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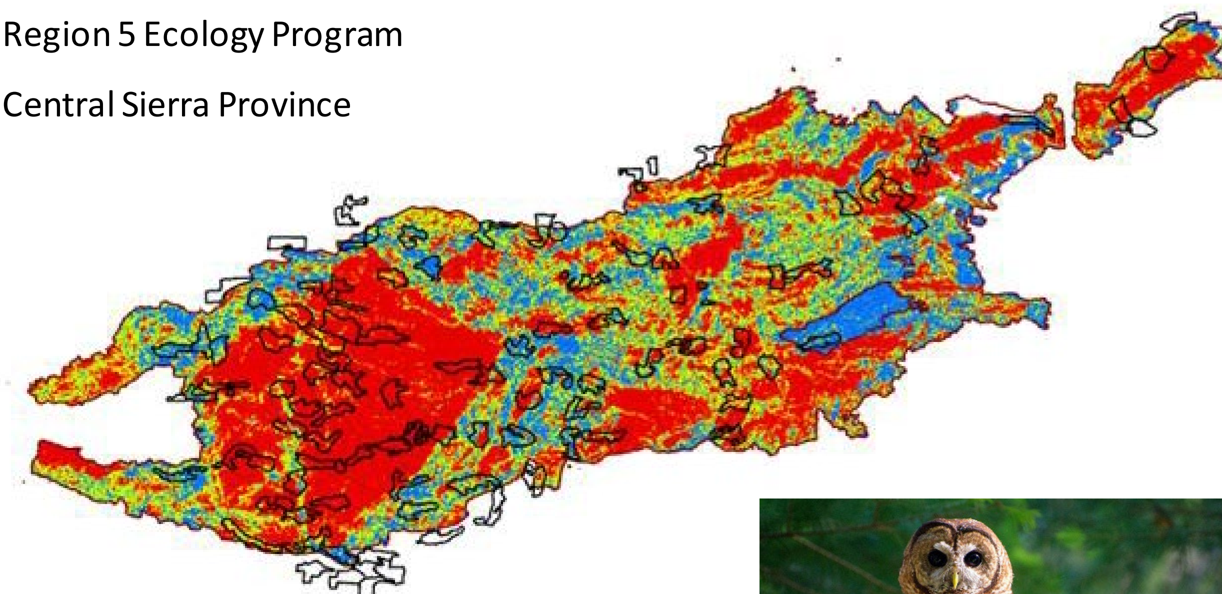
Post-fire Restoration Opportunities for California Spotted Owl Habitat in the 2021 Caldor Fire, Eldorado National Forest and Lake Tahoe Basin Management Unit

USDA Forest Service

Region 5 Ecology Program

Central Sierra Province



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Date Updated: January 26, 2023

Summary

We evaluated fire effects from the 2021 Caldor Fire on California spotted owl (*Strix occidentalis occidentalis*) habitat within the Eldorado National Forest and the Lake Tahoe Basin Management Unit using a science-based approach outlined in the "Postfire Restoration Framework for National Forests in California" (Meyer et al. 2021). We identify potential restoration opportunities in California spotted owl habitat within the Caldor Fire and recommend a suite of management actions. Application of this framework can help guide proposed actions, however, the resulting recommendations will require additional analysis, surveys and validation.

Suggested Citation: Bovee, K., Allen, T. and Estes, B. and 2023. Post-fire Restoration Opportunities for California Spotted Owl Habitat in the 2021 Caldor Fire, Eldorado National Forest and Lake Tahoe Basin Management Unit. Pacific Southwest Region Ecology Program, USDA Forest Service. 36 pages.
https://www.fs.usda.gov/detail/r5/plants-animals/?cid=FSEPRD1087476

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Introduction

The California spotted owl (*Strix occidentalis occidentalis*) occurs across a large area of California, including the southern Cascade Range, the Sierra Nevada, the mountains of central coastal California, and the Peninsular and Transverse Ranges of southern California. Most of the current range of the California spotted owl occurs on public lands, primarily those managed by the USDA Forest Service (USFS). The California spotted owl (CSO) is a USFS sensitive species. Demographic studies conducted in the Sierra Nevada indicate that CSO populations have been declining over the past 20 years (e.g., Conner et al. 2013, Tempel et al. 2014). Large, high severity fire can degrade remaining owl habitat and decrease the probability of use by CSO (Jones et al. 2021, Jones et al. 2022), the need to maintain and restore CSO habitat throughout its range has become increasingly important.

The 2021 Caldor fire burned 221,784 acres across land ownership and vegetation types. Ninety CSO Protected Activity Centers (PACs), established to protect key nesting and roosting habitats for CSO, are located within the fire perimeter (**Figure 1**). Of the 90 PACs, 86 are on the Eldorado NF, and 4 are on the Lake Tahoe Basin Management Unit. We analyzed fire effects to CSO habitat at multiple spatial scales including the PAC scale, the 1,000 acre Territory scale (mapped as circles with Activity Centers as centroids), and the Home Range Core Area (HRCA) scale. We included PACs outside of the fire perimeter where the associated Territory or HRCA overlapped with the fire. In all, the analysis includes 98 PACs, 1,000 Territories, and 92 HRCAs. Caldor HRCAs range in size from 996 acres to 1,385 acres, although the median value is 1,000 acres. Many of the owl PACs before the fire were sharing overlapping 1,000-acre HRCAs.

California Spotted Owl habitat experienced a range of fire severities, with just under half of habitat experiencing no to low severity fire, and just under half experiencing high severity fire (**Table 1**). Very little area experienced a change in basal area loss in intermediate fire severity classes. The Caldor fire is additionally characterized by high severity patch sizes that exceeded what would be expected under NRV, including a large, 32,700 acre high severity patch in conifer forest types. Most of the fire area is highly departed from expected fire return intervals under NRV (Post-Fire Restoration Framework in Mixed Conifer Forests in the 2021 Caldor Fire, USDA FS 2022), with 86% of PAC acres considered extremely departed from NRV prior to the Caldor Fire, and 10% moderately departed (FRID dataset, Safford and Van De Water 2014), meaning they have not burned as frequently as would be expected under a natural fire regime.

Table 1. Number of Protected Activity Centers (PACs), Territories and Home Range Core Areas (HRCAs) within or immediately adjacent to the Caldor fire. Acres and relative percentage of PACs, Territories and HRCAs experiencing each fire severity class are shown (RAVG 7-class BA).

Scale	Number	No Change	Low Severity (0-25% BA loss)	Low-Moderate Severity (25-50% BA loss)	Moderate-High Severity (50-75% BA loss)	High Severity (75-100% BA loss)	Total
PACs	98	4,959 (15%)	10,012 (31%)	1,853 (6%)	1,676 (5%)	13,908 (43%)	32,408 (100%)
Territories	97	12,671 (15%)	27,794 (33%)	5,280 (6%)	4,785 (6%)	34,476 (41%)	85,276 (100%)
HRCAs	92	11,043 (15%)	24,048 (31%)	4,633 (6%)	4,180 (5%)	33,404 (43%)	77,308 (100%)

