approach based on delineating a circular territory could result in an insufficient quantity and quality of habitat conserved and protected for CSO.

Other aspects of the CSO strategy and the proposed amendment for which the science basis has not been provided include retirement of a PAC based on lack of occupancy, the amount of habitat alteration allowed in a PAC, and habitat management in watersheds with 75% of the area in territories. Each of these actions is less protective of spotted owls compared to current direction. We also note that this is not an exhaustive list of changes that are proposed. The science basis and rationale for each change proposed in the project-specific forest plan amendment must be discussed and evaluated in the EIS.

6. The Criteria Used to Delineate a PAC or Territory Is Conflated with the Desired Condition.

A clear statement of desired conditions for PACs and territories is required to establish the ecological conditions necessary to maintain a viable population of each species of conservation concern. This is required for a forest plan amendment under the 2012 planning rule. (36 CFR 219.9) Both the proposed project-specific amendment and the CSO strategy conflate the criteria proposed to delineate a PAC or territory with the conditions one ultimately wants to achieve in those designations. The SNFPA makes a clear distinction between these delineation criteria and desired conditions by clearly identifying the desired conditions for these areas (see USDA Forest Service 2004, for PACs, p. 37 and 45; HRCAs, p. 39 and 46). The proposed amendment either provides no statements about the desired ecological conditions needed to support viable populations of spotted owls[1] or equates the delineation, as in the case of a territory, to defining its desired condition.

The issue of delineating the territory illustrates the problem (scoping package, p. 27). This plan component directs the delineation of a territory based on a descending priority of habitat types. The implication by adopting a descending priority is that some types are more important than others. However, if used as a desired condition without clearly stating where one draws the line in emphasis of habitat quality, a territory that contains 40% to 60% CWHR 4M satisfies the desired condition as written in the proposed amendment. Yet there is no science support for this as a desired condition. To the contrary, numerous studies point to larger tree structures and higher canopy cover being needed at the PAC and territory scales to support productive spotted owls (see research summary in Appendix A of these comments). What is more, the desired conditions for HRCAs in the current forest plan reinforce this.

Our ongoing discussions with the Regional Office indicate that the desired condition is for 40 to 60% of the territory to be in CWHR types 5M, 5D, and 6. This is consistent with the overall desire to increase the amount and distribution of stands with large trees over the territory to better reflect NRV and support productive spotted owls. This was also the desired condition and management intent in the SNFPA.[2] The desired condition with a threshold attached to preference for CWHR 5M, 5D and 6 then makes meaningful the plan component to conserve CWHR 5M, 5D, and 6:

> When occupied territories do not meet the desired conditions described above, retain the existing large tree moderate/high canopy cover habitat (for example, CWHR 6, 5D, 5M) wherever it exists throughout the territory. [SERAL scoping package, p.27]

[1] The statements on p. 24 of the scoping package that are labeled "desired conditions" for the proposed plan amendment are too vague and undefined to satisfy the requirement to define the necessary ecological conditions for species at risk.

[2] The conservation measures in the SNFPA for high quality habitat in HRCAs: "Arrange treatment patterns and design treatment prescriptions to avoid the highest quality habitat (CWHR types 5M, 5D, and 6) wherever possible" and the desired conditions generally reflect CWHR 5M, 5D, and 6 habitats types (USDA Forest Service 2004, p. 46)

This means that if the desired condition has not been met with CWHR 5M, 5D, and 6, these types shall be conserved wherever they exist in the territory. The proposed plan components for both PACs and territories should be revised to:

- Clearly state the desired ecological conditions in terms that can be measured in the field;
- Separate out criteria for delineation from desired conditions; and
- Establish the intended context for CWHR 5M, 5D, and 6 habitats when desired conditions for CWHR 5M, 5D and 6 are not met in the territory.

7. CSO Plan Components and Exceptions in Strategic Fire Management Features (SFMF)

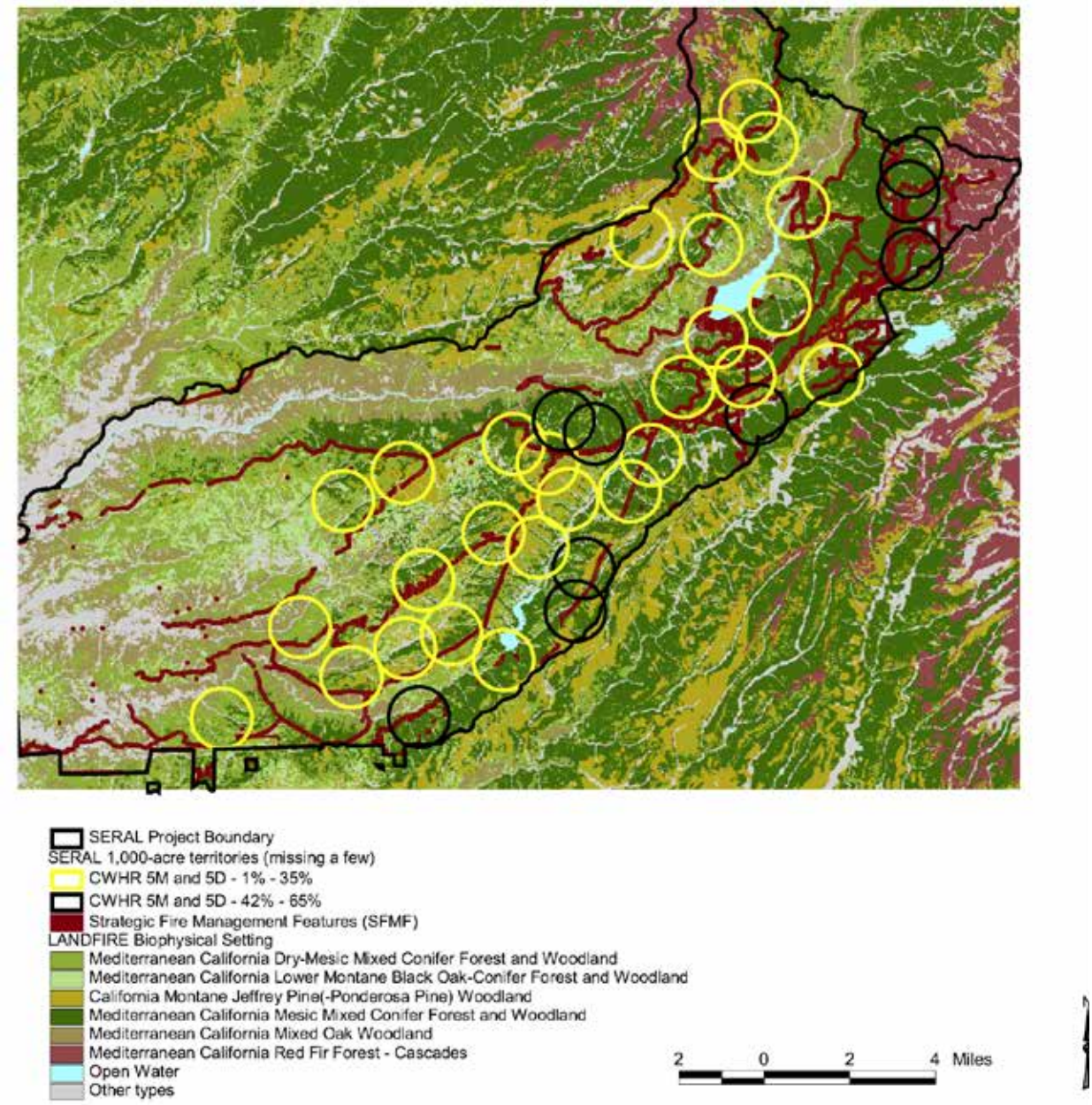
Five exceptions to the plan components for territories that intersect strategic fire management areas (SFMA) are included in the forest plan amendment. These exceptions to the recommendations for SFMA are not part of the CSO strategy and were not contemplated in its design.

We estimated the locations of territories for 37 activity centers in the project area.[3] We overlaid these estimated territories with the SFMFs. We found that all these territories were in some way affected by the SFMFs with the portion of the territory affected ranging from 1% to 41%. We found the density of the SFMF to be especially concerning for numerous territories in the northeastern portion of the project area (Figure 3). Figure 3 also indicates the locations of territories containing less than 35% of their area in CWHR 5M and 5D (see yellow circles on Figure 3). Several of these "yellow" territories also contain a high density of SFMFs.

The significant overlap between the SFMFs and CSO territories should be examined in detail. Each territory and associated SFMFs should be first evaluated to determine if reduced flame length and intensity can be provided while maintaining suitable habitat. In cases where these objectives are not compatible, the territory should be redrawn to avoid the fuelbreak and provide the highest quality habitat available within 1.5 miles of the activity center in as compact arrangement as possible.

[3] We recognize that there are additional activity centers within the project boundary, but we did not have sufficient data to estimate their locations.

Figure 3. Relationship between strategic fire management features (SFMF) and estimated California spotted owl territories. Not all territories in the project area are reflected in the figure below.



8. Defining Habitat Conditions for CSO

Appendix B uses a number of terms that are not defined in the project documents. Clear definitions for these terms are needed to enable the implementation of the plan components. Definitions for these terms are also needed to establish the ecological conditions necessary to

maintain a viable population of each species of conservation concern as required for a forest plan amendment under the 2012 planning rule. (36 CFR 219.9)

Definitions should be provided for the following items because their condition or state is used to make judgments about taking management actions in habitat for CSO:

- Suitable foraging habitat
- Suitable nesting and roosting habitat
- Reduction of habitat quality
- Highest quality nesting and roosting habitat
- Key habitat elements
- Essential habitat for survival and reproduction

Appendix B can be searched for these phrases. Several occur frequently and all are critical for judging the appropriate action to take as directed by the proposed plan amendment.

Appendix B also refers to Safford and Stevens (2017) for the determination of characteristics that would inform desired conditions or standards for the following:

- Landscape level seral stage and canopy diversity (desired condition)
- Stand level patch diversity (desired condition)
- Large tree structures (standard)
- Coarse woody debris (standard)

These characteristics also happen to be essential ecological conditions necessary to provide for viable populations of CSO (USDA Forest Service 1992). It is inappropriate to rely on a citation to the literature for these plan components. Metrics for these characteristics should be included in the forest plan amendment. The metrics included in the draft revised forest plan for the Sierra National Forest (USDA Forest Service 2018) should be reviewed for guidance and adoption.

9. Evaluating Impacts of the Project-Specific Forest Plan Amendment

We expect that the impacts of the proposed changes in management direction on spotted owls and other old forest associated species will be evaluated in the EIS. We expect any changes, especially those that provide reduced conservation benefit, and are less certain or more risky than current practice, will be evaluated for their potential impact on owl viability and persistence. We also expect that the suite of old forest associated species that are currently listed as Forest Sensitive Species will be identified as Species of Conservation Concern and addressed in the analysis of effects. This is especially relevant to the proposed changes in direction regarding canopy cover requirements and diameter limits controlling the removal of large trees.

B. Condition Based Management

Elements of the proposed actions, including salvage of fire-killed trees (Sec. D. pp. 12-13), appear to employ a Conditions Based Management (CBM) approach. While the scoping package remains vague in this regard, actions associated with landscape-scale planning and

implementation of salvage in response to Potential Fire Event 1 and 2 [and annual prescribed fire targets (10-20,000acres / year in unspecified areas)] would occur in areas not specifically identified at the time of a NEPA decision, and therefore where project-specific planning and implementation would occur after a NEPA decision.

In general, we are concerned about the use of CBM in the NEPA process because of the tension between CBM's reduced reliance on site-specific analyses, and NEPA's requirement for disclosure of site-specific impacts that could result in negative impacts to the environment. A recent court decision demonstrates a failure of the Forest Service to harmonize landscape-scale CBM planning with NEPA requirements (see Southeast Alaska Conservation Council et al., v. USFS et al. (March 11, 2020)). While our organizations continue to work with the Forest Service and other forest management agencies to increase the pace and scale of necessary work through appropriate means, we are concerned that incorporating CBM into the SERAL planning approach will result in outcomes that trade reduced due diligence and public engagement for a process with a disproportionate emphasis on increased timber volume that diminishes wildlife habitat.

Scoping package Background information states:

> Traditional project planning efforts have identified site-specific treatment units with spatially-specific management requirements and prescriptions directly associated with those units. In this traditional way, the decision authorizes treatments to occur that were designed based on conditions that exist at the time of decision, with minimal flexibility. [p. 2]

Key values and benefits associated with current, "traditional," planning include a higher degree of certainty that specific issues are analyzed and addressed directly where localized conditions for wildlife are based on site-specific attributes that may be unknown without on-the-ground surveys and/or difficult to incorporate into broadly written management prescriptions. For example, rare plant habitat is often confined to specific ecological conditions (e.g., microhabitats based on unusual soils) whose ecological and management needs are discontinuous with the surrounding landscape.

