Draft Interim Recommendations for the Management of California Spotted Owl Habitat on National Forest System Lands 29 May 2015

Overview

Region 5 is in the process of developing a new conservation strategy for the California spotted owl throughout its range in California. A science team was assembled to first develop a Conservation Assessment for the owl that summarizes current scientific information regarding the biology, population status, habitat use, forest conditions, and threats. The Conservation Assessment will be completed in mid-2015, and it is intended to serve as the primary scientific foundation for the Conservation Strategy, which Region 5 anticipates to be completed by March 31, 2016. In the intervening time period, the Region asked the leading experts in the California spotted owl, forest ecology, and fire ecology in the Sierra Nevada associated with the Conservation Assessment to provide interim recommendations on changes to forest management prior to the development of the Conservation Strategy.

Significant challenges and uncertainty face the management of habitat to support viable populations of the California spotted owl – the risk of high intensity fire, loss of habitat from stand-replacing fire, impacts of mechanical treatments to habitat suitability, and declining populations - there are no simple solutions. The Conservation Assessment and the Conservation Strategy to follow it will provide the strongest foundation of scientific information and its application to the challenge of managing habitat for the spotted owl in the Sierra Nevada. The measures recommended in this document are intended to inform changes to existing management that are likely to reduce risks to the California spotted owl and could be considered important interim measures to enhance management's ability to meet current goals for the conservation of the species until a more comprehensive conservation strategy can be developed and implemented. This charge cannot be accomplished through simple measures such as increasing the amount or quality of suitable habitat set aside for the owl because of the risk that fire poses to habitat loss, particularly in dense-canopied forests associated with owl occupancy and productivity.

The recommended conservation measures provided here are based on the findings of the draft Conservation Assessment (May 2015), and represent a first approximation of actions available for consideration in the interim period between the development of the Conservation Assessment and implementation of a Conservation Strategy for the owl. These recommendations constitute a suite of measures that individually hold promise and support in scientific literature pertaining to owls and forest ecology, but they have not been field tested as a composite set of conservation measures. Thus, we cannot offer any certainty in terms of their benefits, only the potential for benefits based on the best available science in the form of the draft Conservation Assessment. Final interim recommendations may be issued once the draft Conservation Assessment is reviewed and finalized. The bulk of the work of reconciling the challenges that face the conservation of old forest ecosystems in the Sierra Nevada will fall to the Conservation Strategy.

Contributors

The following individuals made contributions to the development of these interim guideline recommendations: John Keane, Patricia Manley, Peter Stine, Malcolm North, Dawn Lipton, and Dana

Walsh of the US Forest Service; Brandon Collins, Scott Stephens, and Mark Schwartz of the University of California, and Zach Peery of the University of Wisconsin. These individuals were also primary authors of the draft Conservation Assessment.

Summary of Interim Recommendations

The recommended conservation measures summarized here are intended to provide options to reduce risk to the California spotted owl in the short-term relative to the degree of risk associated with current standards and guidelines (Table 1). The recommended conservation measures pertain to each of four scales relevant to spotted owl habitat management: protected activity center (PAC), territory, home range, and landscape (Fig. 1). There is no single approach that can eliminate risk to the spotted owl population given the complex nature of the current situation: declining population trends, severe drought, fire suppressed forests, and high risks of high intensity wildfire. These recommendations are intended to provide a balance of conserving existing high quality habitat, enhancing habitat conditions through management, and reducing the risk of habitat loss through high intensity fire. These conservation measures are not expected to be appropriate or ideal for every situation – their greatest value is in prompting managers to consider these additional protections, and possibly others, in the process of planning and implementation.

Table 1. Summary of interim recommendations for conservation measures for the California spotted owl as they pertain to land allocations and their associated current management direction.

Habitat Scale	Current Direction	Recommended Conservation Measures
PAC:		
Acres of habitat	300 ac	No change
Characteristics	Best available	≥ 70% canopy cover or best available
Mechanical treatment	Allowed – retain >30" dbh trees and >40% canopy cover (cc)	Not allowed, unless needed to improve habitat suitability
Other treatments	Allowed – retain >30" dbh trees and > 40% cc	Allowed, if treatment improves habitat suitability; retain >30" dbh trees
Territory:		
Acres of habitat	--	700 ac, to enhance habitat retention close to activity center
Characteristics	--	400 ac > 70% cc (including any such habitat within PAC); remaining acres > 50% cc
Mechanical treatment in designated habitat	(see home range)	Not allowed, unless needed to improve habitat suitability
Other treatments in designated habitat	(see home range)	Allowed, if treatment improves habitat suitability; retain >30" dbh trees
Treatment of undesignated habitat area	Maintain > 40% cc	Manage for habitat heterogeneity and fine-scale mosaic
Prescribed fire	--	Encouraged as mgt tool

Habitat Scale	Current Direction	Recommended Conservation Measures
Home Range:		
Acres of habitat	700 ac	300 ac (majority of acres are close to activity center)
Characteristics	> 40% cc	Best available
Minimum acres of designated habitat	1000 ac	No change
Target acres of suitable habitat	1000 ac	~1500 ac
Mechanical treatment in designated habitat	Allowed	Not allowed, unless needed to improve habitat quality
Other treatments in designated habitat	Allowed	Allowed, if they improve habitat quality
Treatment of remaining home range	Manage to 40% cc	Manage for habitat heterogeneity and fine-scale mosaic
Prescribed fire	--	Encouraged as mgt tool
Landscape:		
Target conditions	Manage to 40% cc	Manage for integrated desired conditions: territory quality, home range quality, forest resilience