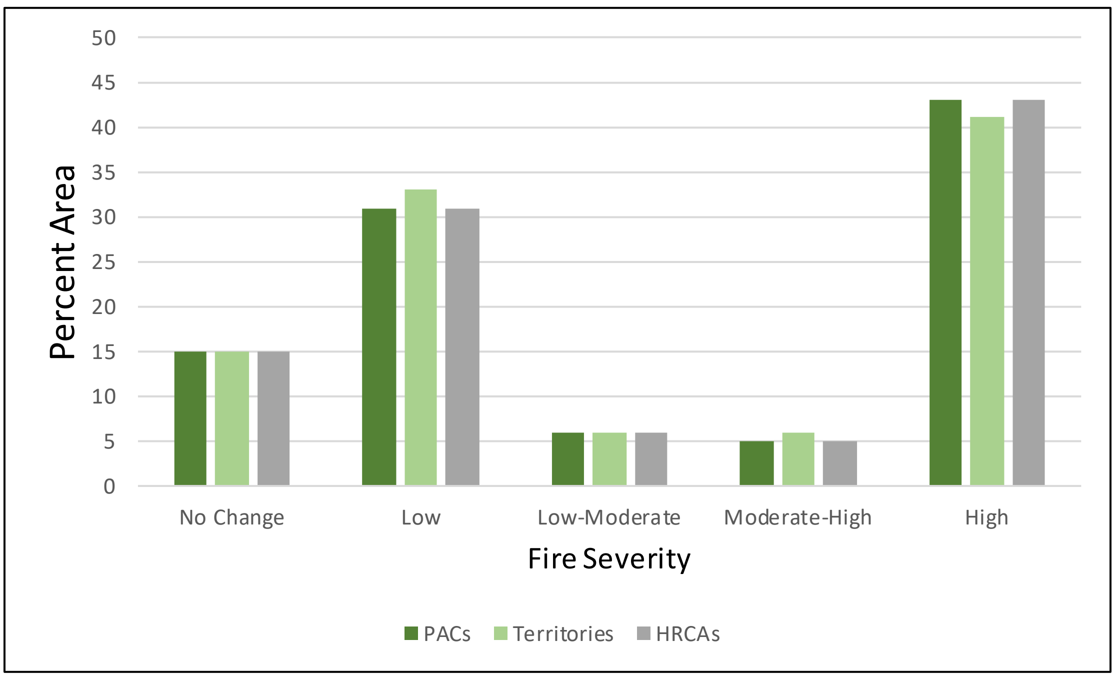

Fig. 2. Percent of total PAC, Territory and HRCA acres within each fire severity class.

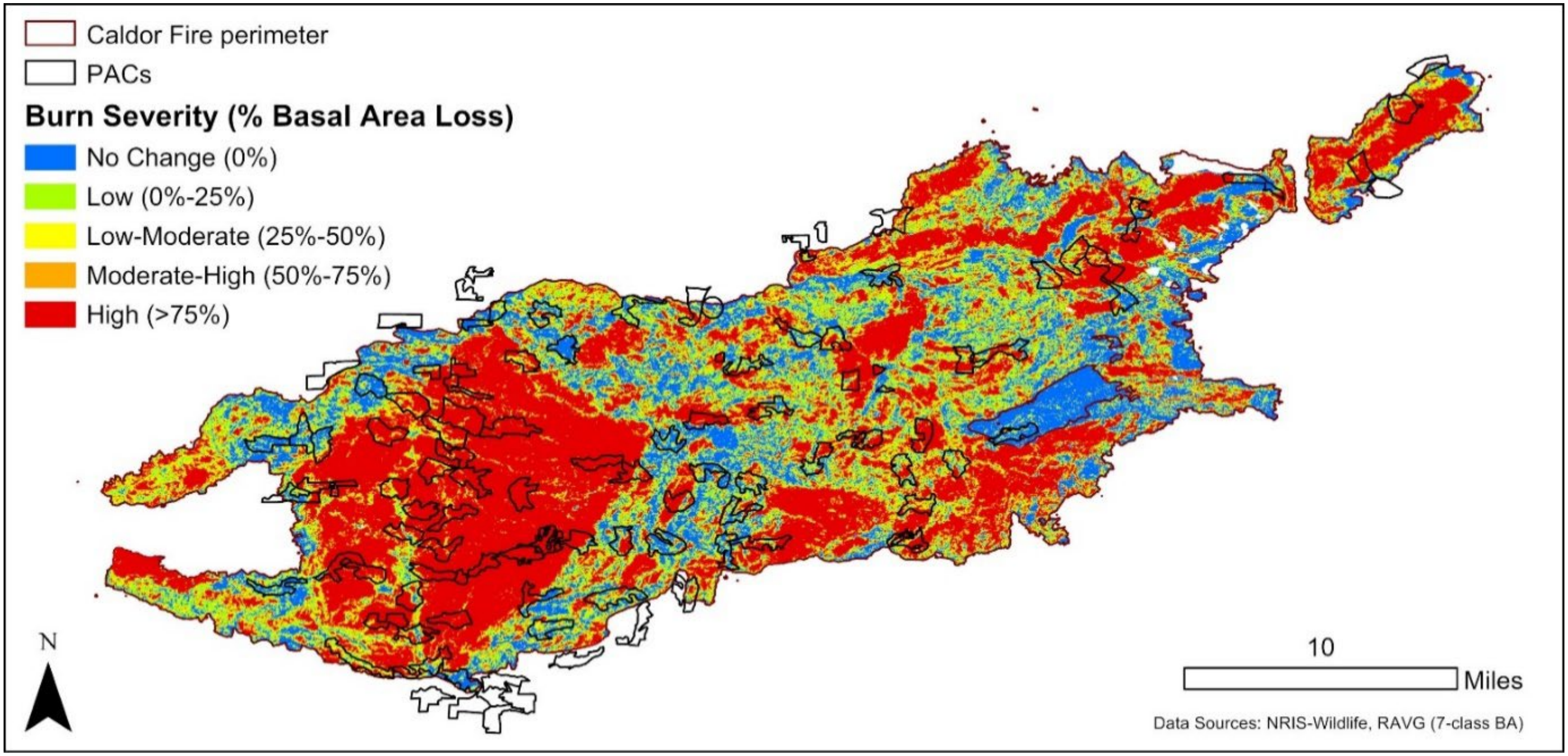

Figure 2. Protected Activity Centers (PACs) mapped within and adjacent to the Caldor Fire perimeter are displayed with fire severity (expressed as relative Basal Area loss).

Often the first post-fire task that falls to wildlife biologists and other land managers is to evaluate if PACs will be retained, retired, or re-mapped based on availability of remaining suitable habitat. The Sierra Nevada Framework states that Protected Activity Centers should be retired or removed from the network when disturbance events change conditions to the degree that continuing contribution to the population is unlikely (USDA 2004). After a stand-replacing event, the USFS is directed to evaluate habitat conditions for CSO within a 1.5-mile radius around the Activity Center (known nest stand or roost) to identify opportunities for re-mapping the PAC (USDA 2004). If there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network.

This document provides a basis and framework for evaluating PAC retirement, along with restoration opportunities in areas where the fire may have improved or maintained desired conditions for CSO, and areas where the fire may have degraded habitat, although enough suitable habitat may remain to retain the existing PAC.

Post-fire Restoration Assessment Process

To evaluate fire effects on CSO habitat, we used the process outlined in the "Postfire Restoration Framework for National Forests in California" (Meyer et al. 2021). This strategy provides a science-based, post-fire ecological restoration framework for national forests in California. The framework is rooted in the following ecological principles designed to enhance or recover ecological integrity after a large-scale disturbance such as fire: 1) Restore key ecological processes; 2) Consider landscape context; 3) Promote regional native biodiversity; 4) Sustain diverse ecosystem services; 5) Establish a prioritization approach for management interventions; and 6) Incorporate adaptation to agents of change. The framework outlines a five-step process that leads to the development of a restoration portfolio that can inform project planning and monitoring. The five steps we followed to conduct this assessment are outlined in **Figure 3** and described in more detail below.

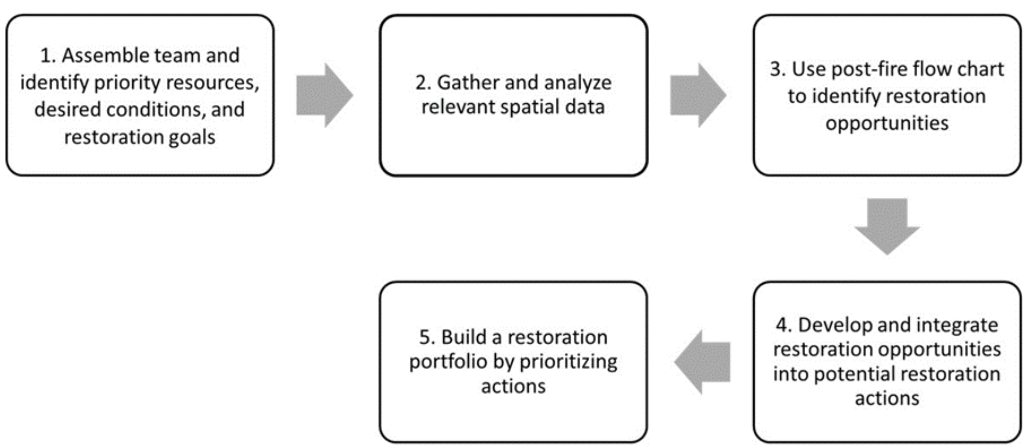

Figure 3. Five step process used to develop the post-fire restoration framework.