The Forest Service should describe the process whereby condition based actions like salvage in response to Potential Fire Event 1 and 2 will uphold the public's right to basic information about proposed actions, the impacts of those actions on our shared public resources, and our ability to track and meaningfully engage in on-going SERAL project analysis and planning. Scoping package Background information continues:

> These past efforts have taken on average 2 to 5 years to complete, have authorized on average 1,000 to 5,000 acres of treatments, and often take greater than 5 years to fully implement, or in some instances, had limited implementation so far, while not keeping pace the current trend of natural disturbances. To continue forest management in these traditional ways will leave the forest vulnerable to largescale mortality from wildfire, insects, disease, and drought. We are in a planning and implementation race with these natural disturbances. [p. 2]

These statements imply the traditional planning method itself is too cumbersome and inefficient to keep pace with what is needed to address natural disturbances. A recent review of the USFS own information found that shrinking budgets and reduced staff capable of sustaining project planning and implementation are the main barriers to project implementation and completion (Fleischman et al., 2020). To frame the challenge of achieving increased pace and scale in terms of having to reinvent planning (i.e., adopting a SERAL vs. "traditional" planning approach), as the scoping package does, obfuscates the root of the problem and presents a false choice to the public. Failing to acknowledge the need for additional staff as part of the solution, the forest service erodes public confidence in the SERAL project's approach to transparency.

> Since the 2004 SNFPA ROD, new scientific information and tools have become available and additional planning tools are currently being developed to support the SERAL effort. (One tool is based on the Landscape Treatment Designer (Agar et al. 2012) another tool is based on fire risk prioritization (Dunn et al. 2020).) [p2]

We will need more information about these tools and their decision-support outputs to assess the SERAL project. How will these new tools be incorporated into SERAL and when will the public be able to assess their planning use, applicability, and appropriateness? What is the timeline for this within SERAL planning?

III. Additional comments by Scoping Package Sections

1. BACKGROUND

1.03. Risks to human communities, resources, and infrastructure

The scoping package makes several references to "NRV" and "forest NRV" as a general reference condition that SERAL intends to mimic, approach, and/or achieve. Since there is no single, over-arching NRV value to target with proposed actions, and because proposed action goals are calibrated to "NRV," the Forest Service should make explicit references to particular forest structure, process, and composition attributes when referencing "NRV" goals, and provide citations upon which those NRV values are based. This would help us understand the rationale and science behind SERAL goals related to desired NRV outcomes. For example, the scoping package states:

> Throughout the western United States, forest health challenges are prevalent. From extensive insect and disease outbreaks to successive record fire years, the changes to the landscape and ecosystem function are beyond their NRV. [p.5]

Disease outbreaks associated with dwarf mistletoe (*Arceuthobium abietinum f. sp. magnificae*) in red fir can contribute naturally to compromised red fir health and mortality, as can disturbance from mechanical thinning. However, dwarf mistletoe outbreaks have not been found to be beyond their NRV (Meyer and North 2019, pp.31-32).

Well-articulated NRV attributes and citations, and current trend analysis, where available, in those conditions will be important to consider during planning.

1.04 Social Resilience

We support the establishment of social resilience among rural, forested communities, and are committed to ensuring the link between social and ecological resilience remains sustainable. The Scoping Package states:

> This work on National Forest lands provides jobs, and the output from those workers contributes to social resilience. [p.6]

The SERAL project should provide a framework that ensures service work, prescribed fire, fuelbreak maintenance, biomass removal, and other activities that can provide jobs and can contribute to social resilience are implemented as well as variable density thinning and canopy reduction treatments. Removing larger trees for timber while not implementing service work, subsequent prescribed fire maintenance, and/or biomass removal because it is not economically viable would not be contributing to either sustainable social or ecological resilience.

Regarding how changes in forest processes affect remote forested communities, the scoping package states:

> Individuals, communities, businesses and industry are a critical component of most areas in the western United States, yet more remote areas that have fewer large industries, year-round businesses, and employers situated locally are more deeply affected by repetitive or unpredictable environmental disturbances. [p.6]

The Forest Service should provide examples of how these communities are more deeply affected by disturbances and articulate how SERAL will address the problem(s). This will help the public appreciate the gravity of these statements and clarify their relationship to SERAL goals and objectives.

2. PURPOSE AND NEED

Purposes

> *1. Conduct landscape-scale forest planning and active management*

Reducing fire risk to communities and natural resources are among the stated purposes and needs of the proposed action [scoping package pp. 6-7]. While the proposed actions state to the importance of fire risk reduction, provide general descriptions of treatments to occur, and make reference to analysis tools intended to identify and prioritize the strategic fire management treatments at some later date, the timeline and process whereby the public will be able to review these tools and their outputs remains unclear. The Forest Service should incorporate the following information into the development of a strategic network of SERAL treatments.

Studies have repeatedly shown that strategic treatment of fuels on a portion of the landscape can significantly reduce wildfire risk and impacts from extreme wildfire (see for example Tubbesing et al. 2019 and Pritchard et al. 2020) while treating only a portion of the landscape. The efficacy and benefit of fuels treatments depends on strategic approach to fire management that builds on the areas treated or to be treated in the Wildland Urban Interface (WUI). A strategic approach to fire management is also key to establishing areas on the landscape from which fire can be most effectively suppressed when needed or managed for resource benefit when conditions are right (Caggiano 2019, Stratton 2020). The proposed action and any action alternative should identify the approach to strategic fire management that clearly identifies: 1) the locations from which fire is best managed for suppression and resource benefit; 2) treatment priorities in order to sequence fuel reduction treatments in a manner that builds on the existing fuel reduction work and prioritizes prescribed burning. The proposed action identifies the first item, but would benefit from a discussion about why these locations are strategic for controlling fire. The proposed action and alternatives analyzed in the EIS should include the second item to inform selection of the areas to treat first.

Thinning, especially mechanical treatment, can degrade or reduce the quality of important habitat in the short and long term. These negative impacts must be evaluated against the gains that might accrue from fuels reduction. Because of this tension between benefit of risk reduction and potential for habitat degradation, it is essential that the Forest Service include a careful and detailed analysis of fire and fuels issues to justify the proposed logging with respect to fuels reduction. The analysis should include, at a minimum, the following.

- The Forest Service should provide estimates of projected flame length, fire resiliency, mortality of dominant and codominant trees, and probability of initiation of crown fire for each alternative, and disclose the underlying data and rationale.

- The Forest Service should prepare an analysis of impacts on fire hazard based on thinning from below up to a range of diameter limits, including 12 inches, 20 inches, 24 inches, and 30 inches.

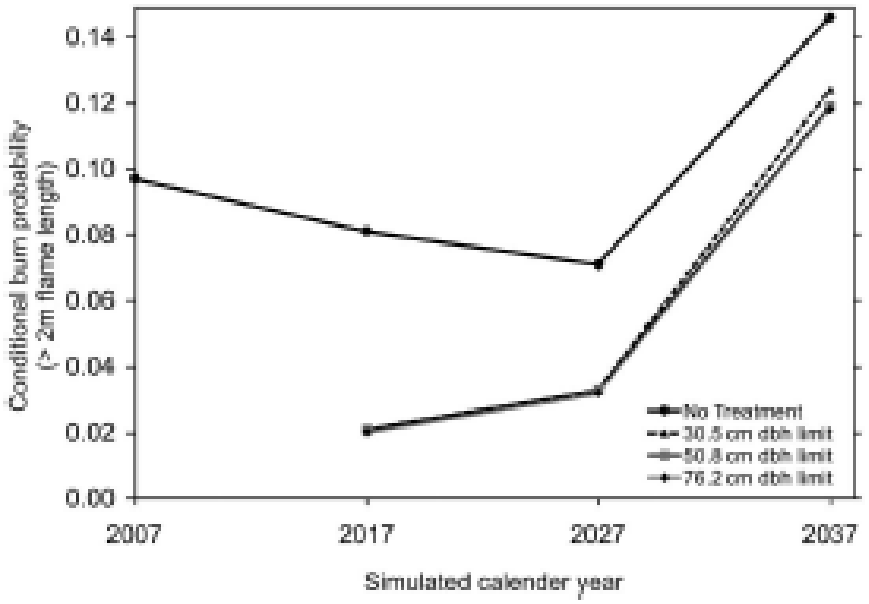
- Based upon concerns raised in fire science literature (see for example Agee and Skinner 2005), the Forest Service should provide an analysis of tradeoffs leading to increased fire hazard from increased canopy openings. The Forest Service should disclose specific microclimate effects, including changes in wind speed, humidity, understory re-growth, and maintenance issues in treatment areas as part of the fire and fuels analysis.

- The fire and fuels analysis should specifically address and respond to the scientific information indicating the achievement of fuel objectives (flame length, lowered rate of spread, and increased height to live crown) does not require logging trees greater than 20” DBH or reducing canopy cover below 50 percent to significantly improve fire resiliency. See for example North et al. (2009, p. 24) finding that fire severity and crown fire reduction is generally achieved by removing trees up to 16” DBH. Consistent with this, most fuel reduction projects implemented by local fire safe councils on private land adjacent to communities do not include the removal of trees >10 inches DBH, and these projects are deemed to be effective. The environmental analysis should recognize and

discuss the considerable scientific evidence indicating that it is not necessary to significantly reduce canopy cover or remove trees greater than 12 to 20 inches DBH to reduce wildfire hazard, including the studies summarized below.

Collins et al. (2011, p. 84) compared the effectiveness of three different diameter limits on flame length across a landscape over a 30-year period (Figure 1). Their results suggest that across the landscape, there was virtually no difference in conditional burn probability between stands that had a 12-inch, 20-inch, or 30-inch diameter limit.

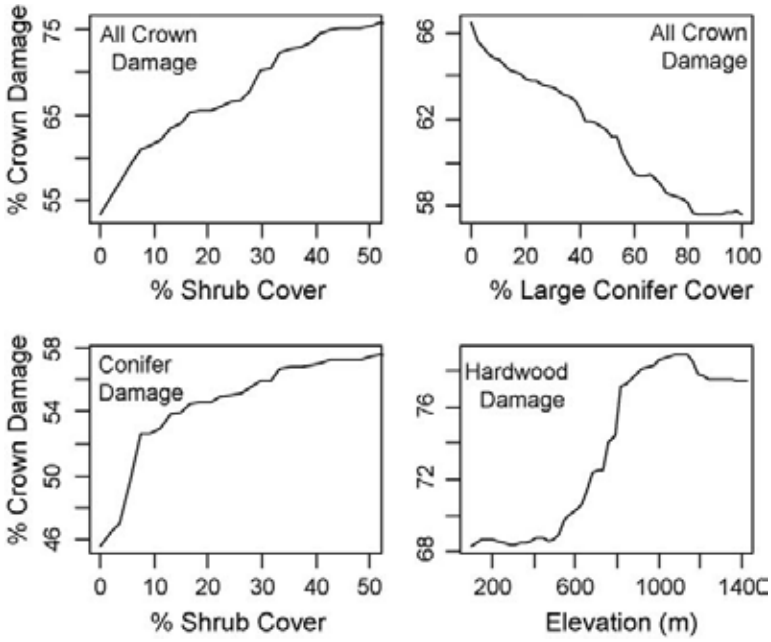
Figure 1. "Mean conditional burn probabilities across the Last Chance landscape for which simulated flame lengths are >2 m. Three diameter-limited thinning scenarios along with a no treatment scenario are reported. Each scenario was modeled into the future based on output from the Forest Vegetation Simulator, using our 2007 field inventory plot data as a baseline. Probabilities are based on 5,000 randomly placed ignitions simulated using RANDIG (see Methods for explanation). Note that the [results of the] three thinning scenarios are nearly indistinguishable, with the exception of a slight departure for the 30.5-cm scenario in 2037." (From Collins et al. 2011, page 84).



Agee and Skinner (2005, p. 9) state: "Some effective fuelbreaks had only surface fuels and ladder fuels treated, with residual canopy cover exceeding 60–70%. Even though canopy bulk density was insignificantly reduced, fire severity was significantly reduced, suggesting that reductions in canopy bulk density are not always needed to reduce wildfire severity."

Thompson and Spies (2009, p. 1690) found that (Figure 2), "Open tree canopies with high levels of shrub-stratum cover were associated with the highest levels of tree crown damage, while closed canopy forests with high levels of large conifer cover were associated with the lowest levels of tree crown damage."