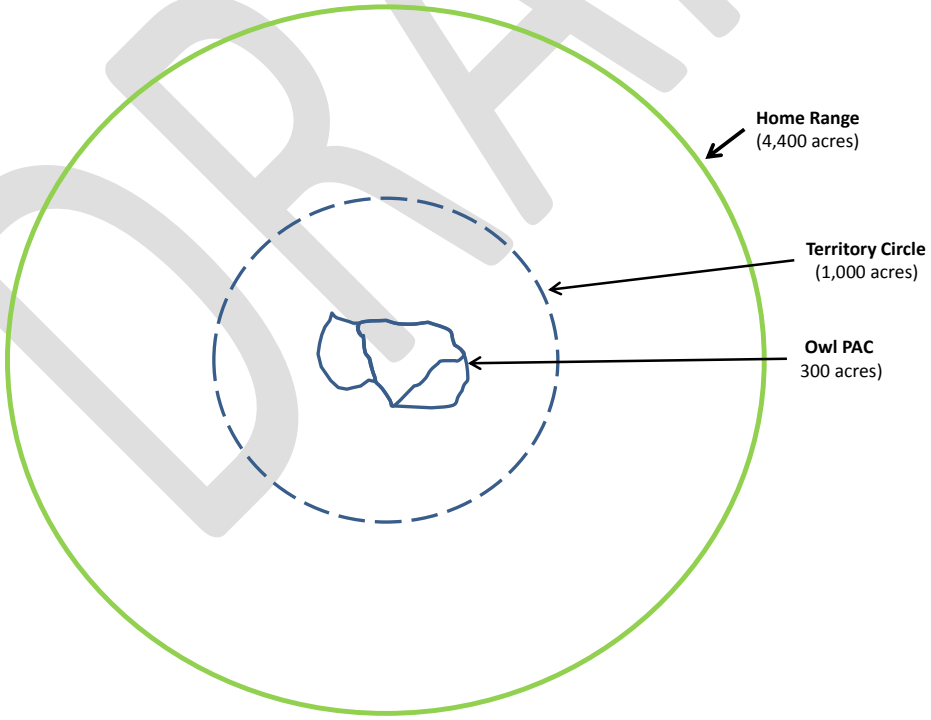

Figure 1. Nested spotted owl management areas.

Management Guidelines Not Addressed

Old Forest Ecosystem and Associated Species Management Goals

The long-term viability of the California spotted owl will depend on producing pine and mixed-conifer forests that are resilient to disturbances such as fire, tree-killing insects, and drought. Essential to this resilience is supporting regeneration and mortality patterns consistent with historic forest processes adapted to these perturbations. The overall strategy for old forest ecosystems was not evaluated, nor did the team evaluate the degree to which our recommendations affect the overall network of land allocations. We do not offer recommendations regarding the old forest ecosystem strategy or the Northern goshawk, per se. Although we do offer recommendations on conditions that are likely to confer resilience, we do not address landscape-scale forest resiliency. Given the broad geographic range of the California spotted owl across the Sierra Nevada, we suggest that the Region consider an integrated old forest ecosystem management strategy for old forests and associated species across the Sierra Nevada, including specific considerations for the California spotted owl, Northern Goshawk, Pacific fisher, American marten, and possibly other sensitive old forest associated species. Any conservation strategy for old forest associated species will need to reconcile how to manage for a sufficient quality, quantity, and distribution of suitable habitat to maintain viable populations of associated species while working to reduce the risk of extensive high severity fire and to improve prospects for the use of fire as a management tool.

Maintenance of PACs Regardless of Occupancy Status

In reference to the maintenance of PACs regardless of occupancy, the allocation of fixed patches of habitat established around California spotted owl locations regardless of their occupancy status over long periods of time presents a potential barrier to managing resilient landscapes that are essential to a long-term strategy for maintaining old forest conditions. Clearly, occupancy is not the only criterion for consideration in determining the value of retaining suitable habitat in a given location, but absent a landscape-wide evaluation of population dynamics and persistence, there is no firm foundation to determine the desired number and relative value of territory and home range locations across landscapes and over time. We suggest that the current static representation of the forest and of owl occupancy be revisited in the conservation strategy to strive for a balance between providing a sufficient amount and distribution of suitable habitat to support a viable population of owls, and the ability to manage dynamic landscape conditions over time.

1. Land Allocation

Background

Two scales are recognized in the existing direction - activity (300 ac) and home range (4400 ac). There is no formal recognition of a territory scale or landscape scale in the current management direction. However, the territory scale serves an important ecological function in that it represents the core habitat and area requirements to support a single or paired owls, and as such it is typically defended and not shared between pairs of the same species. Similarly, the landscape scale is the scale at which population dynamics and long-term persistence (viability) are expressed. Species conservation approaches most effectively start with population-level objectives and approaches, followed by habitat and management approaches at the home range and territory scales.

The activity center, territory, and home range can be conceptualized as a nested set of concentric management areas (Fig. 1). The territory scale has an important ecological function in that it is, in principle, the area of the home range that is not shared (i.e., defended) between adjacent owl pairs. Thus, it is the area within the home range that the owl pair depends upon the most. It is commonly estimated as ½ of the nearest neighbor distance. Given that home ranges tend to be larger in the northern Sierra and smaller in the southern Sierra, adjustments to territory sizes in northern (Hat Creek and Eagle Lake Ranger Districts of the Lassen National Forest) and southern (Sequoia and Sierra National Forests) locations are recommended.

Conservation Measures

1a. We recommend that habitat conservation for California spotted owls be addressed at four scales – activity center, territory, home range, and landscape. We provide specific recommended conservation measures for the activity center, territory, and home range scales in this document. We do not provide any recommendations for the landscape scale because guidelines at this scale will require detailed analysis and policy discussions regarding population and forest resilience parameters that were not possible to develop as part of this effort.

1b. In the central Sierra Nevada, we recommend a 1000-acre circle (0.7 mi radius) as a reasonable representation of a territory. In the southern Sierra (Sierra and Sequoia NF), estimated territory size would be 800 acres (0.6 mi radius). In the northeastern portion of the range on the Lassen, estimated territory size would be 2400 acres (1.25 mi radius).

2. CASPO PAC Designation and Desired Condition

Background

Current direction for PAC establishment provides guidance on where and how to establish 300 acres of suitable habitat in response to the discovery of territorial owls, and the duration of the habitat designation. Primary concerns regarding existing habitat designation (acres specifically identified as contributing toward minimum habitat requirements) and desired conditions for PACs pertain primarily to minimum canopy cover conditions and how canopy cover is measured and modeled. The current direction of "at least 60-70% canopy cover" is vague and contrary to other guidelines that specify "at least 70% tree canopy cover". We suggest a more consistent designation of target minimum canopy cover of ≥ 70% for PAC habitat.

Current management direction also specifies the duration of the land allocations. PACs are to be maintained regardless of California spotted owl occupancy status. However, after a stand-replacing event, guidelines specify to "identify opportunities for re-mapping the PA C within a 1.5-mile radius around the activity center, and if there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network." See background text and recommendations in the salvage section below, given that high-intensity fire currently is the primary source of stand-replacing events in the Sierra Nevada.

The specific existing criteria for designating habitat for individual PACs are pasted below for reference.

> "PACs are delineated to: (1) include known and suspected nest stands and (2) encompass the best available 300 acres of habitat in as compact a unit as possible. The best available habitat is selected for California spotted owl PACs to include: (1) two or more tree canopy layers; (2) trees in the dominant and co-dominant crown classes averaging 24 inches dbh or greater; (3) at least 70 percent tree canopy cover (including hardwoods); and (4) in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50 percent canopy cover (including hardwoods). Aerial photography interpretation and field verification are used as needed to delineate PACs. "
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> "Stands in each PAC have: (1) at least two tree canopy layers; (2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; (3) at least 60 to70 percent canopy cover; (4) some very large snags (greater than 45 inches dbh); and (5) snag and down woody material levels that are higher than average. "

Conservation Measures

2a. In reference to the desired condition criteria for suitable habitat, we recommend that the description and measurement of canopy cover be standardized across the Region. Chapter 14 in PSW-GTR-237 provides clarification of the terms "canopy cover" and canopy closure", and how each is measured. We also recommend that field measurements of canopy cover using a densitometer (or similarly accurate and precise measure) be used to characterize pre- and post-treatment canopy cover conditions where treatments are proposed within designated owl habitat (also see page 6 of these guidelines).