Step 1: Identify priority resources and desired conditions

Interdisciplinary Team (CSO)

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Priority resources

California spotted owl habitat. Other priority resources for the Caldor Fire area (e.g. mixed conifer forest) are addressed in the Post-Fire Restoration Framework in Mixed Conifer Forests in the 2021 Caldor Fire, Eldorado National Forest and the Lake Tahoe Basin Management Unit (USDA FS 2022).

Desired Conditions

As described in the Conservation Strategy for the California Spotted Owl in the Sierra Nevada (USDA 2019) and the Sierra Nevada Forest Plan Amendment – Final Supplemental Environmental Impact Statement Record of Decision (USDA 2004), desired conditions for CSO include high-quality nesting and roosting habitat that will likely enhance occupancy and demographic performance. These areas are generally characterized by structurally complex conifer forests with large trees and high canopy cover, including a hardwood component.

Restoration goals

- Maintain California spotted owl habitat (i.e., PACs) so that it continues to support reproduction of California spotted owls.
- Promote California spotted owl persistence on the landscape by increasing the resiliency of existing habitat and facilitating the development of additional, high-quality habitat.

Step 2: Gather and Analyze Relevant Spatial Data

Data Sources

This table describes the nature and source of data used within the Caldor CSO Analysis, and its location within the geodatabase created for this analysis. The geodatabase, **Caldor_GTR270_CSO.gdb**, is located at T:\FS\NFS\R05\Program\Ecology\GIS\CentralSierraProvince\Province\Caldor\CSO.

Table 2. Geospatial data gathered for analysis, along with sources, descriptions, and location within the database of record for this report.

Data type	Description/Source	Location within Geodatabase
CSO PACs	Natural Resource Inventory System- Wildlife database. https://www.fs.usda.gov/managing-land/natural-resource-manager#wildlife.	Caldor_GTR270_CSO.gdb\CSO_PAC_Caldor
CSO Territories	1000 acre circle with each Activity Center as centroid. Created with a 1,135 m radius around each Activity Center (from NRIS-Wildlife, cited above).	Caldor_GTR270_CSO.gdb\CSO_Territory_Caldor
CSO HRCAs	Natural Resource Inventory System- Wildlife database. https://www.fs.usda.gov/managing-land/natural-resource-manager#wildlife.	Caldor_GTR270_CSO.gdb\CSO_HRCA_Caldor
CSO 1.5 mile buffer	Area (circle) within 1.5 miles of each Activity Center (from NRIS-Wildlife, as cited above).	Caldor_GTR270_CSO.gdb\CSO_OneAndHalfMile_Caldor
RAVG Fire Severity	Remote Sensing Lab's Rapid Assessment of Vegetation Condition after Wildfire (RAVG) program, 7-class Basal Area loss. Accessed at Burn Severity Portal. https://burnseverity.cr.usgs.gov/products/ravg.	Caldor_GTR270_CSO.gdb\Caldor_RAVG_BA7_20211017
Pre-fire Vegetation (eVeg)	USFS Region 5 Existing Vegetation. https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5365219	Caldor_GTR270_CSO.gdb\eVeg\eVeg_3miles_Caldor (eVeg coverage in vicinity of Caldor)
Wildland Urban InterMix	USFS Region 5. https://www.fs.usda.gov/detail/r5/landmanagement/gis/?cid=fsbdev3_048299	Caldor_GTR270_CSO.gdb\Forest\WUI_TMU & Caldor_GTR270_CSO.gdb\Forest\WUI_ENF
Potential Operational Delineation Units (PODs)	Eldorado NF	Caldor_GTR270_CSO.gdb\Forest\CaldorPODsV3
Climate Exposure	Combined California Refugia model, 8.5 RCP, Consensus model for MIROC-CSM and CNRM-CM5 (Thorne et al. 2020).	Caldor_GTR270_CSO.gdb\combine85_all7_Clip1
NRV for proportion of high severity fire	LANDFIRE dataset, Biophysical Setting, 2016 Remap. Historical Fire Frequency and Severity Layer. https://landfire.gov/fireregime.php	Caldor_GTR270_CSO.gdb\LandFire\LandFire_BPS_HighSeverity
Fire return interval departure	US Forest Service, Fire Return Interval Departure dataset. https://www.fs.usda.gov/detail/r5/landmanagement/gis/%3Fcid%3Dstelprdb5361974	Not within geodatabase.
Natural regeneration probabilities	Outputs from the Post-fire Spatial Conifer Regeneration Prediction Tool (POSCRPT) (https://stewartecology.shinyapps.io/POSCRPT_dev_version/)	Caldor_GTR270_CSO.gdb\POSCRPT_mean_py
Patches of high severity fire effects	Patches of high severity fire > 250 acres, aggregated using the PatchMorph tool.	Caldor_GTR270_CSO.gdb\PatchAnalysis\Caldor_Patches

Scale

Most metrics were evaluated at three spatial scales: the PAC, the 1000-acre Territory centered around Activity Centers, and the HRCA. Fire severity metrics (basal area loss, patch size) are bounded by the Caldor Fire perimeter; vegetation metrics, climate exposure, and regeneration potential consider adjacent habitat even when outside the fire perimeter.

Step 3: Use Flowchart to Identify Restoration Opportunities

We used a logical process adapted from GTR-270 (Meyer et al. 2021) to distinguish restoration opportunities for CSO in response to the range of effects caused by the Caldor Fire (Figure 3). This process was applied at the PAC, Territory, and HRCA scales.