Figure 2. Partial dependence plots from random forest predictions of total crown damage on percent shrub cover; total damage on large conifer cover; conifer damage on percent shrub-stratum cover, and hardwood damage on elevation. Partial dependence is the predicted value of the response based on the value of one predictor variable after averaging out the effects of the other predictor variables in the model. From Thompson and Spies (2009, page 1690)



Fry et al. (2015) found that the higher canopy cover forests of the Sugar Pine study area were more resilient to fire than the lower canopy cover forests of the Last Chance study area. Treatment of 29 percent of one of the study areas, which included a 16-inch diameter limit for tree removal applied to a significant portion of the treatment area, reduced modeled fire size from 3,200 acres to about 123 acres and conditional burn probability was reduced by about half after treatment.

Table 1 below is a comparison of the amount of high severity burned forests in evergreen closed tree canopy vs. evergreen open tree canopy forests on non-wilderness Forest Service-managed lands for fires that burned greater than 20,000 acres (all ownerships) between 2008 and 2018 on the west-side Sierra Nevada bioregion within the range of the California spotted owl. The results indicate that open canopied evergreen forests are as likely, if not more likely, to burn at high severity as closed canopied evergreen forests in the Sierra Nevada. This suggests that canopy cover is not a significant driver of high severity fire.

Table 1. Comparison of the amount of high severity burned forests in evergreen closed tree canopy vs. evergreen open tree canopy forests on non-wilderness Forest Service-managed lands for fires that burned greater than 20,000 acres (all ownerships) between 2008 and 2015 on the west-side Sierra Nevada bioregion and within the range of the California spotted owl.

				Evergreen Closed Tree Canopy (Non-Wilderness FS Ownership Only)			Evergreen Open Tree Canopy (Non-Wilderness FS Ownership Only)			
Fire Name	Year	Forest	Fire Size (Acre of All Ownerships)	High Severity	Total Acres Burned	High Severity %	High Severity	Total Acres Burned	High Severity %	Closed % - Open %
Cub Complex	2008	Lassen	20,860	1,830	11,984	15%	1,167	4,483	26%	-11%
BTU Lightning Complex	2008	Plumas/Lassen	58,337	792	6,482	12%	3,512	14,442	24%	-12%
Canyon Complex	2008	Plumas	39,793	2,808	16,709	17%	1,610	15,374	10%	6%
Piute	2008	Sequoia	37,258	981	3,064	32%	9,530	16,170	59%	-27%
American River Complex	2008	Tahoe	21,284	2,721	10,622	26%	1,816	6,465	28%	-2%
Chips	2012	Plumas	76,328	11,142	45,539	24%	4,395	14,803	30%	-5%
Reading	2012	Lassen	28,055	3,530	7,748	46%	920	2,840	32%	13%
Rim	2013	Stanislaus	257,619	13,409	47,882	28%	38,362	74,704	51%	-23%
American	2013	Tahoe	27,416	4,016	13,083	31%	2,070	8,028	26%	5%
Aspen	2013	Sierra	22,700	1,414	6,998	20%	2,909	11,316	26%	-6%
King	2014	Eldorado	96,513	14,195	26,687	53%	16,297	32,800	50%	4%
Bald	2014	Lassen	39,828	415	631	66%	12,129	20,519	59%	7%
Eiler	2014	Lassen	33,157	3,254	4,368	74%	5,055	7,043	72%	3%
Rough	2015	Sequoia/Sierra	145,908	6,519	24,304	27%	29,181	64,052	46%	-19%
Total			**905,056**	**67,026**	**226,101**	**30%**	**128,953**	**293,039**	**44%**	-14%
Other Recent Fire of Note										
French	2014	Sierra	13,819	729	1,983	37%	3,984	8,939	45%	-8%

RAVG data was obtained from the USFS's Post-Fire Vegetation Conditions webpage November 10, 2015:
http://www.fs.fed.us/postfirevegcondition/index.shtml
The following terms are defined in the RAVG glossary:
http://www.fs.fed.us/postfirevegcondition/glossary.shtml
Closed Tree Canopy - A class of vegetation that is dominated by trees with interlocking crowns (generally forming 60 to 100% crown cover).

Evergreen Open Tree Canopy - This vegetation group describes an open tree canopy condition dominated by evergreen tree species. Evergreen species contribute more than 75% of the total tree cover. Forest covers associated with this group are described in Forest Cover Types of the United States (Society of American Foresters, F.H. Eyre, Editor, 1980).

Evergreen Closed Tree Canopy - This vegetation group describes a closed tree canopy condition dominated by evergreen tree species. Evergreen species contribute more than 75% of the total tree cover. Forest covers associated with this group are described in Forest Cover Types of the United States (Society of American Foresters, F.H. Eyre, Editor, 1980)

- The Forest Service should provide analysis of fire and fuels treatment outcomes in terms of how these treatments have affected stand density, prior to asserting additional need for increased logging to meet separate stand density objectives.

- A fundamental objective of strategic fuel treatments is to improve fuel conditions. Skyline logging systems should only be used in settings where the surface and ladder fuels are also reduced immediately post treatment. Leaving pre-treatment surface and ladder fuels and activity generated fuels only contributes to the fire hazard and does not address the purpose and need.

2. Restore fire regimes

The scoping package states:

> Prepare the landscape for the safe reintroduction of fire and reestablish fire processes through larger, watershed scale efforts that mimic the natural range of fire severity and frequency (i.e., the natural range of variation). [p.6]

The Forest Service needs to clarify what is intended by "efforts that mimic" fire severity and frequency NRV. How will post-treatment landscape goals be established, and how will efforts achieve these conditions? As stated elsewhere, we will need to understand the methodologies and modeled outcomes of the Dunn / Ager et al. tools referenced in the Scoping Package in order to make an assessment of SERAL proposed actions.

3. Restore forest conditions to a range of natural conditions (i.e., the NRV) [p.6-7]

Elements (b-h) presented under Purpose #3 (we address item (a) above) can provide multiple benefits and achieve multiple objectives, but their efficacy and our support for them depends on which forest attributes are considered, what desired objectives are defined, and how proposed actions are implemented relative to desired NRV goals. The Forest Service needs to provide more detail and clarity on these points that includes an analysis of the rate of change, and the degree of short-term risk to essential habitat resulting from proposed actions.

5. Provide for increased economic sustainability

The Forest Service should provide an analysis of current capacity and possible future needs of local industries and businesses to adjust and accommodate novel wood material byproducts from SERAL (e.g., small-diameter (5.5" - 12" dbh) pole wood, biomass material). Concurrent with our responsibility to rearrange the forest is our responsibility to adapt technologies to accommodate small timber byproducts of effective forest rearrangement.

6. Increase the ability of groups or communities to cope with external stresses as a result of environmental change

The Forest Service should clarify how safe recreation will help present and future generations cope with external stresses that result from environmental change.

Needs

1. Vegetation Management

b. Thin forest vegetation to modify forest structure, composition, and fuel loads towards the NRV. [p. 7]

As stated elsewhere, the SERAL project must articulate NRV-related purpose, need, and goals in clearer terms in order to assess their validity and potential to achieve desired outcomes.

c. Generate forest products (sawtimber, biomass) to support local businesses. [p. 7]

SERAL should examine and propose alternatives where small timber and biomass markets are utilized, including developing capabilities to do so.

2. Strategic Fire Management Features

c. Provide improved opportunity for fire retardant to penetrate the forest canopy. [p. 7]

The Forest Service must provide more information regarding the ability of SFMFs to provide fire retardant penetration. For example, does this actually result from fuelbreaks, prepared roadsides, and defensible space? Which of these open up canopy for improved retardant penetration, and are there examples or citations the Forest Service can provide to help the public better understand this point?

IV. Other Planning Issues

A. Description of the Project

The Forest Service should provide a clear and detailed description of the project, including the nature, intensity, and extent of planned logging by unit in the draft EIS. The scoping letter states that the Forest Service plans to conduct a variety of actions across the 116,000-acre project area. Among other things, approximately 38,000 acres is identified for variable density thinning.

- The vegetation data used to characterize the existing conditions in the project area should be updated to reflect any tree mortality experienced in the last 5 years. The traditionally applied Eveg data that is maintained by the Forest Service is updated on cycles of 5-7 years. Source imagery for the data for the northern Sierra Nevada region ranges from the year 1995 – 2016, and for the southern Sierra Nevada region ranges from 2000 – 2014. Neither of these datasets includes the full span of the tree mortality event from 2014 to 2018. This updated information is needed to characterize baseline conditions in the project area and to accurately described habitat quality for the affected species, including California spotted owl. Updated information is also critical since the proposed forest plan amendment relies on identifying required habitat using CWHR. We have heard repeatedly

from the Forest Service that millions of trees have died and that many were of large size. These statements suggest that CWHR types could have changed as a result of the mortality event, including those important to CSO.

- We request that the Forest Service provide detailed maps that identify timber harvest unit locations and the types of treatment in relation to ecologically important features including CWHR type (especially CWRH 6, 5D, 5M, 4D, 4M), CSO PACs, HRCAs, CSO territories, forest carnivore sightings, areas identified as important for the movement of forest carnivores, and important to connectivity for CSO.

- With respect to the size of trees that will be removed, the Forest Service should identify the maximum tree diameter that will be removed within each treatment unit occurring in HRCAs and CSO territories, based upon the applicable large tree and canopy retention objectives in the Sierra Nevada Forest Plan Amendment (SNFPA) (USDA 2004, p. 46) and for the Proposed Action the criteria in the project specific forest plan amendment. The Forest Service should provide the underlying data and analysis that supports the diameter limit.

- For each unit, the Forest Service should disclose the existing canopy cover and the canopy cover that will remain if the project is implemented. The Forest Service should explain how reductions in canopy cover are informed by concepts in Pacific Southwest Research Station General Technical Reports PSW GTR 220, PSW GTR 237, and PSW GTR 256, and how they are consistent with SNFPA management objectives and standards for the alternative examining the current forest plan or consistent with the proposed plan amendment for the Proposed Action.

- For each unit, the Forest Service should disclose the existing CWHR size class and the post-treatment size class. In addition, the Forest Service should disclose and analyze the extent to which habitat quality within CWHR types is variable. For example, a stand with dominant trees of 20-24" and canopy cover of 55 percent provides far higher habitat quality for the California spotted owl and other old forest species than a stand with dominant trees of 12-14" and canopy cover of 40 percent, yet both stands would be classed as CWHR 4M.

- The Forest Service should specifically identify any logging proposed for purposes other than fuels reduction (e.g., reducing stand density, salvage, insect and disease), including the planned acreage of such logging, the specific units in which such logging will occur, and the rationale for any such treatments. If the project involves reducing stand density to address forest health concerns, the Forest Service should identify the objective criteria used to select the trees removed to meet this objective. The project should identify the specific contribution of fuels reduction treatments to the decreased risk of insect and disease problems related to stand density concerns.

- The Forest Service should identify the acreage and type of logging by land allocation, including threat zone of the wildland urban intermix (WUI), defense zone of the WUI,

protected activity centers (PACs), and owl home range core areas (HRCAs), stream environment zones (SEZ), and any other protected area.

B. Wild and Scenic Rivers

None of the SERAL Project scoping documents, including the Briefing Paper (June 9, 2020), Federal Register Notice of Intent to prepare an EIS (July 16, 2020), and the extended Scoping Notice (undated) mention that the project area includes suitable and eligible Wild and Scenic River segments. Nor do these documents address the 1991 Stanislaus Forest Plan standards and guidelines for the management of these suitable and eligible segments and the protection of their free flowing character and outstandingly remarkable values.

SERAL Project treatments could adversely affect river segments recommended for Wild River protection by the Forest Service in the 1991 Stanislaus National Forest Plan Record of Decision (pgs. 13-14), including:

- Middle Fork Stanislaus Segment 12 (Sand Bar to North Fork Stanislaus confluence)
- Stanislaus River (North Fork/Middle Fork confluence to Clark Flat).