2b. We recommend that target canopy cover conditions for PAC habitat be set specifically at ≥ 70%. Further, we recommend that all snags, 15 inches and above, be retained in PACs, unless they represent a safety hazard.

3. CASPO Territory Habitat Designation

Background

Recent research, primarily in the central Sierra Nevada, indicates that successful territories (i.e., sustained survival and occupancy of a territory) have more than the 300 acres of high quality nesting/roosting habitat (defined as ≥ 70% canopy cover) in the vicinity of the activity center. We assume this new information is relevant and thus applicable to all locations in the Sierra. Two criteria for habitat designation and management at the territory scale are indicated: a minimum amount of habitat with ≥ 70% canopy cover, and total amount of habitat with ≥ 50% canopy cover (including the minimum ≥ 70% canopy cover) (Fig. 2). Research from the central Sierra Nevada has provided strong evidence that maintaining 375 acres or more of habitat with ≥ 70% canopy cover within the territory has significant benefits in terms of occupancy and site fidelity. The total amount of habitat with ≥50% canopy cover has a less certain target condition, but it appears that greater concentrations (i.e., more acreage) of ≥50% canopy cover forests in proximity to the nesting area (i.e., within the territory) are associated with higher performing territories (i.e., higher occupancy rates, lower extinction rates). However, some habitat heterogeneity at the territory scale is likely to be a beneficial attribute

for foraging based on multiple studies that indicate that owls forage frequently along habitat edges, particularly high contrast edges. Thus, concentrating habitat designations within the territory while providing some opportunity for habitat heterogeneity is expected to improve habitat quality and territory performance. Research findings pertaining to minimum patch sizes and spatial distribution criteria for habitat use are limited; this is a key information gap to be addressed in the short term, ideally in time to inform the Conservation Strategy.

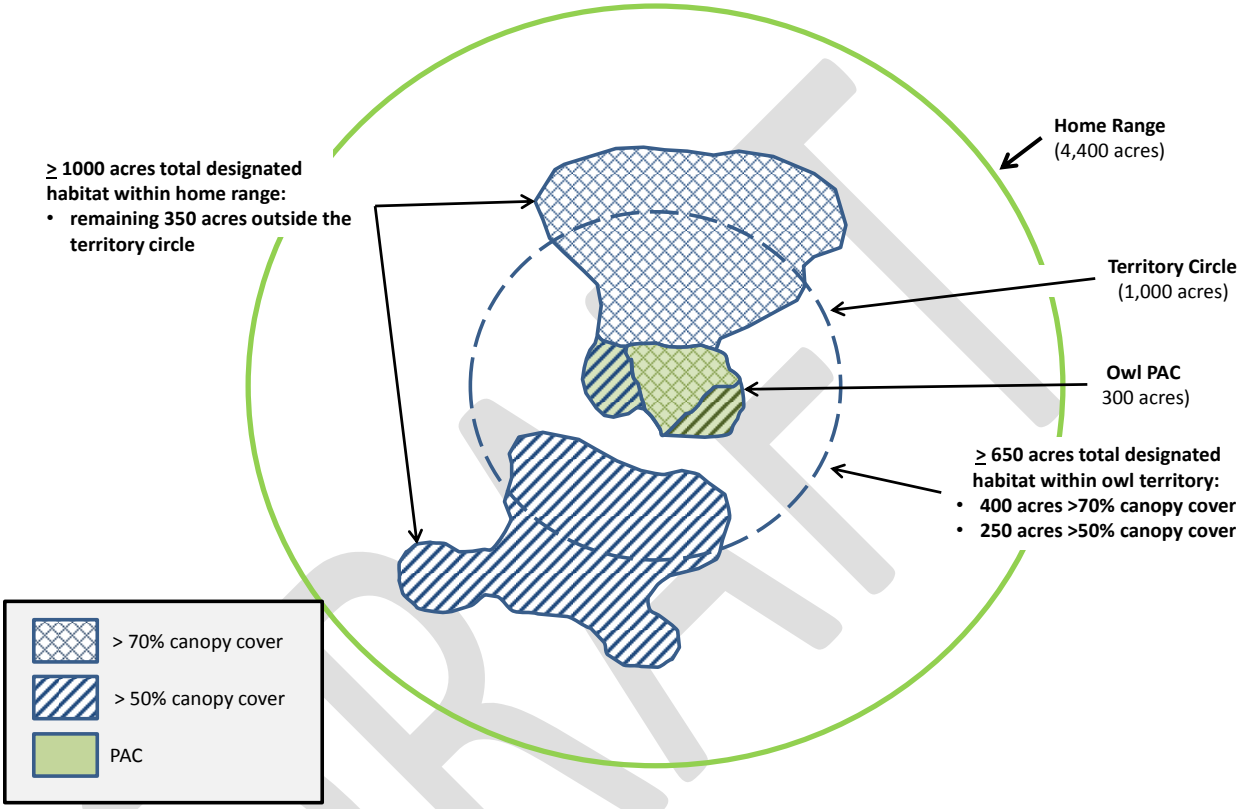


Figure 2. Graphic example of nested spotted owl management areas with designated habitat.

Conservation Measures

3a. We recommend that the desired condition at the territory scale is the maintenance of a minimum of 400 acres of high quality nesting/roosting habitat (≥ 70% tree canopy cover), ideally in the vicinity of the activity center, an increase of 100 acres over current guidelines.

3b. The same designation criteria would apply at the territory scale as for PACs, and as they are specified in the existing guidelines," the best available habitat is to include: (1) two or more tree canopy layers; (2) trees in the dominant and co-dominant crown classes averaging 24 inches dbh or greater; (3) ≥ 70% tree canopy cover (including hardwoods); and (4) in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and if not available, substitute stands with ≥ 50 % canopy cover (including hardwoods)."

3c. We recommend that a minimum of 70% (700 acres) of the 1000-acre territory be maintained in a canopy cover condition of ≥ 50%. Where territories lack 700 acres of suitable habitat, the shortfall would be located within the home range as close to the habitat within the territory as possible.

3d. Designated habitat patches or stands ideally are large enough to provide interior stand conditions (1-2 tree heights from edge) to minimize edge effects, particularly for the acres with ≥ 70% canopy cover.

3e. All habitat that is designated as meeting the minimum habitat requirements to support an owl territory are located on NFS lands.