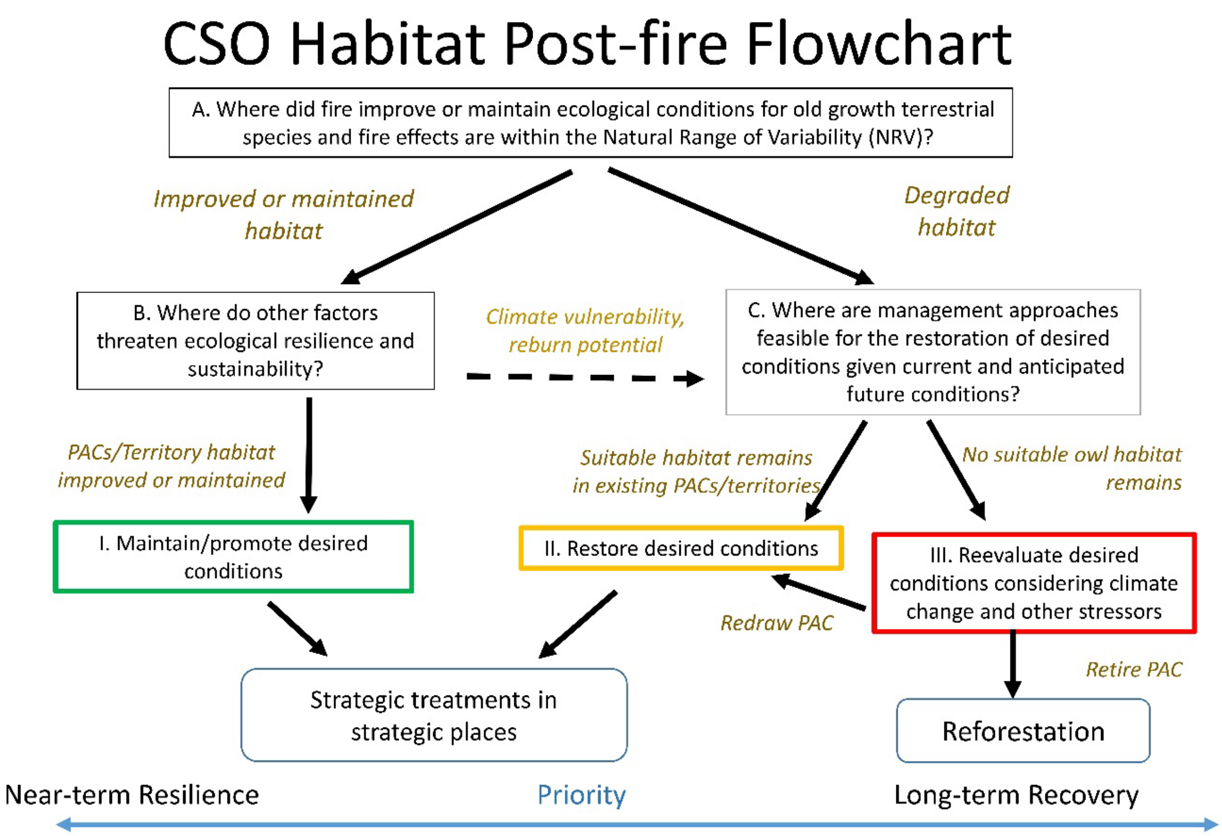

Figure 4. Post-fire flowchart for CSO Habitat. The post-fire flow chart is based on three questions (A, B, and C) for the identification of Tier I, Tier II, and Tier III management responses or "restoration opportunities" that support restoration goals in different portions of the post-fire landscape.

Assessment of Ecological Conditions

We first assessed 1) where the fire may have improved, maintained or degraded CSO habitat, and 2) where habitat degradation occurred to the extent that would necessitate redrawing or retiring PACs.

We used data from the Natural Resource Information System (NRIS) Wildlife database (USDA 2022), which includes delineated PACs. Forest-level mapping of PACs represents the best available data indicating where owls have been known to occur. Although CSO use various sized areas for nesting, roosting and foraging, and the size of these areas differ greatly depending on season, sex, habitat quality and individual differences (Blakey et al. 2019) we elected to use a standardized territory area to be consistent with previous studies of fire effects on CSO for this analysis. We followed the example provided in Jones et al. (2021), who defined a territory as an area within a 1,100-m radius from the PAC (approximately 988 acres). Although we could have evaluated a wide range of other areas around the PAC, Jones et al. (2021) found that patterns of fire severity within the 1,100-m radius area from the PAC was representative of effects seen at other spatial scales (e.g, nest sites and home ranges). We evaluate most metrics at all three spatial scales (PAC, Territory, and HRCA).

While there are many metrics available to assess fire severity, we selected relative basal area loss so that our fire severity classes would be consistent with metrics reported in research on fire effects to owls (Jones et al. 2021, Kramer et al. 2021).

Table 3. Categorization of Rapid Assessment of Vegetation data (RAVG) seven-category percent change in basal area data was binned into fire severity categories.

Code	RAVG – BA7 Description	Fire Severity
0	outside perimeter	No Change
1	0% basal area loss	No Change
2	0% < BA loss < 10%	Low
3	10% <= BA loss < 25%	Low
4	25% <= BA loss < 50%	Low-Moderate
5	50% <= BA loss < 75%	Moderate-High
6	75% <= BA loss < 90%	High
7	BA loss >= 90%	High

Our primary indicator was the proportion of the PAC, Territory and HRCA that burned with high severity (Basal Area loss exceeding 75%, **Fig. 5**). This indicator was used to establish which allocations may have burned within NRV, as well as which allocations may not contain sufficient post-fire habitat, as detailed below. This analysis is structured to accommodate better information as it becomes available. Occupancy status can only be determined based on surveys conducted after the fire during which these assumptions about habitat suitability can be tested and refined. In addition, as better data sources become available (assessments of year-one mortality, post-fire LiDAR), habitat suitability assessment may be revised.

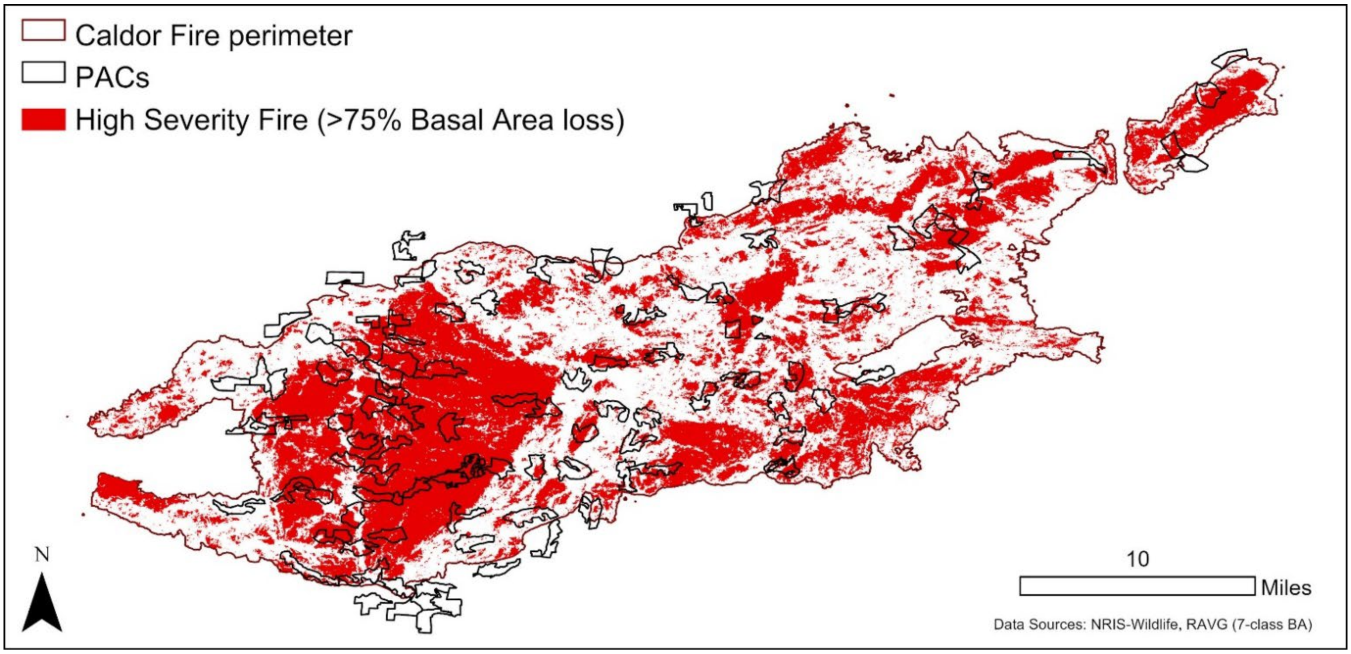

Figure 5. Protected Activity Centers (PACs) and high severity fire areas within the Caldor Fire.

Indicators of Ecological Conditions

Indicator #1: Where were PAC/Territory/HRCA high severity burn proportions within the Natural Range of Variation (<15% of area)?