SERAL Project treatments could also adversely affect river segments determined eligible by the Forest Service in the 1991 Plan/ROD, but not found suitable. These segments were placed into "Alternate Management" by the 1991 Plan to protect their outstandingly remarkable values. These alternatively protected non-suitable segments include:

- Middle Fork Stanislaus Segment 8 (Donnells Dam to Hell's Half Acre)
- Middle Fork Stanislaus Segment 10 (Beardsley Afterbay Dam to Sand Bar)

According to the 1991 Stanislaus National Forest Plan ROD (pgs. 13-4, *emphasis added*):

> Of the 299 miles of river found eligible, I have determined that 113 miles are suitable and will recommend them for Wild and Scenic River designation. These include all eligible portions of the Clark Fork, North Fork Mokelumne River above Salt Springs Reservoir, Niagara Creek, South Fork Tuolumne, North Fork Stanislaus, and Stanislaus. *It also includes five of the eight eligible segments of the Middle Fork Stanislaus.*
>
> All other segments are unsuitable (including segments 8 and 10 of the Middle Fork Stanislaus River), however, their values will be protected through 163 miles of "Alternate Management," meaning another type of management, such as Wilderness, *Near Natural*, Wildlife, Special Interest Area, or Research Natural Area which will protect outstandingly remarkable values. Depending on the values and their locations, Alternate Management may apply to an entire segment, or only to that portion where the values area actually located.

1. Federal Law and Guidelines Require Protection of Eligible and Suitable Rivers

The National Wild and Scenic Rivers Act (Public Law 90-542) requires federal land management agencies to protect the free-flowing character and outstanding values of eligible, suitable (agency recommended), and designated rivers under the agency's jurisdiction. Section 1281(a) of the Act states:

> Each component of the national wild and scenic rivers system shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its esthetic, scenic, historic, archaeologic, and scientific features.

The Forest Service Planning Handbook provides further guidance for implementing this direction for rivers and streams identified by the agency as eligible and/or suitable. FSH 1909.12_84.3 states that "Forest Service-identified eligible and suitable rivers must be protected sufficiently to maintain free flow and outstandingly remarkable values…" The Handbook provides more detailed direction in regard to protecting eligible/suitable rivers in regard to water resources projects, minerals, roads, etc. Following is the wild and scenic river protection direction (FSH 1909.12_84.3) pertinent to the SERAL Project for the suitable (recommended) segment of the lower Middle Fork Stanislaus River:

> (4) Transportation System – Wild Rivers: Roads and railroads are generally not compatible with a wild river classification. Prevent actions related to the road system that would preclude protection of the river as wild. Do not plan roads outside of the corridor that would adversely affect the wild classification. New trail construction should generally be designed for non-motorized uses. However, limited motorized uses that are compatible with identified values and unobtrusive trail bridges may be allowed. New airfields may not be developed.
>
> (7) Motorized Travel – Wild Rivers: Motorized travel on land or water may be permitted, but is generally not compatible with this classification. Where motorized travel options are deemed to be necessary, such uses should be carefully defined and impacts mitigated.
>
> (8) Wildlife and Fish Projects – Wild Rivers: Construction of minor structures and vegetation management to protect and enhance wildlife and fish habitat should harmonize with the area's essentially primitive character and fully protect identified river values. Any portion of a proposed wildlife or fisheries restoration or enhancement project that has the potential to affect the river's free-flowing character must be evaluated as a water resources project.
>
> (9) Vegetation Management – Wild Rivers: Cutting of trees and other vegetation is not permitted except when needed in association with a primitive recreation experience, to protect users, or to protect identified outstandingly remarkable values. Examples of such

> exceptions include activities to maintain trails or suppress wildfires. Prescribed fire and wildfires managed to meet resource objectives may be used to restore or maintain habitat for threatened, endangered, or sensitive species or restore the natural range of variability.

Although this direction does not necessarily preclude all SERAL Project treatments proposed in the lower Middle Fork Wild River and mainstem Stanislaus corridors, it does require that project treatments be applied in a way that avoids harm to the free flowing character and outstanding values of the river segments. And the 1991 Stanislaus Forest Plan requires the protection of outstandingly remarkable values in the eligible but not recommended segments of the Middle Fork Stanislaus River above Sand Bar.

The 1991 Stanislaus Forest Plan reiterates the protective mandates of the law and the planning manual. The following management guidelines are applicable to suitable rivers:

> …to protect the free flowing condition of the river; to preserve and enhance their outstandingly remarkable values; and to maintain conditions at the highest possible Wild, Scenic, or Recreational classification for which the segment is eligible. (Stanislaus Forest Plan, pg. IV-34)

More specific forest plan direction concerning suitable/recommended and eligible river segments is summarized in the Forest Plan Management Compliance section below.

2. Outstandingly Remarkable Values of Eligible and Suitable Wild and Scenic River Segments

a. Main Stem Stanislaus River (suitable/recommended)

The 1.5-mile long main stem Stanislaus River from the North Fork /Middle Fork confluence to Clark Flat were recommended by the Forest Service, proposed for Wild classification, and possess the following outstandingly remarkable values:

Scenery – Outstanding Variety Class A landscape includes a deep, V-shaped, river cut canyon through granitics with some volcanics on the rim. The river provides a variety of water forms, including rapids, cascades, and pools. Vegetation patterns include scattered ponderosa pine and oak woodland.

Recreation – Hiking and fishing are the popular dispersed activities on the lower North Fork, which is remote and wild. Access is limited, resulting in a rare opportunity for solitude and non-motorized recreation experiences, below the snow and available all year.

b. Middle Fork Stanislaus Wild and Scenic River Segment 12 (suitable/recommended)

The 10.5 mile-long segment of the Middle Fork Stanislaus River between Sand Bar and the Middle Fork's confluence with the North Fork is a Forest Service recommended Wild River and possess the following outstandingly remarkable values:

Scenery – The river's outstanding Variety Class A landscape includes a broad, deep and rugged V-shaped, river-cut canyon through granitics with some volcanics and meta-sedimentary rocks. The river provides a variety of water forms including rapids, cascades, and pools. Vegetation patterns are varied, including scattered ponderosa pine and oak woodland.

Recreation – Hiking and fishing are popular dispersed activities on this remote and wild segment. Access is limited, resulting in a rare opportunity for solitude and non-motorized recreation experiences, below the snow and available all year.

Wildlife – Bald eagle winter and potential nesting habitat exists between the river and the rim of the canyon. One of four nest territories on the Forest. Bald eagles use the river for feeding during the winter and early spring and roost on trees along the river.

c. Middle Fork Stanislaus River Segment 8 (eligible but not suitable/recommended)

This 8 mile-long segment of the Middle Fork Stanislaus from Donnell's Reservoir to Hell's Half Acre possesses the following outstandingly remarkable values:

Scenery – Outstanding Variety Class A landscape includes a deep, glacially carved canyon with a variety of mixed conifer and riparian vegetation. The river provides a variety of water forms, including rapids, cascades, and pools.

Wildlife – Bald eagle nesting habitat exists on the canyon slopes. One of the four nest territories on the Forest. Bald eagles use the river for feeding during the winter and early spring and roost on trees along the river.

d. Middle Fork Stanislaus River Segment 10 (eligible but not suitable/recommended)

This 3 mile-long segment of the Middle Fork Stanislaus from the Beardsley Afterbay Dam to San Bar possesses the following outstandingly remarkable values:

Fish – A state-designated Heritage and Wild Trout stream, the river is capable of providing an excellent trout fishery, not artificially supported by planting of hatchery "catchable" trout. It contains brown trout and rainbow trout; one sampling produced the highest number of trout per mile (10,634) on the Forest; and, provides an outstanding angling experience.

Wildlife – Bald eagle nesting habitat between the river and the rim of the canyon. One of the four nest territories on the Forest. Bald eagles use the river for feeding during the winter and early spring and roost on trees along the river.

Historical/Cultural – Unique in the Sierra, the Historic Spring Gap Powerhouse and tramway were constructed between 1919 and 1921 by Tuolumne County Water and Electric Power Company. The powerhouse has been operating since 1921.

3. Proposed Treatments In River Corridors

The SERAL Project treatment maps fail to show the recommended Wild River corridors or the unsuitable but eligible segments allocated to protective alternate management. The maps should be revised to show suitable and eligible river corridors. Visual comparison of the SERAL Project treatment maps and the 1991 Forest Plan Management Area Map I-1 indicate the following:

Middle Fork Segment 8 – Proposed thinning, prepared roadside fuel breaks along Road 5N95 to Donnell Powerhouse and Hell's Half Acre, proposed mastication and oak shrub enhancement along the river in the vicinity of Hell's Half Acre, and treatment of non-native invasive weeds (particularly if herbicides are used) could adversely impact the outstandingly remarkable scenery and wildlife values of the river segment and contravene the river's alternate Near Natural management.

Middle Fork Segment 10 – Proposed thinning near Sand Bar Flat, prepared roadside fuelbreaks along Road 5N02 to Beardsley Dam, defensible space fuelbreaks around the Beardsley Powerhouse and further downstream along Road 4N85 to the Southern Powerhouse and Sand Bar Flat Dam, proposed mastication and oak shrub enhancement along the river, and treatment of non-native invasive weeds (particularly if herbicides are used) could adversely impact the river segment's outstandingly remarkable fish and wildlife values and contravene the river's alternate Near Natural management.

Middle Fork Segment 12 – Proposed mastication and oak shrub treatment sites along the Middle Fork Stanislaus River segment 12 downstream of Trail 16E06 and treatment of non-native invasive weeds (particularly if herbicides are used) could adversely impact the rivers' outstandingly remarkable scenery, recreation, and wildlife values and contravene Near Natural management of the canyon beyond the Wild River corridor.

Stanislaus (Main Stem) – Proposed mastication and oak shrub treatment sites on the river between the North/Middle Forks confluence and Clark Flat and treatment of non-native invasive weeds (particularly if herbicides are used) could adversely impact the river's outstandingly remarkable scenery and recreation values.

The recommended Wild River corridors must be addressed in the project EIS, and the potential impacts of the project on the rivers' outstandingly remarkable values analyzed. Although the amount of proposed fuelbreaks and mastication/oak shrub enhancement proposed is relatively small compared to the entire river corridors, the Forest Service has a pro-active responsibility to protect the free flowing character and specific outstandingly remarkable values of the suitable/recommended rivers.

In its 1991 Stanislaus Forest Plan, the Forest Service made the commitment to ensure protection of the outstandingly remarkable values of the eligible/non-suitable segments of the Middle Fork and the Near Natural management of the river canyons proposed in lieu of recommending these segments for Wild and Scenic protection.

Even though most of the proposed fuelbreaks in the upper Middle Fork segments appear to be along existing roads and the amount of proposed mastication and hardwood/shrub treatments, as well as non-native invasive weeds treatments, in the Wild River corridors are relatively small, there is serious concern that temporary roads will be needed to provide for access and mechanized treatment. Roads are prohibited in Wild River corridors. Even existing roads with newly established wide fuel breaks on each side could be quite visible from the river corridor and harm the rivers' outstandingly remarkable scenery and recreation values. These treatments could also be located near and potentially adversely impact bald eagle nesting, roosting, and foraging sites (the rivers' outstandingly remarkable wildlife value). These potential impacts should be analyzed in the project NEPA review.

We strongly support the use of prescribed fire throughout the area, as long as it can be accomplished without creating permanent fuelbreaks in areas recommended for Wild River Management and in other areas managed under prescriptions that typically preclude large fuelbreaks.

4. Compliance With the Forest Plan

The Stanislaus National Forest 1991 Forest Plan provides extensive management direction for Wild Rivers that must be addressed and complied with by the SERAL Project. This includes:

Recreational Opportunity Spectrum (ROS) – Manage the Wild River corridors to the ROS class of Semi-primitive Nonmotorized. This is the adopted ROS level for all Wild Rivers outside of Wilderness.

Timber – Design special cutting methods to obtain specific Wild and Scenic River management objectives. Special cutting methods will be used to improve the quality of Wild and Scenic River resources.

Transportation and Facilities – Road construction or reconstruction is not allowed on Wild Rivers.

Visual Resources – Manage to a VQO of Retention. This is the adopted VQO level for Wild, Scenic, and Recreational Rivers which are outside of Wilderness.

In addition, the 1991 Stanislaus Plan provides specific management direction for both river canyons between the Wild and Scenic River corridor and the canyon rims. Most of the canyon surrounding the recommended Middle Fork Stanislaus Wild River is managed as Near Natural. The North Fork canyon beyond the Wild River corridor is managed as a Scenic Corridor with some areas of Near Natural.

Fish and Wildlife: Near Natural Fish and Wildlife Standards and Guidelines for Early Successional Stage Management pertinent to the SERAL Project include:

- *Designated Critical Areas for Deer* – In designated critical areas for mule deer, the objective for shrub forage species will be a minimum of 20% crown cover. Portions of the

lower North Fork and Middle Fork Stanislaus River canyons are designated critical winter range for mule deer.