4. CASPO Territory Desired Condition

Background

Given the current emphasis on retaining very high canopy cover for core nesting and roosting habitat, foraging habitat values as well as options to reduce the risk of high intensity fire will rest on forest conditions outside of designated habitat (acres specifically identified as contributing to minimum habitat requirements). As owls select habitat at larger scales and for different activities, from nest stand to core area to foraging habitat, there is greater variability in the habitat characteristics, which suggests greater flexibility in selection. Heterogeneity within the owl territory is likely to support higher prey populations that homogeneous habitat conditions across the entire territory, and is also likely to enhance resiliency to disturbance. Therefore, within the remaining 300 acres of the territory circle, some habitat heterogeneity is desired. The enhancement of habitat heterogeneity without fragmenting existing mature closed-canopy forest represents a challenge in forest management, but is currently being envisioned by forest ecologists as a mosaic of forest clumps and small openings (0.03 to 2.0 acres).

Current habitat maps generated for the National Forests have variable minimum mapping units, depending on the age and source of the remotely-sensed data. Most Forests now have maps that have 1-acre minimum mapping unit. Ideally these maps would be available for characterizing territories (and home ranges) both in terms of suitable habitat and the character and extent of more open habitat types and conditions.

A potential barrier to successful implementation of these recommendations is how canopy cover is measured and modeled. Vegetation maps used for forest and initial project planning are derived from satellite imagery, generated by Region 5 Remote Sensing Lab, and commonly referred to as the "e-veg" layer. This is the source of information used to identify and designate habitat for wildlife, including the California spotted owl. Detailed project planning for forest management commonly employs the use of Forest Vegetation Simulator (FVS) to estimate pre- and post-treatment canopy cover conditions for proposed treatments. The ability of FVS to model changes in canopy cover in a manner that adequately reflects habitat suitability for the spotted owl is limited. Within designated habitat, particularly within the territory circle, field-based measurements are suggested to ensure characterizations of habitat conditions are accurate (see section 6 below, Forest Management within Designated CASPO Habitat).

Conservation Measures

4a. Desired conditions are to create or maintain fine-scale gaps associated with shrubs, meadows, or low tree and canopy densities within a matrix of higher density forests. This recommendation represents a change in the forest-wide standard to maintain canopy cover of >50% (see mechanical thinning section below) at the stand (unit) scale.

4b. Existing open habitat conditions (early seral forests, shrub fields, plantations, meadows) within territories count toward this goal of some heterogeneity within the territory. It is expected that most territories already have areas of low canopy forest or other non-forest vegetation types. Ideally vegetation is mapped at 1 ac (or less) minimum mapping units so that small gaps can be identified and counted toward desired conditions.

4c. The remaining acres within the territory (≤ 300 acres in a 1000-ac territory) ideally are managed to create a fine-scale mosaic (gaps and patches of 0.03-2.0 acres) of low, moderate, and high canopy cover that create heterogeneous conditions, that are in turn conducive to supporting suitable foraging habitat, an abundance of prey, and a reduced risk of high intensity fire. Treatments outside of designated CASPO habitat within territories, however, should avoid creating uniform low tree density and bare understory conditions, as these conditions are not conducive to habitat quality or enhanced prey availability. A reduction in hazardous fire potential may still be achieved while producing a more variable spatial forest structure consistent with supporting a diverse and resilient forest ecosystem (see forest thinning section below).

4d. Desired conditions for a 1000-ac territory are the following:

- ≥ 40% (400 ac) with ≥70% canopy cover (or best available – see recommendation 3b)
- Additional minimum of 300 acres (30%) with ≥ 50% canopy cover
- The remaining area (≤ 300 acres) should represent fine-scale mosaic (gaps and patches of 0.03-2.0 acres) of low, moderate, and high canopy cover that create heterogeneous conditions, that are in turn conducive to supporting suitable foraging habitat and an abundance of prey
- The condition of the territory is a function of all lands that occur within the territory circle. Minimum habitat requirements all need to be met on NFS lands, but evaluations of the condition and quality of territories include all lands.

Percentages are slightly different with the smaller 800-ac territory in the southern Sierra Nevada, as follows:

- ≥ 50% (400 ac) with ≥70% canopy cover (or best available)
- Additional minimum of 100 acres with ≥ 50% canopy cover
- The remaining area (≤ 100 ac) should represent heterogeneous conditions that are conducive to supporting suitable foraging habitat and an abundance of prey (see section 6 below).

Percentages are also slightly different with the larger 2400-ac territory in the northern Sierra Nevada, as follows:

- ≥ 17% (400 ac) with ≥70% canopy cover (or best available)
- Additional minimum of 1000 acres with ≥ 50% canopy cover
- The remaining area (≤ 1000 ac) should represent heterogeneous conditions that are conducive to supporting suitable foraging habitat and an abundance of prey (see section 6 below).

5. CASPO Home Range Habitat Designation and Desired Condition

Background

First, we suggest clarifying language regarding habitat retention within home ranges. It is a source of confusion for many that Home Range Core Areas pertain to designated habitat acres, not to the home range area itself. Our recommendations are to simply refer to the home range area, which is approximated by a 1.5-mi circle around the center of activity for the territory, most commonly represented by the center of the PAC.

Insufficient new information exist to update the minimum amount of suitable habitat to be retained within a given owl home range, so we have no suggested changes to the minimum amount of habitat. However, we do recommend that the outer home range area (outside of territory circles) have a different desired condition than current direction specifies. Recommended desired conditions are to promote or maintain a heterogeneous mosaic of forest conditions that would provide additional acres of suitable habitat beyond the specified minimum acres, as well as variable forest canopy conditions that currently cannot be created outside of limited circumstances. However, the outcome of managing for fine-scale heterogeneity across the home range is expected to yield a total of around 1500 acres of suitable habitat across the home range.

Mosaic conditions are known to be important to providing overall suitable habitat for foraging and fitness. In the Sierra Nevada, California spotted owls select edge habitat for foraging, suggesting that owls exploit a heterogeneous forest matrix when foraging, which is consistent with observations that small mammal diversity is enhanced by increased structural heterogeneity at large spatial scales, as well as greater development of mature forest structure. However, it is difficult to determine a threshold of heterogeneity and finding a balance between habitat heterogeneity and minimizing fragmentation. Similarly, structural heterogeneity in forests can confer a greater resilience to disturbance, particularly fire. Given concerns about the growing risk of loss of forests to high intensity fire, fire resilience is a high priority for forest management. Fire resilient landscapes that contain contiguous patches of closed-canopy mature forest embedded with smaller forest openings and variable forest structure and composition (e.g., presence of large oaks) may represent our best option for sustaining habitat and populations of spotted owls.