Pre-Euro-American settlement, high severity fire comprised a smaller proportion of the burned landscape in mixed conifer forest relative to proportions observed in many contemporary fires (Meyer et al. 2015, Mallek et al. 2013). California spotted owl is adapted to persist on landscapes where high severity fire proportions are within the range predicted under pre-Euro-American settlement, which is considered the Natural Range of Variation (NRV, Kramer et al. 2021). This indicator compares the proportions of PACs, Territories, and HRCAs that burned at high severity (>75% basal area loss) in the Caldor Fire against the proportion of high severity fire that would have been expected under NRV (Safford and Stephens 2017). We derived natural range of variation high severity proportion values specific to the Caldor Fire from the LandFire model, which depicts the vegetation system that may have been dominant on the landscape prior to Euro-American settlement, based upon the current biophysical environment and an approximation of the historical disturbance regime at a resolution of 30 m (LANDFIRE 2016, Mallek 2013). LandFire high severity fire proportions were calculated across all Caldor PACs and Territories to derive an average NRV high severity proportion specific to CSO habitat within our analysis area. This analysis indicated that PACs and Territories averaged 16% high severity fire under NRV, with most (75%) of PAC and Territory acres predicted to have burned with less than a 15% proportion of high severity fire under NRV. This threshold was conservatively consistent with the range of high severity proportions under NRV

(5%-15%) that has been reported for Yellow Pine-Mixed Conifer Forest across the Sierra Nevada (Safford and Stevens 2017). We compared proportions of high severity fire within each PAC, Territory, and HRCA (>75% basal area loss, RAVG BA7 dataset) against this 15% high severity threshold.

Where high severity fire did not exceed 15% of the PAC/Territory/HRCA area, we considered that these allocations may have burned within the NRV for high severity fire proportion.

<u>Indicator #2</u>: What percentage of the PAC/Territory/HRCA burned at high severity across >50% of its area?

We calculated the proportion of each PAC, Territory, and HRCA burned at high severity (>75% basal area loss, RAVG BA7 dataset). We selected a 50% high severity proportion threshold as a critical value based upon assessments of post-fire occupancy and recolonization from the King Fire (USDA 2019, Jones et al. 2021, Jones et al. 2022). PACs/Territories/HRCAs that exceeded this high severity threshold were presumed to have a much lower probability of post-fire occupancy. These PACs may need to be redrawn with the best available remaining post-fire suitable habitat. Where PACs/Territories/HRCAs experienced between 15% and 50% high severity proportion, PACs may not need to be redrawn, but can be considered to have experienced adverse effects from the Caldor Fire that may also shape owl occupancy and behavior (Kramer et al. 2021).

Where high severity fire exceeded 15% of the PAC/Territory/HRCA area, but was less than 50%, we considered that these allocations were outside of NRV for high severity fire proportion, but may have retained sufficient habitat to support CSO. Where high severity fire exceeded 50% of the allocation area, we presumed would PACs would need to be redrawn or retired.

<u>Indicator #3</u>: Where PACs experienced high severity fire across >50% of area, where does suitable habitat remain within the territory? The HRCA? Within 1.5 miles of the Activity Center?

To help evaluate which PACs should be redrawn and which retired, we asked where suitable habitat may remain post-fire within existing Territories and HRCAs, as well as within 1.5 miles of Activity Centers. We derived potential habitat from eVeg, selecting forested vegetation types classified as 4M, 4D, 5M, and 5D (see Table 4). We intersected this potential habitat layer with fire severity to derive acres of potential habitat by fire severity class for each Activity Center. What is immediately clear is that much of this remaining potential habitat is overlapping, particularly in the vicinity of the large, high-severity patch at the western side of the fire (e.g. there may not be enough habitat to redraw all PACs). This indicator may be re-calculated as better post-fire vegetation coverages become available, particularly coverages that capture secondary mortality and/or changes in canopy cover.

Potential CSO habitat may remain where suitable habitat (4M,4D,5M,5D of Forested WHR types) burned at less than high severity within 1.5 miles of Activity Centers.

Table 4. Suitable habitat for the CSO within the analysis area using the California Wildlife Habitat Relationships[2]

CWHR Classification	Tree Size QMD	CWHR Canopy Class	Canopy Cover	Vegetation Types[1]
4D	11 to 24"	Dense cover	60 to 100 percent	DFR, MHC, MHW, MRI, PPN, RFR, SMC, WFR
4M	11 to 24"	Moderate cover	40 to 59 percent	
5D	more than 24"	Dense cover	60 to 100 percent	DFR, EPN, JPN, LPN, MHC, MHW, MRI, PPN, RFR, SMC, WFR
5M	more than 24"	Moderate cover	40 to 59 percent	

[1] CWHR habitat types for CSO include Douglas fir (DFR), eastside pine (EPN), Jeffrey pine (JPN), lodgepole pine (LPN) montane hardwood-conifer (MHC), montane hardwood (MHW), montane riparian (MRI), ponderosa pine (PPN), red fir (RFR), Sierran mixed conifer (SMC), white fir (WFR). CWHR Classification 6 was not present within the analysis area.

Analysis Results

Using the indicators described above, we classified the PAC, territory and HRCA associated with each Activity Center into three categories (Tier I, Tier II, Tier III). These categories reflect the CSO Post-Fire Habitat Flowchart (Fig. 4), and capture where our analysis indicated that high severity proportion was within NRV (Tier I), where high severity proportion was outside of NRV, but may have retained sufficient habitat post-fire to support CSO (Tier II), and where high severity fire effects occurred across more than half of a PAC or Territory and is unlikely to support CSO in the same location post-fire (Tier III). The proportion of high severity fire did not vary widely by spatial scale. With a few exceptions, each PAC and its associated Territory and HRCA tended to follow a similar pattern of proportional high severity burn. While no post-fire owl surveys have been conducted to date, results from 2022 surveys will validate and refine assumptions made about post-fire habitat suitability

Analyses of ecological indicators were conducted in ArcGIS Pro using source layers and indicators described above. Final outputs from the multiscale analysis are contained within PAC, Territory, and HRCA layers in **Caldor_GTR270_CSO.gdb** (the features CSO_PAC_Caldor, CSO_Territory_Caldor, CSO_HRCA_Caldor). **Appendix 2** is a guide to the attributes added to these feature classes that capture additional indicators.

Table 5. Criteria used to classify CSO allocations into Tier I, Tier II and Tier III categories that reflect whether high severity proportions were within the Natural Range of Variability, and whether sufficient habitat may remain post-fire.

Tier	Number PACs in Category	Proportion of PAC that burned at high severity	Proportion of Territory OR HRCA that burned at high severity
I	**27**	<15%	<15%
II	**29**	>15% and <50%	>15% and <50%
III	**42**	>50%	>50%

Tier I: Habitat Maintained or Improved

High Severity less than 15% (within NRV)

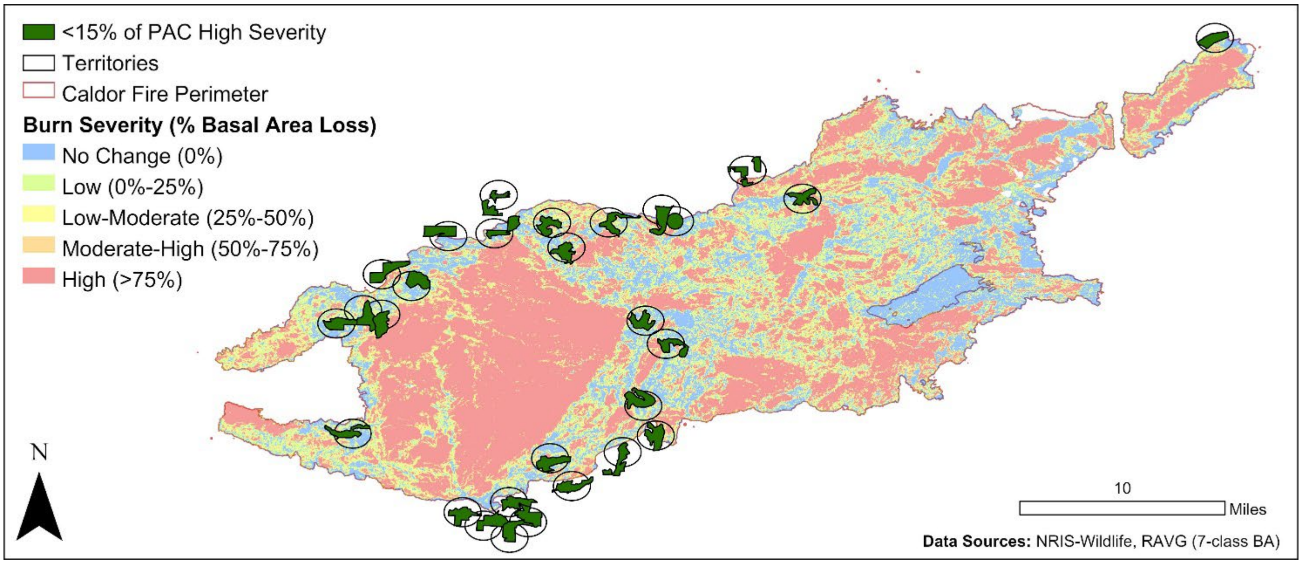

Figure 7. PACs and Territories classed as Tier I.