- *Chaparral Burning* – Coordinate all chaparral burning projects done for fuels management purposes with wildlife management to ensure that wildlife values and objectives are considered.
- *Habitat Improvement/Restoration* – Conduct activities where necessary to improve habitats or restore habitats to natural conditions in order to meet Forest wildlife objectives. All such activities and objectives will be consistent with the overall objective of maintaining near natural conditions.

Near Natural Fish and Wildlife Standards and Guidelines for Late Successional Stage Management pertinent to the SERAL Project include:

- Conduct activities as needed to meet recovery wildlife objectives but in a way that is consistent with the overall objectives of maintaining near-natural conditions.
- Near-Natural standards and guidelines also have extensive snag retention guidance for wildlife purposes.

Timber: Near Natural timber general direction and standards and guidelines include:

- Design special cutting methods to obtain specific Near Natural management objectives.
- Special cutting methods will be used to salvage mortality or improve the quality of resources other than timber.

Roads: Near Natural Transportation and Facilities direction, standards, and guidelines include:

- Construct or reconstruct roads as needed for management activities meeting Near Natural management objectives.
- Restrict traffic to uses meeting Near Natural management objectives.
- Road construction will be designed to meet Near Natural management objectives. Location, design, and construction standards will protect soil, watershed, fisheries, and other resource values.
- Prohibit traffic other than for projects meeting Near Natural management objectives.

Visual Quality: Near Natural Visual Resource general direction, standards, and guidelines include:

- Provide a high quality visual setting where changes are not readily apparent.
- Manage to a VQO of Retention. This is the adopted VQO level for Near Natural as shown on the VQO Map (I-8).

Wild & Scenic Rivers: Near Natural general direction, standards, and guidelines for Wild & Scenic Rivers include:

- Protect Wild and Scenic River values of eligible river segments proposed for Near Natural Alternate Management (see EIS Appendix E, Wild and Scenic Study).
- Manage to Near Natural guidelines, all or portions of the following segments that are within Near Natural: Middle Fork Stanislaus Segments 8 and 10…

Wilderness: Near Natural Wilderness general direction includes:

- Conduct Roadless Area Reviews as necessary.

5. Middle Fork Stanislaus River Wild Trout Water

A 4.4-mile segment of the Middle Fork Stanislaus River from the Beardsley Afterbay Dam to the Sand Bar Diversion Dam is a state-designated Wild Trout Water. This constitutes the outstandingly remarkable fish value that contributed to the eligibility of Middle Fork segment 10. State goals for the Heritage and Wild Trout program include protecting and restoring native trout and their habitats, conducting research and evaluating angling regulations, and engaging the public.[4]

According to the Middle Fork Stanislaus River Wild Trout Management Plan:

> The area is aesthetically pleasing and anthropogenic impacts are rarely evident. Land management practices are limited in scope and duration. This section meets USFS criteria for Recreation Opportunity Spectrum class of semi-primitive, non-motorized. Modified timber harvest methods may be employed to enhance recreation of for salvage purposes. The plan also cites the Forest Service's "near-natural" management for the river canyon. (pg. 4, CDFW, April 2016)

This underscores the need to assess proposed SERAL Project activities in the draft EIS to identify and avoid, or at least mitigate, potential impacts on the river and its wild trout resources.

6. Lower Middle Fork Stanislaus River De-Facto Roadless Area

There appears to be a de-facto roadless area (not previously identified in RARE II or the 1991 Forest Plan) encompassing the Middle Fork Stanislaus canyon downstream of Sand Bar that also encompasses a short segment of the North Fork Stanislaus upstream of the Middle Fork confluence and the short segment of the main stem Stanislaus to Clark Flat. Indications of this de-facto roadless area include the proposed Wild classification of these recommended river segments, the ROS Semi-primitive Nonmotorized classification of the broader river canyons, the overall Near Natural management for the broader river canyons, the retention VQO for the canyons, and examination of the USFS Stanislaus and Crandall Peak 7.5 topo quads.

Management direction for these canyons calls for conducting roadless area reviews as necessary. The SERAL Project DEIS should recognize this de-facto roadless area and assess the project's potential impact on the area's roadless qualities.

C. Use of Designation by Prescription (DxP) and Designation by Description (DxD) to Implement Logging Treatments

We are concerned about the use of Designation by Prescription (DxP) and Designation by Description (DxD) applied to the marking of trees to be logged. This approach relies on a written description to be used by the logger to judge for themselves which trees in a stand should be removed. Our experience indicates that there are limited circumstances where these written approaches to "marking" trees to remove are acceptable. For example, we have seen DxD used

[4] https://wildlife.ca.gov/Conservation/Inland-Fisheries/Wild-Trout

successfully in timber stand improvement that focused on the removal of sub-merchantable material.

The scoping package (p. 10) indicates the intention "to produce a mosaic of individual trees, clumps of trees, and openings (ICO structure) of various sizes, similar to what was once found in historical forests prior to logging and fire suppression." We believe that these outcomes can only be achieved by the Forest Service marking the trees to be removed. If the use of DxD or DxP is intended in the SERAL project, we ask that it be described how the variable density and ICO objectives will be met using these approaches to tree selection and to provide examples of successful applications of these non-marking approaches to achieving similar habitat objectives.

D. Protecting Old Forest Habitats by Limiting the Removal of Large Tress

Recent large landscape studies on historical forest conditions in the Sierra Nevada have consistently identified a deficit of trees >24" DBH (Dolanc et al. 2014, McIntyre et al. 2015, Stephens et al. 2018, Easterday et al. 2018). Specifically, Dolanc et al. (2014) found a significant deficit of >24" in diameter trees of all species associated with mixed conifer forests, except for Douglas fir and incense cedar, which were found to be at historical levels. McIntyre et al. (2015) also found a 30% decline (244 ft^2/acre to 168 ft^2/acre) in basal area from historical conditions. In addition to historical logging, McIntyre et al. (2015) suggest that the loss of large trees may be associated with fire suppression, the dynamics between small tree competition for large tree resources at differing soil depths, pollution, and/or climatic water deficit. Regardless, higher density forests dominated by large trees were not historically uncommon on the landscape.

This potential deficit of large trees should be examined in the project area and any deficit be quantified. Stand prescriptions should be designed to avoid the removal of larger trees if their numbers are below the upper limit of the historical range of variability.

E. Sierran Marten

Sierra marten (*Martes caurina sierrae*) is a Forest Sensitive Species and is a Species of Conservation Concern on national forests to the south of the Stanislaus. The Species of Conservation Concern account completed for the forest plan revision process on the Sierra National Forest for Sierran marten found that:

> Martens are extremely sensitive to the loss and fragmentation of mature forest habitat (Zielinski 2014). From a relatively continuous higher elevation distribution in the early 1900s, marten have retracted to isolated and discontinuous populations (Zielinski et al.2005). Marten are impacted by loss of contiguous old forest breeding habitat from multiple sources, including timber harvest/thinning, vegetation management, extensive tree mortality resulting from drought-mediated insect and disease, and wildfire. Climate change also poses a serious threat due to the predicted increase in higher elevation fires. Recreational activities and roads (with associated roadkill) further increase habitat fragmentation. Additionally, the use of illegal rodenticide poisons to protect marijuana

> plantations is present throughout the marten's range in the Sierra Nevada (Gabriel et al. 2012). [USDA Forest Service 2019, p. 67][5]

Additional information in that species account indicates that martens:

> primarily occupy mature coniferous forests, typically more mesic than xeric (Buskirk and Powell 1994), supporting large-diameter trees and snags, multi-layered canopies (Fuller 2006), large downed logs, moderate-to-high canopy closure, structurally diverse and complex understory and interspersed riparian areas and meadows. These features provide resting and denning sites, as well as escape and thermal cover." The account also notes that "Martens demonstrate a high sensitivity to loss and fragmentation of mature forest habitat, seldom occupying an area after more than 30 percent of mature forest has been harvested (Bissonette et al. 1997, Potvin et al. 2000). Indeed, Moriarty et al. (2011) postulate that even the total amount of habitat may not be the most important determinant of marten occurrence. Rather, attributes of the landscape like core patch size, distance and spatial configuration of patches and microhabitat features within patches may be very important (Hargis et al. 1999). Vegetation management activities must therefore be cognizant of these elements, many of which occur in the understory. (Ibid, p. 67)

Changes in habitat that create barriers to movement are of concern. The account found that:

> Although talus fields are occasionally used, martens usually avoid open areas, and even small openings less than 50 meters (164 feet) across negatively affect use of an area by martens (Heinemeyer 2002). This behavior is attributed to predator avoidance. How marten use the habitat via movements, both seasonally and daily, appears to coincide with prey availability (Zielinski et al. 1983). Microtine rodents are particularly common dietary items, with birds, squirrels, and vegetation also reported (Martin 1994). (Ibid., p. 68)

Habitat features that support denning and resting are especially important for this species.

> Marten appear to be very sensitive to removal of key resting and breeding habitat features from their home ranges. Moriarty et al. (2011) provide compelling evidence for a decline in the marten population on the Sagehen Experimental Forest (SEF) affected by the loss and fragmentation of habitat associated with decades-long timber harvest that consisted of clear-cut, shelterwood and salvage sales. This study documented a substantial decline in the number of martens detected. Key factors contributing to decline in marten numbers on the Sagehen site included decreases in habitat patch size, acres of core habitat area, total marten habitat and an increase in the distance between habitat patches (Moriarty et al. 2011). Loss and fragmentation of suitable habitat in the form of large live and dead/dying trees reduce availability of resting/denning sites (Moriarty et al. 2011). Reduced understory complexity may affect prey habitat and indirectly reduce the ability of marten to forage effectively (Moriarty et al. 2011, 2016); marten movement dynamics

[5] Refer to the Species of Conservation Concern report (USDA Forest Service 2019) for the full citations in the quoted sections.

> change as forest complexity declines, which results from alterations in foraging strategy and predator avoidance behavior. (Ibid., p. 68)

Habitat structure and arrangement is also critical for this species.

> Andruskiw et al. (2008) concluded that vegetation management actions reducing understory complexity have implications for marten prey as well as reducing the ability of martens to forage effectively. This effect was particularly notable in regenerating stands as opposed to older uncut stands. The same understory effects may also function to decrease marten escape cover, rendering them more visible to predators (Drew 1995). In general, martens avoid stands with simplified structure (Moriarty et al. 2016) and may use habitat differently in the summer as opposed to the winter (Zielinski et al. 2015). (Ibid., p. 68)

Given these documented risks from vegetation management, the Forest Service must take a detailed and careful look at the likely impacts on the marten and its habitat of implementing the proposed action. The analysis should address, at a minimum, the following issues.

- The Forest Service should disclose the amount of marten denning/resting and traveling/foraging habitat currently within the project planning area and the amount of such habitat that will be logged, degraded, and/or rendered unsuitable.

- The Forest Service should disclose the impact of creating open stand conditions and openings on marten use of the affected areas.

- The Forest Service should disclose the existence of marten within the planning area. The Forest Service should disclose and discuss any local survey information that indicates presence or absence of marten within the planning area.

- The Forest Service should disclose the impacts on marten distribution and viability of removing medium-large trees and large snags and down wood and decreasing canopy cover within the planning area.

- The Forest Service should disclose the impacts of proposed logging on marten habitat connectivity and on the fragmentation of existing habitat.

The plan components in the SNFPA (USDA Forest Service 2004) designed to address CSO were also intended to benefit other old forest associated species like Sierra marten. The effects of the proposed forest plan amendment on marten should also be evaluated in the EIS.

F. Range of Alternatives

The environmental analysis for the Project should analyze in detail a full range of reasonable alternatives, including alternatives involving less intensive logging than currently proposed. In particular, the Forest Service should analyze an alternative that limits tree removal to trees 20

inches DBH or less to allow the comparison of less intensive yet as effective treatments to reduce fire risk and increase resiliency. Because the project proposes a project specific forest plan amendment, the EIS must also evaluate an alternative that implements the current, unamended forest plan.

Thank you for considering our comments. If you have questions, please contact Greg Suba (916-622-2816; greg@sierraforestlegacy.org).

Sincerely,

Greg Suba
Conservation Biologist
Sierra Forest Legacy

Susan Britting, Ph. D.
Executive Director
Sierra Forest Legacy

Steve Evans
California Wilderness Coalition

Laura Cunningham
California Director
Western Watershed Project

Don Rivenes
Conservation Chair
Sierra Foothills Audubon Society

Jerry Bloom
Science Director
Forest Issues Group

Nick Jensen
Lead conservation Scientist
California Native Plant Society

Pamela Flick
California Program Director
Defenders of Wildlife

Shane Dante
Watershed Conservation Advocate
Foothill Conservancy

References

Agee, J.K. and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management. 211: 83-96.