We provide target proportions of the home range area in various canopy cover conditions. The intent of these target percentages of various canopy cover conditions is to serve as a measurable guide to a heterogeneous, mosaic condition that we believe will provide high quality suitable habitat for the California spotted owl while moving toward landscapes that better reflect a natural disturbance regime and are more resilient to fire and other disturbances. The desired condition recommendations are expected to exceed the current habitat minimums required by existing direction (1000 acres of suitable habitat) within the home range by an estimated 50% (i.e., ~1500), but at the same time promote habitat heterogeneity across the home range by relaxing canopy cover minimums on the remaining acres within the home range. Calculations of these desired conditions over a full home range reveal that by attaining canopy cover levels within the 1000-ac territory and levels within the remaining 3400 acres, as outlined above, the goal of a landscape-scale average of 40% canopy cover outside the 1000-ac territory would be consistent with improved desired conditions for the owl.

The recommendation to have some portions of the home range in shrub, meadow, and/or low canopy cover forests would be a change to the current forest-wide management direction for forest thinning (see forest thinning section below for more details). By specifying a home range-wide average canopy cover condition, as opposed to a stand- or unit-scale minimum, landscapes can be managed to create heterogeneous habitat conditions that are favorable for foraging as well as for old forest resilience. These recommendations are based on empirical data that suggest that habitat management needs to move away from a modal condition of 40-50% canopy cover in forests with reduced vertical and horizontal complexity, to a more divergent and heterogeneous condition including a greater amount of high canopy cover habitat and fine-scale mosaics (gaps and patches of 0.03-2.0 acres) of low, moderate, and high canopy cover. Some acres would be managed to support or create high quality owl habitat; the remaining acres would be managed to meet other forest restoration objectives that would result in openings and a mosaic condition.

Landscapes where known owl locations are at a density where there are significant overlaps in home ranges, and perhaps even overlaps in territory circles, present a special challenge to designating habitat for the spotted owl and creating habitat heterogeneity. We suggest that each territory circle is managed as an independent unit in this interim period, but where overlap among home ranges is high, we suggest habitat management be determined at the subwatershed scale (10,000-30,000 acres) such that the resulting landscape supports territory and home range conditions for each owl, with the composite result being a mosaic of heterogeneous forest conditions that has high foraging habitat quality and reduced risk of high intensity fire.

Conservation Measures

5a. We recommend adopting the simplified term of HRA – Home Range Area – the area that pertains to the 1.5-mi radius circle around activity centers.

5b. The desired condition for a 1000-ac territory calls for $\geq$ 700 acres of suitable habitat with $\geq$ 50% canopy cover, with the remaining of 300 acres of suitable habitat occurring in the home range area outside the territory circle (see Table 1 and 2 for all geographic zones). All habitat designations to meet minimum habitat requirements are on NFS lands.

5c. We recommend that each territory be managed to retain at least the minimum designated habitat acres (e.g., 700 of the 1000 acres in the territory circle), but home range habitat acres may be shared where overlap in home range is significant.

5d. We recommend that the area outside the territory circle and within any given home range area be managed to maintain an average of 40% canopy cover across the entire home range area (not at the stand scale), with conditions ranging from < 25% to > 70% canopy cover across a fine-scale mosaic of heterogeneous conditions. The average condition is intended to serve as a guide in balancing a wide range of stand-scale canopy cover conditions across the home range area toward creating heterogeneous forest conditions.

5e. Habitat heterogeneity is the desired condition in the 3400 acres of the home range area outside the territory circle. The recommendations provided below reflect general parameters of historical forest conditions that, if used to guide forest management in the home range area outside

the territory, are likely serve to enhance forest resilience to fire while maintaining or increasing quality foraging habitat conditions for the spotted owl. In implementation, discourage uniform, homogeneous treatments, but rather create a mosaic of conditions within and among stands (see Forest Thinning sections below for recommendations on condition measures and prescriptions):

- Low and high density forest interspersed across the home range for a target total of ~1500 acres of suitable spotted owl habitat.
- $\leq$ 25% (~850 ac) with ≤ 25% canopy cover as consistent with topographic, edaphic, and site condition influences (including non-forested and low canopy cover forests at the smallest detectable size).
- $\geq$ 10% (~350 ac) with $\geq$ 70% canopy cover
- $\geq$ 15% (~500 ac) with $\geq$ 40% canopy cover
- ~50% fine-scale forest mosaic
- Home range conditions are a function of all lands occurring within the home range circle regardless of land ownership.

5f. Given that specific target values and implementation specifics are not well known or understood, we recommend that projects that propose to treat forests in territories commit to monitoring of owl occupancy pre- and post-treatment to understand and learn from these tactics.

5g. We recommend that landscape designs and associated silvicultural prescriptions integrate topography, soils, and aspect into desired conditions so they are consistent with the ecological patterning that would occur across the landscape under a natural disturbance regime. For example, disturbances such as fire tend to be more frequent on ridge tops and south facing slopes, creating younger and/or more open conditions, as opposed to lower slope, north facing, and ravines, where vegetation conditions would be likely to be more dense and multi-layered.

5h. We recommend developing variable density treatments to create heterogeneity at multiple scales to create spatial discontinuity in forest fuels and create openings for regeneration of pines and oaks.

Summary Tables and Figures

Table 2 summarizes the recommended amount and spatial distribution of habitat conditions at the activity center, territory, and home range scales at each of the three preciously established geographic zones within the Sierra Nevada. Territory specifications for the central Sierra Nevada are based on substantial empirical data, however specifications for the northern and southern zones are an extrapolation of observations from the central Sierra Nevada. Further, the Home Range Area is the 1.5-mile radius circle in the current guidelines, however in the southern Sierra Nevada, the radius of the home range area containing the final 100 acres could be smaller (600 ac is 20% of 3000 ac territory), with potentially beneficial results for the owl.

Table 2. Recommended minimum acres of suitable habitat to be maintained at each of three nested scales, and the total expected total acres of suitable habitat for individual the California spotted owls across the three geographic zones currently recognized for the owl in the Sierra Nevada.