Habitat may have been maintained or improved where the PAC and Territory/HRCA remained unburned or experienced proportions of high severity fire within the Natural Range of Variation (see Indicator #1). For the **29 PACs** placed within this category, PACs averaged 4% high severity fire, 1000 acre territories averaged 8%, and HRCAs averaged 9%. In general, most (80%-90%) of the remaining area burned at low severity (0%-25% basal area loss) or was unburned, with very few acres categorized as low-moderate or moderate-high severity (see Table 1). Many of these PACs are at the perimeter of the fire or around the perimeter of the large, high severity patch at the western portion of Caldor. It is important to note that while these areas may be within NRV with respect to burn severity proportions, most of the Caldor Fire was highly departed from NRV with respect to fire return interval, having not experienced fire in recent history. Restoration opportunities to maintain and improve stand health and resilience may be appropriate, and critical to bolster future resilience to high severity fire. Areas adjacent to the large high severity patch may be particularly crucial to consider for future resilience, as there may be increased risk of reburn, and more extensive utilization of this remaining lower elevation, highly productive habitat by owls.

Tier II: Habitat Degraded, and <50% High Severity

High Severity >15% (outside of NRV)

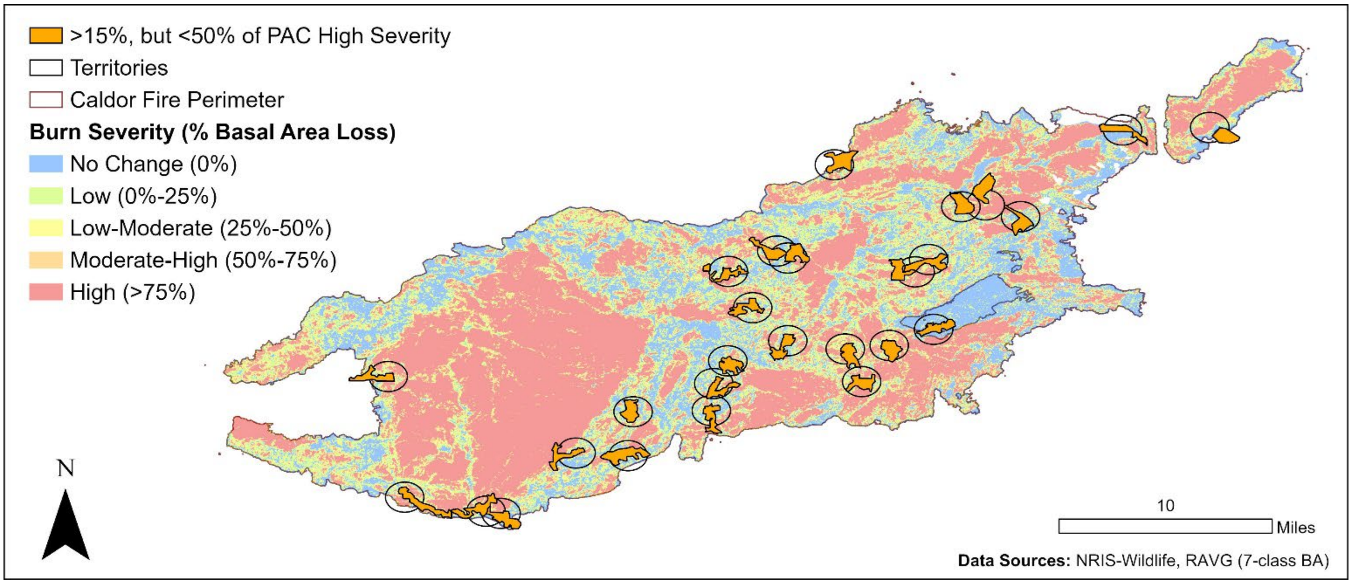

Figure 8. PACs and Territories classed as Tier II.

We considered habitat degraded where proportions of high severity fire were outside of NRV (see Indicator #1). Of these, **27 PACs** and/or their associated Territory/HRCAs experienced high severity fire on more than 15%, but less than 50% of their area (Indicator #2). These thresholds suggest that although fire effects may be outside of NRV, suitable CSO habitat may remain post-fire. PACs averaged 29% high severity fire within this category, territories averaged 30%, and HRCAs averaged 34%. Restoration opportunities can be identified within these PACs and territories to promote reproductive success and habitat resiliency into the future. Post-fire assessment of owl occupancy will be critical for these areas, as they still experienced high severity fire outside of what would be expected under NRV, with high loss of tree cover. Additional management actions could help restore desired conditions and increase the probability of maintaining suitable habitat into the future.

Tier III: Habitat Degraded, and >50% High Severity

High Severity > 15% (outside of NRV)

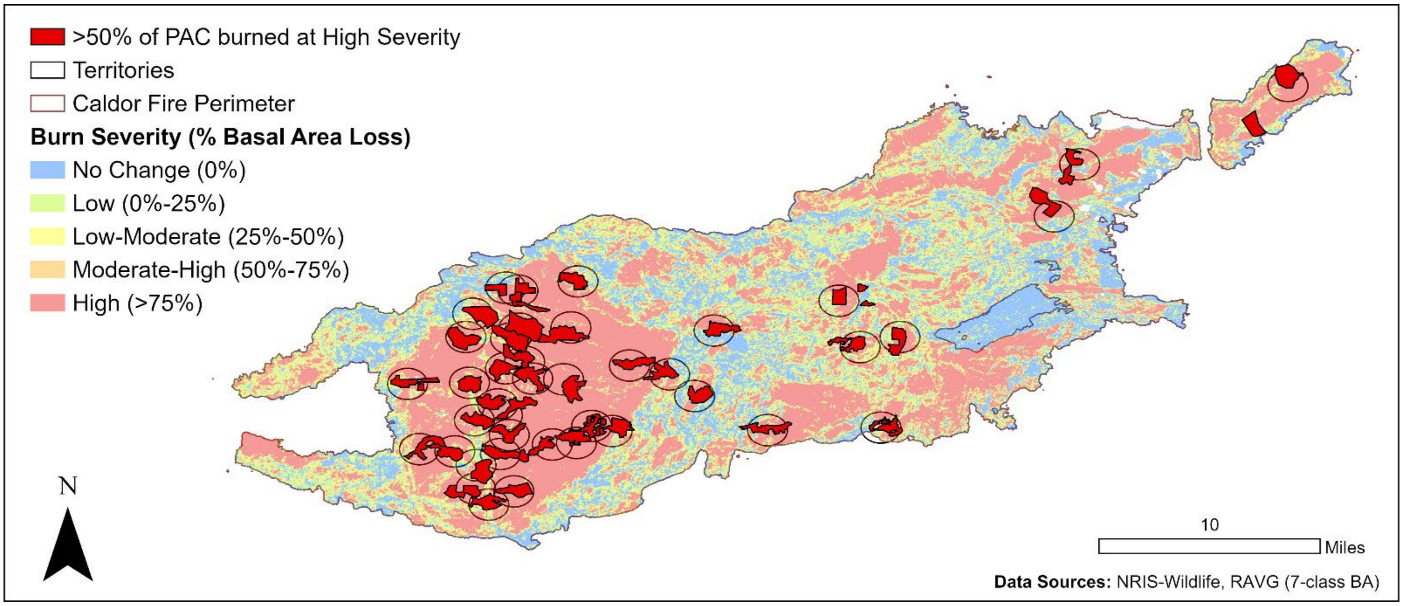

Figure 8. PACs and Territories classed as Tier III.