Blakey, R.V., R.B. Siegel, E.B. Webb, C.P. Dillingham, R.L. Bauer, M. Johnson, and D.C. Kesler. 2019. Space use, forays, and habitat selection by California spotted owls (*Strix occidentalis occidentalis*) during the breeding season: new insights from high resolution GPS tracking. Forest Ecology and Management 432:912-922.

Caggiano, M. D. 2019. Collaboratively Engaging Stakeholders to Develop Potential Operational Delineations. CFRI-1908. https://cfri.colostate.edu/wp-content/uploads/sites/22/2019/08/PODs-Collaborative-Engagement-Final-Report.pdf

Collins, B.M., S.L. Stephens, G.B. Roller, and J.J. Battles. 2011. Simulating fire and forest dynamics for a landscape fuel treatment project in the Sierra Nevada. Forest Science 57:77-88.

Dolanc, C.R., H.D. Safford, J.H. Thorne, and S.Z. Dobrowski. 2014. Changing forest structure across the landscape of the Sierra Nevada, CA, USA since the 1930s. Ecosphere 5:101.

Easterday, K., P. McIntyre, and M. Kelly. 2018. Land ownership and 20th century changes to forest structure in California. Forest Ecology and Management 422:137-146.

Fleischman et al. 2020. US Forest Service Implementation of the National Environmental Policy Act: Fast, Variable, Rarely Litigated, and Declining. Journal of Forestry 118 (4): 403-418.

Fry, D., Battles, J. J., Collins, B., M., and Stephens, S. L. 2015. Appendix A: Fire and Forest Ecosystem Health Team Final Report. Sierra Nevada Adaptive Management Project. University of California, Berkeley, CA. August 31, 2015.

Gutiérrez, R.J.; Manley, Patricia N.; Stine, Peter A., tech. eds. 2017. The California spotted owl: current state of knowledge. Gen. Tech. Rep. PSW-GTR-254. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 294 p.

Jones, G.M., Gutiérrez, R.J., Tempel, D.J., Whitmore, S.A., Berigan, W.J. and Peery, M.Z., 2016. Megafires: an emerging threat to old-forest species. *Frontiers in Ecology and the Environment*, *14*(6), pp. 300-306.

McIntyre, P.J., J.H. Thorne, C.R. Dolanc, A.L. Flint, L.E. Flint, M.Kelly, and D.D. Ackerly. 2015. Twentieth-century shifts in forest structure in California: Denser forests, smaller trees, and increased dominance of oaks. PNAS doi/10.1073/pnas.1410186112.

Meyer, Marc D., and North, Malcolm P. 2019. Natural range of variation of red fir and subalpine forests in the Sierra Nevada bioregion. Gen Tech. Rep. PSW-GTR-263. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

North, M., P. Stine, K. O'Hara, W. Zielinski, and S. Stephens. 2009. An ecosystem management strategy for Sierra mixed conifer forests. USDA Forest Service, General Technical Report PSW-GTR-220. Pacific Southwest Research Station, Albany, California.

North, Malcolm, ed. 2012. Managing Sierra Nevada forests. Gen. Tech. Rep. PSW-GTR-237. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 184 pp.

North, M., JT Stevens, DF Greene, M Coppoletta, EE Knapp, AM Latimer, Christina M Restaino, Ryan E Tompkins, Kevin R Welch, Rob A York, Derek JN Young, Jodi N Axelson, Tom N Buckley, Becky L Estes, Rachel N Hager, Jonathan W Long, Marc D Meyer, Steven M Ostoja, Hugh D Safford, Kristen L Shive, Carmen L Tubbesing, Heather Vice, Dana Walsh, Chhaya M Werner, Peter Wyrsch. 2019. Tamm Review: Reforestation for resilience in dry western US forests. Forest Ecology and Management 432, 209-224.

Prichard, S.J., Povak, N.A., Kennedy, M.C. and Peterson, D.W., 2020. Fuel treatment effectiveness in the context of landform, vegetation, and large, wind-driven wildfires. Ecological Applications.

Safford, Hugh D.; Stevens, Jens T. 2017. Natural range of variation for yellow pine and mixed-conifer forests in the Sierra Nevada, southern Cascades, and Modoc and Inyo National Forests, California, USA. Gen. Tech. Rep. PSW-GTR-256. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 229 pp.

Seamans, M. E., & Gutiérrez, R. J. (2007). Habitat selection in a changing environment: The relationship between habitat alteration and spotted owl territory occupancy and breeding dispersal. *Condor*, *109*(3), 566-576. https://doi.org/10.1650/8352.1

Stephens, S.L., J.T. Stevens, B.M. Collins, R.A. York., and J.M. Lydersen. 2018. Historical and modern landscape forest structure in fir (Abies)-dominated mixed conifer forests in the northern Sierra Nevada, USA. Fire Ecology doi.org/10.1186/s42408-018-0008-6.

Stratton, R. D. 2020. The Path to Strategic Wildland Fire Management Planning. Wildfire 29:1. https://www.iawfonline.org/wp-content/uploads/2020/01/Wildfire-2020-01-Strategic-fire-management-Stratton.pdf

Thompson, J.R. and Spies, T.A. 2009. Vegetation and weather explain variation in crown damage within a large mixed-severity wildfire. Forest Ecology and Management, 258(7), pp.1684-1694.

Tubbesing, C.L., Fry, D.L., Roller, G.B., Collins, B.M., Fedorova, V.A., Stephens, S.L. and Battles, J.J., 2019. Strategically placed landscape fuel treatments decrease fire severity and promote recovery in the northern Sierra Nevada. Forest ecology and management, 436, pp.45-55.

USDA Forest Service 1991. Stanislaus National Forest Plan, Record of Decision.

USDA Forest Service 2004. Sierra Nevada Forest Plan Amendment, Record of Decision. Pacific Southwest Region. January 2004.

USDA Forest Service 2018. Revised Draft Land Management Plan for the Sierra National Forest. Pacific Southwest Region. R5-MB-319.

USDA Forest Service 2019. Conservation Strategy for the California Spotted Owl in the Sierra Nevada. Version 1.0. Pacific Southwest Region. R5-TP-043. April 2019.

USDI Fish and Wildlife Service 2009. Regulatory and Scientific Basis for U.S. Fish and Wildlife Service Guidance for Evaluation of Take for Northern Spotted Owls on Private Timberlands in California's Northern Interior Region.

USDI Fish and Wildlife Service 2012. Protocol for surveying proposed management activities that may impact northern spotted owls.

Table 1. Summary of the results from studies on California spotted owl demographics and habitat selection.

Study	Study Location(s), Sample Size and Unit, and Period	Parameter	Habitat Selection
Blakesley et al. (2005)	Lassen Demographic Study Area, 63 territories, 11 years	Occupancy (pair or single)	The amount of nest area dominated by large trees (>24 in dbh) and canopy cover >70% was positively associated with site occupancy. The amount of nest area dominated by medium- trees (12-24 in dbh) with canopy cover >70% and the amount of area unforested or dominated by small trees (6-12 in dbh) were negatively associated with site occupancy.
		Survival	Apparent survival increased with greater amounts of forest dominated by large trees (>24 in dbh) with normal (40-70%) to good (>70%) canopy cover containing large (>30 in dbh) remnant trees.
		Reproduction	Reproduction decreased as the amount of nest area that was unforested or dominated by small trees increased.
		Nest Success	Nest success was higher when large remnant trees were present in the nest stand.
Seamans and Gutierrez (2007)	Eldorado Demographic Study Area, 66 territories, 15 years	Extinction	The amount of conifer forest dominated by medium (12-24 in dbh trees) and large trees (>24 in dbh) with >70% canopy cover was negatively correlated with the probability of territory extinction.
		Colonization	The amount of conifer forest dominated by medium (12-24 in dbh trees) and large trees (>24 in dbh) with >70% canopy cover was positively correlated with the probability of territory colonization.
Roberts et al. (2011)	Yosemite National Park, 16 burned and 16 unburned territories, 2-14 years post-fire	Occupancy (pair)	The top model suggested that nest and roost site occupancy were best predicted by the combined positive effect of basal area and the negative effect of coarse woody debris. However, there was also support for an alternative model suggesting that higher canopy closure and tree basal area were also useful predictors of nest and roost site occupancy.
Tempel et al. (2014)	Eldorado Demographic Study Area, 70 territories, 20 years	Reproduction	Reproduction was negatively related to the area of hardwood forest with <10% conifer canopy cover.
		Survival	The amount of high (>70%) canopy cover forest dominated by 12-24 in and >24 in dbh trees occurred in the top-ranked models for survival, territory extinction, and territory colonization rates, and explained more variation in population growth rate and equilibrium occupancy than other covariates. Forests dominated by trees >24 in dbh and <30% canopy cover were not associated with demographic parameters.
		Extinction	
		Colonization	
		Occupancy (single or pair)	

Study	Study Location(s), Sample Size and Unit, and Period	Parameter	Habitat Selection
Tempel et al. (2016)	Lassen, Eldorado, Sierra, and Sequoia-Kings Canyon demographic study areas, 275 territories, 19 years	Extinction	Forests with high (>70%) and medium (40-70%) canopy cover were the only habitat covariates that were consistently identified as important for all four study areas. Occupancy reached its lowest value when high and medium canopy cover were minimized and occupancy reached its highest value when these covariates were maximized. Occupancy for the 40–49% canopy cover class was lower than occupancy for the 50–59% and 60–69% canopy cover classes. Occupancy rates are likely to be negatively affected if canopy cover is consistently reduced to 40%.
		Colonization	
		Occupancy (single or pair)	
North et al. (2017)	Sequoia-Kings Canyon, Eldorado, and Sierra demographic study areas and Tahoe National Forest, 316 territories, sites that were occupied by an owl pair at least once between 2001 and 2013	Occupancy (pair)	Across the four study areas, the average values of total canopy cover and cover in trees >48 m (157 ft) was highest at nest sites, and consistently decreased as area expanded to PACs, territories and then the surrounding landscape. A similar trend of decreasing values from nest sites to landscape was identified for the 32–48 m (105-157 ft) strata on the three National Forest study areas but not on Sequoia-Kings Canyon. The amount of cover of trees in the 2-16 m (7-52 ft) height strata was lowest near nest sites and decreased as area expanded to PACs, territories, and then the surrounding landscape.
Jones et al. (2017)	Lassen, Eldorado, Sierra, and Sequoia-Kings Canyon demographic study areas, 275 territories, 19 years	Extinction	Extinction rates increased as the amount of forest characterized by large trees (≥24 in dbh) and high canopy cover (>70% cover) decreased. Median proportion of an owl site containing large trees and high canopy cover forest on national forests ranged from 0.03-0.06, corresponding with higher predicted rates of local extinction and ongoing declines in occupancy. The median proportion of forest characterized by large trees and high canopy cover in owl territories on Sequoia-Kings Canyon was 0.19, which had a lower predicted extinction rate and stable occupancy.
		Occupancy (pair or single)	
Blakey et al. (2019)	Plumas National Forest, 15 owls, 3 years	Roosting and Foraging	Owls selected against roosting and foraging sites with <50% canopy cover, selected for areas with >70% cover, and used areas with 50 -70% cover in proportion to availability. They also selected against areas dominated by trees <12 in dbh.
Atuo et al. (2019)	Northern and Central Sierra Nevada, 53 owls, 1 year	Home Range Size	Home range sizes increased as spatial heterogeneity and elevation increased and decreased as with increasing amounts of forest with >50% canopy cover and QMD 11-13 inches.

Study	Study Location(s), Sample Size and Unit, and Period	Parameter	Habitat Selection
Hobart et al. (2019a)	Northern and Central Sierra Nevada, 151 owl sites, 5 years	Occupancy	Probability of initial site occupancy increased as elevation decreased. Probability of a site being colonized or remaining occupied declined with increasing elevation, younger forest, and open area. Probability of a site being colonized or remaining occupied was lowest when previously unoccupied, and highest when previously occupied with successful reproduction.
		Reproduction	Probability of reproduction increased as elevation decreased, when territories had more north-facing slope, and more younger forest with high basal area of hardwoods.
Hobart et al. (2019b)	Across the Sierra Nevada Bioregion	Extinction	Territory extinction probability was lower when owl diets contained more woodrats and pocket gophers
		Home Range	Home range sizes decreased as the dietary proportion of woodrats and pocket gophers increased.