	Northeast SN (Hat Creek and Eagle Lake RD)		Central SN (all other Forests*)		Southern SN (Sequoia and Sierra NF)	
Scale	Area (ac)	Amount of designated habitat (ac)	Area (ac)	Amount of designed habitat (ac)	Area (ac)	Amount of designated habitat (ac)
PAC – min	300	300	300	300	300	300
Territory – min >70%cc	2400	400	1000	400	800	400
Territory – min > 50% cc	2400	1400	1000	700	800	500
Home Range - min	4400	2400	4400	1000	4400**	600
Home Range - expected		>2400		`>1500		>900

* Modoc, Inyo, Humboldt-Toiyabe, Plumas, Tahoe, Eldorado, Lake Tahoe Basin Management Unit and Stanislaus National Forests

** Could potentially be reduced to 3000 acres

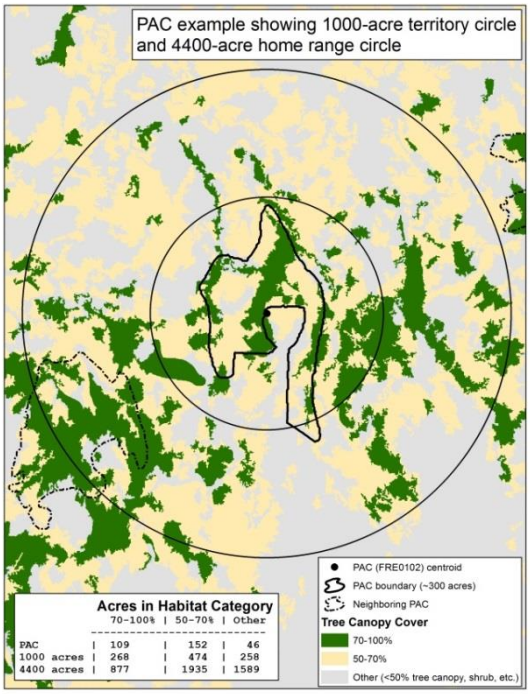
Table 3 below summarizes the recommended desired conditions for territories and home ranges in the central Sierra Nevada (acres for northern and southern zones would need to be adjusted as per recommendations in Table 2).

Figure 3 reflects two home range conditions from the Sierra Nevada: one with limited availability of suitable habitat (3A), and one with an abundance of suitable habitat (3B). These figures illustrate how varied the distribution and abundance of suitable habitat can be within a territory circle and home range area. Figure 4 depicts a small landscape with multiple home ranges. This figure illustrates a situation where there is a high density of known owl territories. The overlap in territory circles is expected to be low, as shown here, but the overlap in home range areas can be high.

Table 3. Summary of desired conditions for activity centers, territories and home ranges in the central Sierra Nevada.

DESIGNATION	SIZE	DESCRIPTION OF KEY FEATURES	DESCRIPTION OF REMAINDER OF AREA
PACs	300 acres	Minimum of 300 acres of high quality nesting and roosting habitat (≥ 70% canopy cover or best available as per section 3b) as close to the activity center as possible	
Territories	1,000 acres	Measured as a 0.7 mile radius circle around the activity center. Minimum of 400 acres of high quality habitat (≥ 70% canopy cover, including acres of this habitat in the PAC) plus at least 300 acres of suitable foraging habitat (≥ 50% canopy cover) for a total of 700 acres within the territory	300 acres in a fine-scale mosaic forest structure designed to achieve heterogeneous forest cover and stand density
Home Ranges	4,400 acres	Minimum of 1,000 acres of designated suitable habitat; including the minimum 700 acres within the territory circle. Recommended criteria for heterogeneous mosaic conditions in the home range area outside of the territory are expected to yield an additional 700-800 acres of suitable habitat with > 50% canopy cover, for a total acreage exceeding 1500 acres.	3400 acres comprised of: - Low and high density forest interspersed across the home range - ≥ 10% (~350 ac) with ≥ 70% canopy cover - ≥ 15% (~500 ac) with ≥ 40% canopy cover - ≤ 25% (~850 ac) with ≤ 25% canopy cover as consistent with topographic, edaphic, and site condition influences - ~50% fine-scale forest mosaic

A)



B)

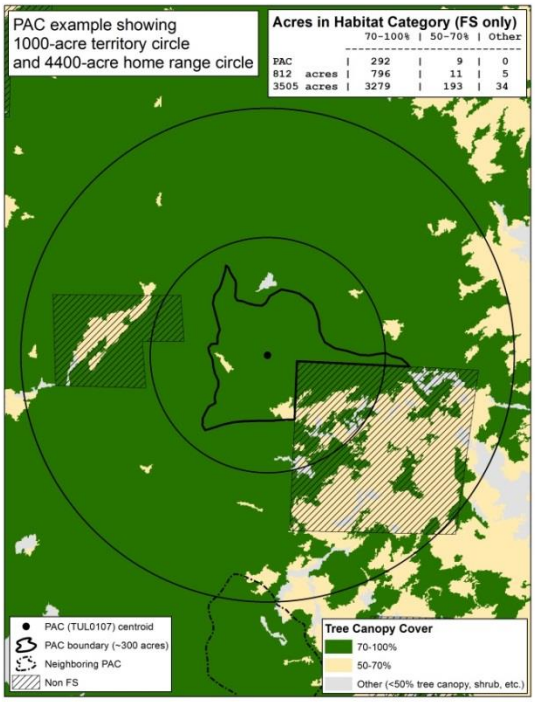


Figure 3. Home range conditions from actual locations in the Sierra Nevada. A) Home range with limited suitable habitat. B) Home range with an abundance of suitable habitat.