In **42 PACs** and their associated territories/HRCAs, more than 50% of the area burned at high severity (Indicator #2). Not only is this habitat considered degraded and outside of NRV, but research suggests the probability of post-fire occupancy or recolonization is low (Jones et al. 2021, Jones et al. 2022). It is possible that CSO may continue to use some portion of these areas if the surrounding landscape continues to support suitable habitat characteristics for owls. In addition, there are interior islands within the high severity patch that may support several PACs. We identified where suitable habitat may remain post-fire within surrounding territories, HRCAs and within 1.5 miles of activity centers (Indicator #3). Of these 42 PACs, 14 contain at least 300 acres of CWHR 4M, 4D, 5M or 5D habitat that burned at less than high severity in the associated 1000 acre territory or HRCA. All but four may have suitable habitat remaining with 1.5 mile of the activity center, however, for the 31 of these PACs that occur within or near the large high severity patch, remaining available habitat may occur within existing territories outside of the patch or be shared by multiple degraded PACs (Indicator #3).

Potential habitat within 1.5 miles of PACs where >50% burned at High Severity

While adequate suitable habitat may not remain within existing PACs, there may be a potential to redraw PACs if suitable habitat remains within 1.5 miles of the Activity Center. We overlaid Tier III PACs onto potential habitat (CWHR 4M, 4D, 5M, 5D) and burn severity. While only four PACs lack any postfire habitat within 1.5 miles of the activity center, there are many instances in and adjacent to the large high severity patch where suitable habitat would be shared among PACs or located within existing PACs that burned at lower severities (**Fig. 9**). These PACs will need to be evaluated on a case-by-case basis to determine whether and how they can be re-drawn.

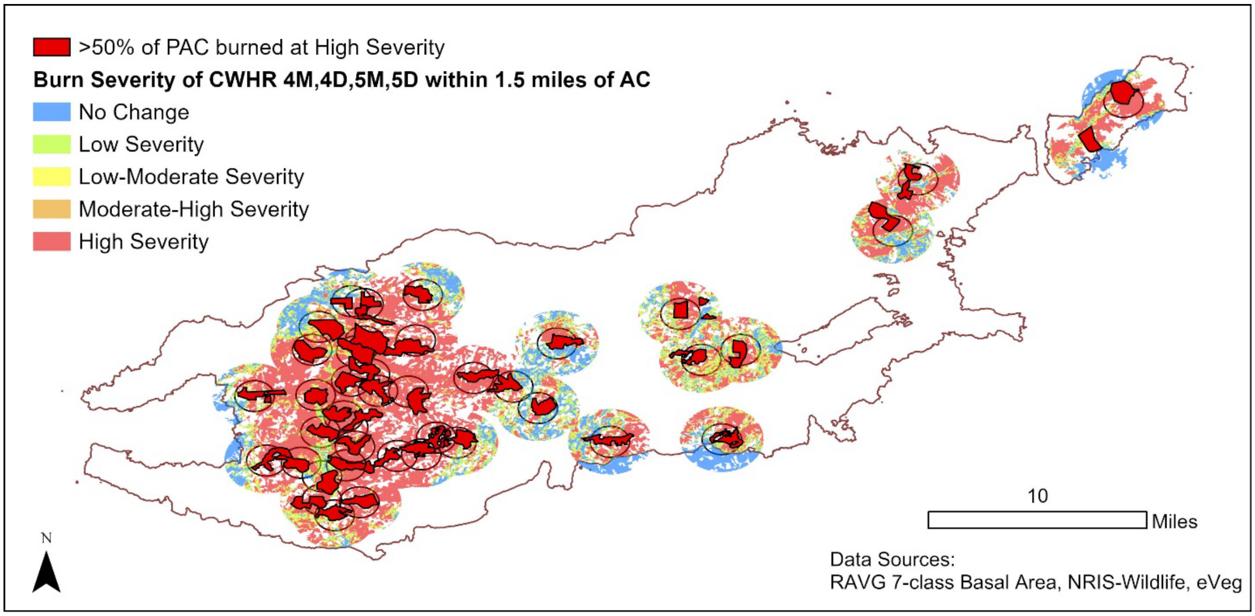

Figure 9. PACs where >50% burned at high severity (Tier III) and the burn severities of areas within 1.5 miles of each associated Activity Center that is CWHR habitat type 4M, 4D, 5M, or 5D.

Prioritization Layers

We present additional geospatial coverages that may help to develop and prioritize treatments. Some of these are ecological models (climate exposure, probability of natural regeneration, high severity patches), while some relate to management or socio-economic considerations (ownership, PODs, WUI). These coverages can be used to refine treatments with consideration to climate change and other forest objectives as projects are defined and treatments are developed within and around CSO allocations. See Appendix 2 for specifics on how these data are captured in attribute tables for PACs, Territories and HRCAs.

1. Climate Exposure:

We utilized a climate exposure that assesses which areas are predicted to maintain existing vegetation at mid-century (California Refugia model, Thorne et al. 2020). This model asks where vegetation types (e.g. mixed conifer forest) are predicted to be climatically stable under two different future climate scenarios that presume no change in global emissions at mid-century (2040-2069): a warmer, wetter future (modelled with the CNRM-CM5 global climate model) and a hotter, drier future (modelled with the MIROC-ESM global climate model). We evaluate where there is consensus between these two models and report the proportion of each PAC/Territory/HRCA that may serve as refugia for mixed conifer forest types, and the proportion at high risk of type conversion (**Appendix I, Map 1**).

Metric: Climate_Exp_High = Percentage of PAC/Territory/HRCA considered refugia for conifer vegetation by mid-century; Climate_Exp_Low= Percentage of PAC/Territory/HRCA at high risk for type conversion by mid-century.

Potential Use: Identify PACs and territories that may be at high risk for drought stress and may benefit from density treatments or treatments to improve health and persistence of large trees on the landscape. High-exposure areas suggest that conifer planting may need to occur at lower densities or with different species composition than may have occurred prior to the fire; conversely lower-exposure areas suggest that conifers more likely to persist through mid-century with pre-fire species composition

2. Natural Regeneration:

Natural regeneration probabilities in the Caldor Fire perimeter have been modelled for the entire fire area using the POSCRPT model, and are summarized in detail in the Post-Fire Restoration Framework in Mixed Conifer Forests in the 2021 Caldor Fire. This model expresses the probability of natural regeneration (the probability that one regenerating seedling will be observed in a 60 m^2 plot) under the two global climate models described above, also incorporating fire severity, aspect, slope, and seed availability. Our analysis highlights these probabilities for high severity burn areas within PACs and territories within the analysis area (**Appendix I, Map 2**).

Metric: Probability of natural regeneration in areas that burned at high severity.

Potential Use: Identify PACs and territories where regeneration is unlikely to occur naturally, which could inform reforestation priorities.

3. High Severity Patches:

Under NRV, high severity patches rarely exceeded 100-ha (247 ac) in size (Safford and Stephens 2017), and research from the King Fire suggests that owls avoid large, high severity patches that exceed 115 hectares (284 acres, Jones et al. 2021). We highlight large patches within the analysis area in two different ways. One is by identifying the 39 PACs and territories that are within or adjacent to the large high severity patch on the western side of the fire. These PACs will face unique management challenges due to the paucity of unburned or low severity acres in the interior of the patch, and high density of existing PACs around the perimeter. A second coverage shows all patches that exceed 250 acres in the Caldor Fire, and an attribute indicating where PACs, Territories and HRCAs intersect these large patches (**Appendix I**, **Map 4**). Areas that burned at high severity may be more likely to reburn at high severity (Coppoletta et al. 2016), underscoring the importance of protecting remaining late seral and big tree habitat adjacent to these patches through additional fuels reduction adjacent to fire refugia (Larson et al. 2022).