Table 2. Summary of results from studies on the effects of logging and fuel reduction on spotted owl demographics.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Demographic Parameter)
Seamans and Gutierrez (2007)	Eldorado Demographic Study Area, 66 territories, 15 years.	High Severity Fire (including salvage), Logging	Extinction	**Negative** - Alteration of ≥50 acres of mature conifer forest was positively correlated with territory extinction probability.
			Colonization	**Negative** - Probability of colonization was related to the amount of mature conifer forest habitat in the territory and the alteration of such habitat reduced the probability of colonization.
Clark et al. (2013)	Southwest Oregon, 31 burned/103 unburned territories, up to 15 years pre-fire and 4-5 years post-fire.	Logging, High Severity Fire, Salvage Logging	Extinction	**Negative** - Probability of extinction increased due to the interactive effect of past timber harvest, high severity fire, and salvage logging.
			Colonization	**Unclear** - Few colonization events were observed.
			Occupancy (pair)	**Negative** - Declines in occupancy were driven by increases in extinction, attributable to past timber harvest, high severity fire, and salvage logging.
Tempel et al. (2014)	Eldorado Demographic Study Area, 70 territories, 20 years.	High-intensity Logging, Wildfire (including salvage), and Medium-intensity Logging.	Reproduction	**Negative** - Medium-intensity timber harvests characteristic of proposed fuel treatments were negatively related to reproduction of Spotted Owls in our study. Reproduction appeared sensitive to modest amounts of medium-intensity harvests, and was predicted to decline from 0.54 to 0.45 when 20 ha were treated.
			Survival	**Negative** - Medium-intensity logging, when implemented in high canopy cover forests, was associated with reductions in survival.
			Extinction	**Positive** - Extinction was negatively correlated with the area of high-intensity timber harvest. High intensity timber harvest occur on 5.4% of the total area within owl territories in the study.
			Colonization	**Negative** - Medium-intensity logging, when implemented in high canopy cover forests, were associated with reductions in colonization.
			Occupancy (single or pair)	**Negative** - Equilibrium occupancy was negatively correlated with wildfire.
Stephens et al. (2014)	Plumas National Forest, 8 territories, 4-5 years pre-treatment, 3-4 years post-treatment	Group Selection and Fuels Treatments	Occupancy (single or pair)	**Negative** - By 3–4 years post-treatment, the number of occupied sites declined decline by 43% from the pretreatment numbers.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Demographic Parameter)
Tempel et al. (2015)	Tahoe National Forest, 4 territories, modeled 30 years post-treatment.	Fuels Treatment, Wildfire	Fitness	**Negative** - Fuels treatment had a negative effect on fitness, an effect that was still present after 30 years of simulated forest growth. **Negative** - Simulated wildfire without fuels treatment negatively affected fitness. **Negative** - Fuels treatment with simulated wildfire negatively affected fitness, but the effect was not a great as the effect of simulated wildfire without fuels treatment.
			Occupancy (single and pair)	**Negative** - Fuels treatment alone had a negative effect on equilibrium occupancy, an effect that was still present after 30 years of simulated forest growth. **Negative** - Simulated wildfire without fuels treatment negatively affected equilibrium occupancy. **Negative** - Simulated wildfire with fuels treatment negatively affected equilibrium occupancy, but the effect was not a great as the effect of simulated wildfire without fuels treatment.
Tempel et al. (2016)	Lassen, Eldorado, Sierra, and Sequoia-Kings Canyon demographic study areas, 275 territories, 19 years.	Wildfire (including salvage on National Forests), Prescribed Fire, Logging	Extinction	**Positive** - On the ELD study area, logging less than 1% of a territory in the previous 3 years was negatively correlated with extinction. **Neutral** - No support for an effect of logging less than 1% of a territory in the previous 3 years was detected for the LAS or SIE study areas. **Positive** - On the SKC study area, wildfire was negatively related to extinction. **Neutral** - No support for an effect of wildfire was detected on the ELD, LAS, or SIE study areas.
			Colonization	**Neutral** - No support for an effect of logging less than 1% of a territory in the previous 3 years was detected for the ELD, LAS, or SIE study areas. **Negative** - On the SKC study area, prescribed fire was negatively associated with colonization.
			Occupancy (single or pair)	**Neutral** - No support for an effect of logging when less than 1% of a territory was logged in the previous 3 years for the LAS, or SIE study areas. **Positive** - On the ELD study area, logging less than 1% of a territory in the previous 3 years was positively associated with occupancy.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Demographic Parameter)
Jones (2019)	Lassen, Eldorado, Sierra, and Sequoia-Kings Canyon demographic study areas, 275 territories, modeled forward from 2012 -2064.	Wildfire and Fuel Reduction Treatments	Occupancy (single or pair)	**Negative** - Treatments that converted CWHR 5D to 5M negatively affected occupancy. There were uniform benefits to midcentury occupancy when treatments were excluded from owl territories, compared to a no-treatment scenario. When treatments occurred within territories, benefits were greater when treatments were designed to avoid modifying large tree/high canopy cover forest.

Table 3. Summary of the results from studies on the effects of fire and salvage logging on spotted owl demographics.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Parameter)
Bond et al. (2002)	Shasta-Trinity, Klamath, San Bernardino, Coconino, and Gila National Forests, 11 burned and >300 unburned territories, 9-16 years for unburned and 1 year post-fire for burned territories.	Wildfire	Survival	**Neutral** - No difference in survival was detected between burned and unburned territories.
			Reproduction	**Positive** - Reproductive success was higher in burned territories the year following fire than in unburned territories.
			Fidelity	**Neutral** - No difference in fidelity was detected between burned and unburned territories.
Jenness et al. (2004)	Coconino, Gila, Coronado, and Lincoln National Forests, 33 burned and 31 unburned territories, 1-4 years post-fire.	Wildfire and Prescribed Fire	Reproduction	**Negative** - Unburned territories tended to be occupied by pairs and more reproductive pairs than burned territories.
			Occupancy (single or pair)	**Negative** - Probability of occupancy was higher in unburned sites compared to burned sites.
Seamans and Gutierrez (2007)	Eldorado Demographic Study Area, 66 territories, 15 years.	High Severity Fire (including salvage), Logging	Extinction	**Negative** - Alteration of ≥50 acres of mature conifer forest was positively correlated with territory extinction probability.
			Colonization	**Negative** - Probability of colonization was related to the amount of mature conifer forest habitat in the territory and the alteration of such habitat reduced the probability of colonization.
Clark et al. (2011)	Southwest Oregon, 23 radio-marked birds, years 3 and 4 post-fire.	Wildfire (including salvage)	Survival	**Negative** - Average annual survival of owls living inside burn perimeters (also salvage logged) was lower than outside the burn perimeters and was lower than survival rates of spotted owls in all other areas with survival estimates at the time of the study.
Roberts et al. (2011)	Yosemite National Park, 16 burned and 16 unburned territories, 2-14 years post-fire.	Wildfire and Prescribed Fire	Occupancy (pair)	**Neutral** - Fire did not reduce the probability of occupancy.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Parameter)
Lee et al. (2012)	Sierra Nevada-wide, 41 burned/145 unburned territories, up to 7 years post-fire.	Wildfire (including salvage)	Extinction	**Neutral** - No significant difference between burned and unburned sites in probability of local extinction.
			Colonization	**Neutral** - No significant difference between burned and unburned sites in probability of colonization.
			Occupancy (single or pair)	**Neutral** - No significant effect of high severity fire on occupancy.
Clark et al. (2013)	Southwest Oregon, 31 burned/103 unburned territories, up to 15 years pre-fire and 4-5 years post-fire.	Logging, High Severity Fire, Salvage Logging	Extinction	**Negative** - Probability of extinction increased due to the interactive effect of past timber harvest, high severity fire, and salvage logging.
			Colonization	**Unclear** - Few colonization events were observed.
			Occupancy (pair)	**Negative** - Declines in occupancy were driven by increases in extinction, attributable to past timber harvest, high severity fire, and salvage logging.
Lee et al. (2013)	San Bernardino National Forest, 78 unburned/58 burned territories, 9 years for unburned and 8 years post-fire for burned territories.	High Severity Fire, Salvage Logging	Extinction	**Negative** - Average annual extinction probability was higher in burned territories, increased as the amount of habitat that burned at high severity increased, and increased as the amount of habitat that was salvage logged increased.
			Colonization	**Negative** - Mean annual probability of colonization was lower in burned sites than unburned sites, but was not affected by salvage logging.
			Occupancy (single and pair)	**Negative** - When >50 ha of forested habitat burned at high severity, site occupancy probability decreased by 0.003 for every additional hectare of forested habitat severely burned and post-fire salvage logging exacerbated the effect by decreasing occupancy probability an additional 0.05.
Tempel et al. (2014b)	Eldorado Demographic Study Area, 70 territories, 20 years.	High-intensity Logging, Wildfire (including salvage), and Medium-intensity Logging	Reproduction	**Negative** - Medium-intensity timber harvests were negatively related to reproduction. Reproduction was sensitive to modest amounts of medium-intensity harvests.
			Survival	**Negative** - Medium-intensity logging, when implemented in high canopy cover forests, was associated with reductions in survival.
			Extinction	**Positive** - Extinction was negatively correlated with the area of high-intensity timber harvest.
			Colonization	**Negative** - Medium-intensity logging, when implemented in high canopy cover forests, were associated with reductions in colonization.
			Occupancy (single or pair)	**Negative** - Equilibrium occupancy was negatively correlated with wildfire.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Parameter)
Lee and Bond (2015a)	Stanislaus National Forest, 45 territories, 1 year post-fire.	High Severity Fire	Occupancy (single and pair)	**Neutral** - Probability of occupancy of a single individual 1 year post-fire was relatively high, compared to other studies on the species in burned or unburned forest in the Sierra Nevada, with most sites being occupied by pairs.
Lee and Bond (2015b)	San Bernardino National Forest, 76 unburned/52 burned, 9 years for unburned and 4-8 years post-fire for burned territories.	High Severity Fire, Salvage Logging	Reproduction	**Neutral** - No significant effect of fire or logging on reproduction were detected.
			Occupancy (single or pair)	**Negative** - Occupancy was lower in burned vs. unburned sites and was further reduced by the amount of salvage logging that occurred.
Tempel et al. (2016)	Lassen, Eldorado, Sierra, and Sequoia-Kings Canyon demographic study areas, 275 territories, 19 years.	Wildfire (including salvage on National Forests), Prescribed Fire, Logging	Extinction	**Positive** - On the ELD study area, logging less than 1% of a territory in the previous 3 years was negatively correlated with extinction. **Neutral** - No support for an effect of logging less than 1% of a territory in the previous 3 years was detected for the LAS or SIE study areas. **Positive** - On the SKC study area, wildfire was negatively related to extinction. **Neutral** - No support for an effect of wildfire was detected on the ELD, LAS, or SIE study areas.
			Colonization	**Neutral** - No support for an effect of logging less than 1% of a territory in the previous 3 years was detected for the ELD, LAS, or SIE study areas. **Negative** - On the SKC study area, prescribed fire was negatively associated with colonization.
			Occupancy (single or pair)	**Neutral** - No support for an effect of logging when less than 1% of a territory was logged in the previous 3 years for the LAS, or SIE study areas. **Positive** - On the ELD study area, logging less than 1% of a territory in the previous 3 years was positively associated with occupancy.
Jones et al. (2016)	Eldorado demographic study area, 15 unburned/30 burned territories, 22 years pre-fire/1 year post-fire.	High Severity Fire	Extinction	**Negative** - Probability of extinction increased as the proportion of high-severity fire increased and extinction was 7 times more likely in territories that burned with >50% high severity.
			Colonization	**Negative** - Sites that burned at <50% high-severity were more likely to be colonized after the fire than unburned territories or territories that burned with <50% high severity.
			Occupancy (single or pair)	**Negative** - Probability occupancy was nine times lower for territories that burned with >50% high-severity fire effects than unburned sites.

Study	Study Location(s), Sample Size and Unit, and Period	Disturbance Type(s) Evaluated	Parameter	Response (Effect on Parameter)
Rockweit et al. (2017)	Klamath Province, 24 burned/70 unburned territories, 26 years for unburned and 4-26 years post-fire for burned territories.	Wildfire	Survival	**Negative** - As the total amount of high severity and moderate severity fire effects increased, apparent survival decreased.
			Recruitment	**Neutral or Positive** - There was no significant difference between post-fire recruitment rates and the control group, except for owls affected by wildfire in 2008, where recruitment rates increased.

Atuo, F.A., K. Roberts, S. Whitmore, B.P. Dotters, M.G. Raphael, S.C. Sawyer, J.J. Keane, R.J. Gutierrez, and M.Z. Peery. 2019. Resource Selection by GPS-tagged California spotted owls in mixed-ownership forests. Forest Ecology and Management 433:295-304.