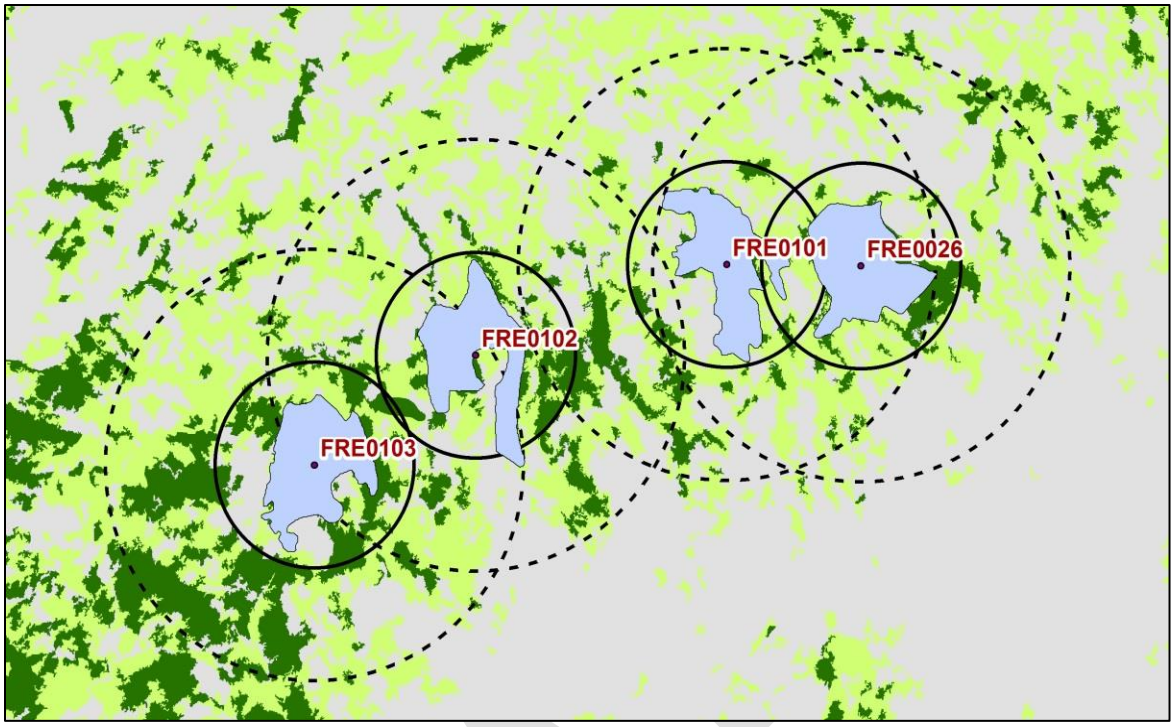


Figure 4. Example of a landscape with multiple territories in close proximity. Points indicate the center of the territory, blue indicates the 300 ac PAC, solid black circle indicates the 1000-ac territory circle, and dashed circle indicates the 4,400 ac home range area. The dark green color represents suitable habitat with >70% canopy cover; the light green color represents suitable habitat with 50-70% canopy cover.

6. Forest Management Within Designated CASPO Habitat

Background

The acres of suitable habitat within PACs, territories, and home ranges that are identified as meeting the habitat requirement guidelines for the California spotted owl are explicitly identified and designated on each Forest. Fuel reduction treatments that are consistent with habitat enhancement are likely to be very modest (e.g., removal of smaller diameter trees in dense stand, prescribed fires), given that the highest priority for these acres in the short term is to maintain or enhance habitat quality for spotted owls. Thinning within designated habitat could be accomplished with mechanical thinning, hand thinning, or prescribed fire (where feasible). Prescribed fire is a valuable management tool and is increasingly important for reintroducing fire as an essential ecosystem process. Barriers to implementing prescribed fire are many, but its increased use will be essential to creating and maintaining forest resilience. Tree retention standards for trees ≥ 30-in diameter remain in place within home ranges, given that these larger diameter trees make significant contributions to canopy cover, as well as providing a diversity of other habitat values.

Conservation Measures

6a. We recommend that no mechanical treatment occur within the designated habitat acres for the spotted owl (e.g., 1000 acres per home range in the central Sierra Nevada) unless it is intended to maintain or improve habitat conditions for the spotted owl in the short-term (1-5 years). Key features of desired conditions (i.e., multi-layered structure, diversity of diameter classes, moderate to high tree canopy cover) are retained or enhanced as a result of forest management actions. This is likely to limit treatments to the removal of small diameter woody material through hand thinning or prescribed fire.

6b. We recommend that no overstory trees be removed with PACs and rarely within the remaining designated habitat, including the retention of trees ≥ 30-in diameter except in circumstances where public safety is at risk as a result of tree fall.

6c. We recommend the use of prescribed fire as a valuable and essential forest management tool in instances where fire can be used to create desired conditions and improve habitat quality in the short-term.

6d. In instances where mechanical thinning in designated habitat is warranted, we recommend that silvicultural prescriptions be informed by and follow to the degree possible the concepts in GTR-220 and 237, and parameters described for non-designated habitat (below) while being consistent with the objective of short-term habitat improvement for the spotted owl . Given the likelihood of prescriptions being limited to the removal of small diameter material, hand thinning may be a more feasible and effective approach.

6e. We recommend that pre- and post-thinning canopy cover conditions be measured in the field using a densitometer using standard forest measurement sampling designs whenever possible to obtain a sufficiently precise estimate of average canopy cover and within-stand variability pre- and post-thinning. For example, a 25-pt densitometer grid could be added to the measurements taken at each stand exam plot location and a sufficient number of stand exams.

6f. We recommend the use of fixed-plot methods be used for project planning and effectiveness monitoring whenever possible when treatments are planned within designated habitat in territories.

7. Salvage within Designated CASPO Habitat

Background

The value of burned forests as habitat or as landscape components within a territory or home range is not clear. Some research suggests that burned forests can enhance the foraging opportunities for California spotted owl, other research suggests that burned forests themselves provide suitable foraging habitat, while still other studies show limited value of large areas of burned forests and a negative impact as burned forest becomes the predominant condition within a territory. The number of studies, their associated samples size, and their divergent findings create uncertainty about appropriate management direction regarding burned forests as habitat for the spotted owl. The entire issue of the effects of salvage on spotted owls remains unclear and should be carefully revisited in the conservation strategy. Promoting and supporting research directed at understanding the habitat value of burned forests would greatly enhance the ability of the conservation strategy to identify appropriate management guidelines for the treatment of burned forests.

Conservation Measures

7a. We recommend that PAC habitat (designated 300 acres) burned at any intensity be retained as unsalvaged, and PAC acres burned at high intensity (> 75% mortality) be augmented by unburned forest within the territory where it exists. In cases where multiple PACs are located in close proximity, this recommendation could be reconsidered in light of potential ecological impacts of leaving large areas of unsalvaged intensively burned forest.

8. Forest Management in Home Range Areas Outside of Designated CASPO Habitat

Background

An overarching point of concern that surfaced through the course of developing tthese interim recommendations was the existing forest-wide standards and guidelines that targeted 40-50% average canopy cover at the "unit" scale (i.e., stand scale), which at this small scale translates in the field to a minimum canopy cover. The outcome has been is that stands with higher canopy cover and variable canopy conditions can be treated to reduce canopy cover down to near 40% and simplify vertical structure by removing ladder fuels. These treatments create more homogeneous conditions within stands and across landscapes that meet the minimum criteria for suitable habitat, but provide low quality habitat for owls. These stands do not necessarily benefit the owl or other old forest associated species and can present barriers to managing for forest resilience.

Forest restoration that positively affects spotted owl habitat ideally starts at scales larger than the home range, and then scales down to the home range and territory scales, in order to ensure that the analysis encompasses the entirety (or at least the majority) of home ranges within the targeted treatment area. We suggest subwatersheds as a minimum planning unit size for restoration projects. The subwatershed scale ranges roughly from 10,000 to 30,000 acres, and is reasonably approximated by sixth-level hydrologic units [HU] (as enumerated with 12-digit codes). This is the scale at which landscape heterogeneity begins to be expressed, and planning restoration treatments across multiple subwatersheds would be ideal given the large size of recent wildfires (e.g., 2013 Rim Fire, 2014 King Fire) and the area burned in extreme single burn periods within these fires (30,000-50,000 ac). This step already is commonly employed to identify target treatments, but it may not be explicitly documented as part the project file or explicitly target home range conditions as part of project objectives. Ideally, planning and analysis would occur at even larger scales commensurate with the scale of major disturbances (100,000 – 200,000-ac range), but that scale of analysis and desired conditions is beyond the scope of these recommendations. We suggest that the conservation strategy for old forests and associated species outline desired conditions and associated measures at multiple scales, including large landscapes in this 100,000 to 200,000-ac scale.

Within subwatersheds, we suggest that forest conditions could be evaluated at three scales: stand, home range, and subwatershed-wide. We are considering stands as a scale unit of roughly 5-40 ac and not the silvicultural definition ("a spatially contiguous group of trees and associated vegetation having similar structures" [Oliver and Larson 1996]) because that definition emphasizes identifying relatively homogeneous areas. The home range scale is 4400 acres, and subwatershed is 10,000-30,000 acres, as described earlier.

Specific treatments that will move forest conditions toward desired conditions will be better informed by field data. Field assessments a typically take the form of common stand exams conducted in a systematic manner across the proposed treatment area. We suggest that restoration projects will benefit from conducting field assessments across one or more entire territories and home ranges in order to determine where and what type of stand-scale treatments will move the landscape to a more desired condition. For example, larger-scale analysis may lead planners to propose treatments in stands that have been recently mechanically treated to reduce fuels, as well as in stands that have not been treated recently. Fixed plot methods would also provide additional valuable information, but may only be warranted or feasible across smaller areas and would be most valuable in instances where designated habitat is targeted for treatment (see section below).

At the stand scale, we suggest that forest conditions be characterized using the three elements consistently found in frequent-fire forests: individual trees, clumps of trees and openings (ICO) (see Larson and Churchill 2012). The ICO concept and approach is relatively new in its application to designing resilient forests in dry forest ecosystems of the Sierra Nevada, so its implementation will be a learning process. Project planners will be challenged with how to gather and interpret field data gathered as part of initial stand exam efforts in a manner that enables them to assess current and potential future conditions in terms of ICO parameters to assess heterogeneity and in terms of stand-scale canopy conditions to assess owl habitat suitability. The ICO parameters provided in the recommendations are intended to serve as a starting point based on the limited empirical information currently available (Lyderson et al. 2013, Fry et al, 2014).

Canopy cover, as a stand- or landscape-level average, does not adequately describe or quantify the desired variability in canopy cover and tree density, particularly if it is based on e-veg or standard FVS calculations. Also, neither of these sources accounts for tree spatial patterns, which is a central feature of forest restoration for fire resilience (see PSW-GTR-220). Chapter 9 of PSW-GTR-237 (North and Sherlock 2012) provides some suggested tools and techniques that can be used to interpret stand exam data to assess forest heterogeneity, including ways in which FVS can be used to assess variability in canopy conditions. Field measurements using a densitometer (i.e., a sighting tube) are the recommended method to characterize canopy cover conditions because they provide an accurate and precise measure of canopy cover conditions (overall average and variability) and it is more consistent with measures of canopy cover used to determine spotted owl habitat associations.

Tree retention standard for trees ≥ 30-in diameter would remain in place throughout the home range area, including the PAC, territory, and outer home range area. The 30-inch diameter limit serves an important function outside of designated habitat, namely the retention and recruitment of large trees. We acknowledge that there is a deficit of large trees across the landscape, especially larger trees with structure (i.e. cavities, platforms, etc.) for nesting or roosting use. Based on conversations with District and Forest silviculturists, the > 30-in diameter retention standard is not expected to be a significant limiting factor in achieving heterogeneous forest conditions. However, the 30-in diameter limit outside the California spotted owl home range areas could present an impediment in certain circumstances where there are high densities of white fir trees in this size class, and retaining all of them could be counter-productive to objectives for maintaining/restoring heterogeneity. We encourage the conservation strategy to reevaluate the broad applicability of the 30-inch diameter limit and identify circumstances under which the 30-inch diameter limit may be counter-productive to meeting habitat conservation objectives for the spotted owl. Close monitoring of projects that propose treatments throughout territories and home range areas will provide valuable insights into these assumptions (and others).

Conservation Measures

8a. We recommend the subwatershed scale (10,000-30,000 ac) as a target for the broad-scale analysis for project planning. Boundaries can be defined by HUC boundaries or other relevant topographic features that represent a meaningful ecological unit.

8b. Within the subwatershed planning unit, we recommend evaluating among-stand heterogeneity across the landscape based on e-veg, other sources of satellite imagery, and information on management history. Project planners can use these data to evaluate existing conditions for each territory and home range within the planning subwatershed: location of designated CASPO habitat, amount of suitable habitat, proportion of the area occupied by each canopy cover condition, diversity of canopy cover conditions, and average canopy cover. The results of this analysis can be used to identify territories and home ranges that do not currently meet desired conditions, and where and how treatments could be applied to move them closer to desired conditions.

8c. We recommend that project planning include stand exams that are distributed across entire territories or home ranges as needed to characterize existing stand-scale structures and inform where treatments will be directed and toward what change in condition. If FVS is used to model forest structure, consider using alternative approaches (re: GTR-237) that can be used to assess canopy variability.

8d. We recommend that densitometer readings be added to stand exam measurements in order for canopy cover and structure to be accurately assessed. We recommend that pre- and post-thinning canopy cover conditions be measured in the field using a densitometer as part of the standard forest measurement sampling designs to obtain a sufficiently precise estimate of average canopy cover and within-stand variability pre- and post-thinning. For example, a 25-pt densitometer grid could be added to the measurements taken at each stand exam plot location and a sufficient number of stand exams.

8e. ICO parameters for stand-scale heterogeneity are recommended for use in evaluating existing and desired future forest heterogeneity, recognizing that they are a work in progress and may be updated as new information becomes available. Project planners can assess current and potential future conditions in terms of ICO parameters to assess heterogeneity and in terms of stand-scale canopy conditions to assess owl habitat suitability, extent (acres) and spatial distribution.

- A clump is any group of adjacent trees with touching or overlapping crowns, with tree groups generally ranging from 2-50 trees.
- A gap is a forest opening roughly equivalent to or greater than the area occupied by the canopy of a dominant, overstory tree (e.g., an overstory tree with 20-ft crown radius would have a canopy area of 1250 ft^2 or about 0.03 ac) generally ranging from 0.03 to 2 ac, but greater variability in clumps and gaps is valuable and recommended.
- Areas identified as typically supporting higher tree density and/or canopy cover based on topographic position and aspect would be managed toward the upper end of clump size and lower end of gap size and frequency
- Areas identified as typically supporting lower tree density and/or canopy cover based on topographic position and aspect would be managed toward the lower end of clump size and upper end of gap size and frequency.
- Snag retention objectives can be achieved by variable densities that distribute snags throughout large areas consistent with the clumpy, variable nature of tree distribution.

8f. Tree retention standards for trees ≥ 30-in diameter remain in place throughout the territory and home range area.

8g. We recommend the use of prescribed fire whenever applicable and feasible as a valuable and important management tool. It may be particularly effective in restoring resiliency and integrity across landscapes recently thinned to reduce fuels.