Blakesley, J.A., B.R. Noon, and D.R. Anderson. 2005. Site occupancy, apparent survival, and reproduction of California spotted owls in relation to forest stand characteristics. Journal of Wildlife Management 69:1554-1564.

Bond, M.L., R.J. Gutiérrez, A.B. Franklin, W.S. LaHaye, C.A. May, and M.E. Seamans. 2002. Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and reproductive success. Wildlife Society Bulletin 30:1022-1028.

Clark, D.A., R.G. Anthony, and L.S. Andrews. 2011. Survival rates of northern spotted owls in post-fire landscapes of southwest Oregon. Journal of Raptor Research 45:38-47.

Clark, D.A., R.G. Anthony, and L.S. Andrews. 2013. Relationship between wildfire, salvage logging, and occupancy of nesting territories by northern spotted owls. Journal of Wildlife Management 77:672-688.

Hobart, B.K., K.N. Roberts, B.P. Dotters, W.J. Berigan, S.A. Whitmore, M.G. Raphael, J.J. Keane, R.J. Gutierrez, and M.Z. Peery. 2019a. Site occupancy and reproductive dynamics of California spotted owls in a mixed-ownership lanscape. Forest Ecology and Management 437:188-200

Hobart, B.K., G.M. Jones, K.N. Roberts, B.P. Dotters, S.A. Whitmore, W.J. Berigan, M.G. Raphael, J.J. Keane, R.J. Gutierrez, and M.Z. Peery. 2019. Trophic interactions mediate the response of predator populations to habitat change. Biological Conservation 238:108217

Jenness, J.S., P. Beier, and J.L. Ganey. 2004. Associations between forest fire and Mexican spotted owls. Forest Science 50:765-772.

Jones, G.M., R.J. Gutiérrez, D.J. Tempel, S.A. Whitmore, W.L. Berigan, and M.Z. Peery. 2016. Megafires: an emerging threat to old-forest species. Frontiers in Ecology and the Environment 14:300-306

Jones. G.M., J.J. Keane, R.J. Gutiérrez, and M.Z. Peery. 2017. Declining old-forest species as a legacy of large trees lost. Diversity and Distributions DOI: 10.1111/ddi.12682.

Lee, D.E., M.L. Bond, and R.B. Siegel. 2012. Dynamics of breeding-season site occupancy of the California spotted owl in burned forests. The Condor 114:792-802.

Lee, D.E., M.L. Bond, M.I. Borchert, and R. Tanner. 2013. Influence of fire and salvage logging on site occupancy of spotted owls in the San Bernardino and San Jacinto mountains of southern California. Journal of Wildlife Management 77:1327-1341.

Lee, D.E., and M.L. Bond. 2015a. Occupancy of California spotted owl sites following a large fire in the Sierra Nevada, California. The Condor 117:228-236.

Lee, D.E., and M.L. Bond. 2015b. Previous year's reproductive state affects spotted owl site occupancy and reproduction responses to natural and anthropogenic disturbances. The Condor 117:307-319.

North, M.P., J.T. Kane, V.R. Kane, G.P. Asner, W. Berigan, D.J. Churchill, S. Conway, R.J. Gutiérrez, S. Jeronimo, J. Keane, A. Koltunov, T. Mark, M. Moskal, T. Munton, Z. Peery, C. Ramirez, R. Sollmann, A.M. White, and S. Whitmore. 2017. Cover of tall trees best predicts California spotted owl habitat. Forest Ecology and Management 405:166-178.

Roberts S.L., J.W. van Wagtendonk, A.K. Miles, and D.A. Kelt. 2011. Effects of fire on spotted owl site occupancy in a late-successional forest. Biological Conservation 144:610-619.

Rockweit, J.T., A.B. Franklin, and P.C. Carlson. 2017. Differential impacts of wildfire on the population dynamics of an old-forest species. Ecology 98:1574-1582.

Seamans M.E., and R.J. Gutiérrez. 2007. Habitat selection in a changing environment: the relationship between habitat alteration and spotted owl territory occupancy and breeding dispersal. The Condor 109:566-576.

Stephens, S.L., S.W. Bigelow, R.D. Burnett, B.M. Collins, C.V. Gallagher, J. Keane, D.A. Kelt, M.P. North, L.J. Roberts, P.A. Stine, and D.H. Van Vuren. 2014. California spotted owl, songbird, and small mammal responses to landscape fuel treatments. BioScience 64:893-906.

Tempel, D.J., R.J. Gutiérrez, S.A. Whitmore, M.J. Reetz, R.E. Stoelting, W.J. Berigan, M.E. Seamans, and M.Z. Peery. 2014. Effects of forest management on California spotted owls: implications for reducing wildfire risk in fire-prone forests. Ecological Applications 24:2089-2106.

Tempel, D.J., R.J. Gutiérrez, J.J. Battles, D.L. Fry, Y. Su, Q. Guo, M.J. Reetz, S.A. Whitmore, G.M. Jones, B.M. Collins, and S.L. Stephens. 2015. Evaluating short-and long-term impacts of fuels treatments and simulated wildfire on an old-forest species. Ecosphere 6:1-18.

Tempel, D.J., J.J. Keane, R.J. Gutierres, J.D. Wolfe, G.M. Jones, A. Koltunov, C.M. Ramirez, W.J. Berijan, C.V. Gallagher, T.E. Munton, P.A. Shaklee, S.A. Whitmore, and MZ. Peery. 2016. Meta-analysis of California spotted owl (Strix occidentalis occidentalis) territory occupancy in the Sierra Nevada: Habitat associations and their implications for forest management. The Condor 118:747-765.

Blakey, R.V., R.B. Siegel, E.B. Webb, C.P. Dillingham, R.L Bauer, M. Johnson, and D.C. Kesler. 2019. Space use, forays, and habitat selection by California spotted owls (*Strix occidentalis occidentalis*) during the breeding season: New insights from high resolution GPS tracking.

Sample Size and Methods: Tracked 8 female and 7 male spotted owls with GPS in 2015-2017 on the Mount Hough Ranger District of the Plumas National Forest.

Results: Owls selected for >70% canopy cover in areas dominated by medium and large trees for foraging and against low and very low canopy cover dominated by small trees or open areas. There was low overlap between PACs and roost locations (<50%) and foraging space (<25%), including <5% foraging and roost locations being contained within the PAC for some owls.

Notes: Good quote from discussion (p. 920) "Based on the relatively low overlap between PAC areas and roosting and foraging habitat use by the owls we studied, we hypothesize that insufficient habitat protection from stand-altering activities outside PAC areas could partially explain ongoing population declines. Most of the habitat used by owls for roosting and foraging in our study was outside of PACs and therefore available for stand-altering forestry activities. Even where PACs protect nesting stand conditions conducive to successful reproduction, stand-altering activities elsewhere in owl home ranges may reduce occupancy or reproductive success."

Bond, M.L., D.E. Lee, R.B. Siegel, J.P. Ward. 2009. Habitat use and selection by California spotted owls in a postfire landscape. Journal of Wildlife Management DOI: 10.2193/2008-248.

Sample Size and Methods: Greenhorn Mountains and Kern Plateau. Sequoia National Forest. 2002 McNally Fire footprint. Radio telemetry of foraging habitat selection for 3 male and 4 female CSO from 4 territories during the 2006 breeding season.

Results: The vast majority of roosts were in unburned and low severity patches, but 15% of the roosts did occur in moderate and one roost may have been in high severity. "Probability that any of these 7 owls would use a site for foraging was greatest when the site was burned and was located within approximately 1 km of a nest or roost center (Fig. 1). For 5 of 7 owls, strongest selection for foraging areas was in high-severity burned forest within 1.5 km from the center of their foraging ranges. Although selection of burned forest for foraging was strong, high standard errors indicate selection was variable among owls."

Notes: Based on maps provided by Monica, salvage did occur in the area, especially near the center of one of the territories. From an eyeball analysis, several birds appear to be foraging along the perimeters of a salvaged areas.

Statistical analysis used a sample size of 7, but there are potential issues with pseudo replication, since spotted owls are central place foragers, the 3 males shared territories with the females and CSO do not forage independently.

Eyes, S.A., S.L. Roberts, and M.D. Johnson. 2017. California spotted owl (*Strix occidentalis occidentalis*) habitat use patterns in a burned landscape. The Condor DOI: 10.1650/CONDOR-16-184.1

Sample Size and Methods: Used radio telemetry to study foraging locations of 13 spotted owls with territories that overlapped burned areas in Yosemite National Park.

Results: The average area that was unburned or unchanged in all spotted owl home ranges was 53 percent, while 25 percent burned at low, 16 percent at moderate, and 4 percent at high severity. The proportion of the home range in each fire severity category declined with increasing severity, and the average size of patches used more than once by owls varied depending on fire severity, with the largest used patches burned at low to moderate severities." "The odds of owls using the high contrast edge type were 2.78 times greater than odds for the low contrast edge type and 3.5 times greater than for the no edge type."

Notes: Not included in the analysis, large portions of the study area had burned in other wildfires within the past 30 years. In effect, the results are of an area that has repeatedly burned.

Gallagher, C.V., J.J. Keane, P.A. Shaklee, H. Anu Kramer, and R. Gerrard. Spotted owl foraging patters following fuels treatments, Seirra Nevada, California. Journal of Wildlife Management DOI: 10.1002/jwmg.21586.
Sample Size and Methods: Used GPS and LiDAR to study 10 spotted owls (6 females, 4 males) in the Meadow Valley project area on the Plumas National Forest from 2007 to 2008.

Results: "The top model for owl foraging locations in a post-treatment landscape included negative correlations with mechanical thin, high (>70%) canopy cover in the 32-m height strata, proportion of gaps, and distance to the owl's site center, and a marginally positive correlation with slope." "Owl foraging locations contained greater proportions of high (>70%) overall canopy cover than random locations." "probability of use for owl foraging was negatively related to the proportion of gaps (canopy height <2 m) in the ellipse, and edge was not a component in competitive models."

Notes: Gaps were defined as any area >2-m x 2-m (~36 ft^2) with maximum canopy height <2 meters. Such a small gap size may not be biologically meaningful and the high number of small gaps may be swamp the ability to detect selection of larger gaps.

Irwin, L.L., D.F. Rock, S.C. Rock, C. Loehle, and P. Van Deusen, 2015. Forest ecosystem restoration: initial response of spotted owls to partial harvesting. Forest Ecology and Management 354:232-242.

Sample Size and Methods: Used radio telemetry to study foraging habitat selection of 16 northern and 3 California spotted owls 2 years before and 2 years after logging (primarily seed-tree and shelterwood harvest methods) on 5 study sites in the Klamath in western Oregon and California and the southern Cascades in Oregon and California. Study sites were a mixture of federal, private, and state lands, with the only California spotted owl study site having been composed almost entirely of private timberlands.

Results: Radio-tagged owls selected against stands scheduled for harvest and selected recently harvested stands in proportion to availability. Nearly 50% of the harvested units were not found to be used before or after harvest. They also found weak evidence for a positive effect of retained basal area of trees over 26 inches dbh and strong evidence for a quadratic effect of basal area of mid-story conifers. The authors did not observe site abandonment during the study.

Notes: The authors did not include any variables associated with the forest structure of stands scheduled for treatment in their models.

Williams, P.J., R.J. Gutiérrez, and S.A. Whitmore. 2011. Home range and habitat selection of spotted owls in the central Sierra Nevada. Journal of Wildlife Management 75:333-343.

Sample Size and Methods: Used radio telemetry to study foraging in 14 spotted owl territories in the Eldorado Study Area in the central Sierra Nevada in 2006.

Results: Home-range size variation was most correlated with the number of patches of distinct vegetation classes within home ranges (i.e., habitat heterogeneity), with home-range size increasing as heterogeneity increased. Although owls selected mature forests with medium and high canopy cover most often relative to their availability, there was sparse distribution of large stands of mature forests outside of PACs.

Notes: None of the pairs successfully reproduced during the study, so it cannot be suggested that such foraging selection represents high quality foraging habitat.

Williams, P.J., S.A. Whitmore, and R.J. Gutierrez. 2014. Use of private lands for foraging by California spotted owls in the central Sierra Nevada. Wildlife Society Bulletin 38:705-709.

Sample Size and Methods: Primarily industrial private timber lands, for foraging by 14 radio marked spotted owls in the central Sierra Nevada in 2006.

Results: Spotted owls were more likely to select public land than private land for foraging.

Notes: The authors conclude that privately owned land is not equivalent to publicly owned land as a contributor to spotted owl conservation in the central Sierra Nevada.