Metrics: V_Lg_Patch_Int_Adj = "Y" if PAC/Territory/HRCA is within or adjacent to the 40,000 acre patch; L_Patch_Int="Y" if PAC/Territory/HRCA intersects a high severity patch >250 acres.

Potential Use: Identify PACs and Territories within or adjacent to high severity patches that may be at high risk for re-burn. Prioritize large, high severity patches within or adjacent to PACs and Territories for reforestation and long-term recovery of late-seral habitat.

4. Isolated Remnant Green Forest:

Isolated stands of mixed conifer forest that were unburned or burned at low severities may have an outsized importance as CSO habitat and seed sources for conifer regeneration, as well as high vulnerability to future high severity fire (**Appendix I, Map 4**). See the Post-Fire Restoration Framework in Mixed Conifer Forests in the 2021 Caldor Fire for additional detail on how these remnant stands were identified and mapped.

Metric: Acres of isolated remnant green forest within PACs and territories

Potential Use: Identify high-priority PACs and territories where isolated stands are surrounded by high severity burn, and where restoration actions may be critical to improve resilience to future high severity fire.

5. Potential Operational Delineation Units (PODs):

The Eldorado NF is partitioned into Potential Operational Delineation units (PODs) defined by potential control features, such as roads and ridge tops, within which relevant information on forest conditions, ecology, and fire potential can be summarized (**Appendix I, Map 5**).

Metrics: POD = list of all PODs that intersect with the PAC, Territory or HRCA

Potential Use: Alignment with Forest priorities

6. Wilderness Urban Interface (WUI):

Areas within Defense and Threat zones may be prioritized for fuels reduction treatments (**Appendix I, Map 5**). In additional, there is guidance specific to fuel reduction treatments in WUI (USDA 2004, USDA 2019).

Metrics: WUI_Threat_Acres = number of acres within PAC/Territory/HRCA within a WUI threat zone; WUI_Defense_Acres = number of acres within PAC/Territory/HRCA within a WUI defense zone

Potential Use: Alignment with Forest priorities

Step 4: Develop restoration opportunities into actions

A broad range of management actions can be used to maintain and promote desired conditions for CSO habitat as well as restore those habitat areas where conditions were degraded. These actions include targeted and strategic fuels management designed to meet the dual objectives of 1) conserving California spotted owl habitat and 2) promoting resilience of Sierra Nevada forests by retaining large trees, reducing surface fuels and small tree densities, and promoting fire regimes within the natural range of variation for Sierra Nevada forests (USDA 2019, Kramer et al. 2021, Jones et al. 2022). Creating a dynamic mosaic of tree clumps and openings of variable sizes, shapes, spatial configurations, and seral stages can enhance forest resilience to fire and other disturbances and protect existing stands of mature, multi-canopied forest preferred by CSO (Kane et al. 2013). Maintaining or restoring heterogeneity can also be accomplished by varying management approaches across different spatial scales. Actions that are taken within the territory or the home range may differ from those employed within the PAC because habitat elements that promote foraging are different from those associated with nesting and roosting. Consideration of spatial scale may enable the achievement of multiple restoration objectives that would conflict on an acre-by-acre basis (e.g. fuel breaks to protect remnant habitat versus promotion of late seral structure within nest stands). This approach would have the added benefit of increasing structural heterogeneity and habitat resilience at the landscape scale.

Potential Objectives:

- Reduction of surface and ladder fuels (PACs, territories) to promote future resilience to high severity fire.
- Improved growing conditions for remaining large diameter trees (reduced drought stress, decreased susceptibility to insects and disease). Retention of large trees and reduced small tree densities to increase Quadratic Mean Diameter within CSO habitat.
- Adequate retention and future recruitment of large down wood balanced against removal of snags that may prevent future treatments within CSO habitat.
- Increased forest heterogeneity (vertical and horizontal) that is within the natural range of variation at all spatial scales.
- Protection of PACs/territories with strategic fuelbreaks outside of Territories
- Long-term recovery of heterogeneous late-seral habitat where natural regeneration not predicted to occur (due to patch size and future climate scenarios)

Potential Treatments:

- Prescribed burning and hand thinning – these treatments could maintain, promote and/or restore desired conditions in CSO habitat areas, in existing PACs and Territories, as well as redrawn PACs and Territories. Prescribed burning would be the preferred treatment in existing PACs.
- Mechanical thinning and dead tree removal – these treatments may be appropriate in some areas to improve stand resilience, reduce the risk of future high severity fire and allow for subsequent actions such as prescribed burning to restore natural fire regimes and desired conditions for CSO.

- Reforestation- this management intervention may be warranted to restore desired conditions in areas with large patch sizes of high severity fire effects where replanting can accelerate the re-establishment of forest cover. Reforestation in these areas may consider planting preferred species by CSO, such as Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), and red fir (*A. magnifica*). Hardwoods are also an important component of CSO habitat and these species should be protected and maintained during site prep and other post-fire management activities.

Spatial Scale and Heterogeneity

Management approaches will be most effective at restoring desired conditions for CSO if they can be designed to promote and maintain heterogeneity. Creating a dynamic mosaic of tree clumps and openings of variable sizes, shapes, spatial configurations, and seral stages can enhance forest resilience to fire and other disturbances and protect existing stands of mature, multi-canopied forest preferred by CSO (Kane et al. 2013). Maintaining or restoring heterogeneity can also be accomplished by varying management approaches across different spatial scales.

Monitoring and Adaptive Management

Monitoring is a critical component of any restoration strategy for CSO to test assumptions regarding post-fire use. For example, monitoring in areas that we predicted would differ in occupancy could help refine our definitions and prioritization. In addition, potential habitat areas outside of existing PACs should be monitored to evaluate where this habitat can be used to buffer the effects of large-scale fires on California spotted owls. In addition, the success of any management action taken will need to be evaluated through a well-maintained feedback loop between science and management in an adaptive management context.

Step 5: Build a restoration portfolio by prioritizing actions

After developing a list of potential restoration opportunities as described above, our Tier I, Tier II and Tier III classifications can help us to prioritize where and when these treatments can occur. The geospatial analysis has helped us to place existing habitat along a continuum, from areas where high quality habitat is likely to remain, to areas that may no longer support CSO in the near-term. Prioritization reflects the overall CSO-related restoration goals within the Caldor Fire – to maintain California spotted owl habitat so that it continues to support reproduction of California spotted owls, and to promote California spotted owl persistence on the landscape by increasing the resiliency of existing habitat and facilitating the development of additional, high-quality habitat. This prioritization can be further refined at the project level by considering additional factors such as climate exposure, natural regeneration potential, adjacency to large high severity patches, adjacency to WUIs, and locations within POD fuelbreak networks (see **Appendix I**). These factors are all attributed within feature classes, and can be used to fine-tune site-specific treatments (see **Appendix 2**).

CSO Habitat Restoration Prioritization

near-term resilience of remaining habitat ⟷ *long-term recovery of late-seral forest*

Tier I

Fire may have maintained or improved conditions

(<15% PAC/territory burned at high severity)

Objective 1. *Promote CSO persistence by increasing the resilience of remaining owl habitat to future large-scale disturbances.*

Priority 1. PACs/territories adjacent to the largest high severity patch (40K-acre)

Priority 2. Refugia of large/tall tree and high canopy cover stands.

Tier II

Fire may have degraded habitat

(between 15%-50% PAC/territory burned at high severity)

Objective 1. *Promote CSO persistence by increasing the resilience of owl habitat to future large-scale disturbances.*

Objective 2. *Promote and maintain well-distributed California spotted owl habitat by retaining and developing key habitat elements and connectivity.*

Priority 1: PACs/territories adjacent to large high severity patches.

Priority 2. PACs/territories where restoration treatments can successfully restore habitats to NRV conditions and increase resilience of remaining habitat.

Tier III

Fire has degraded habitat

($\geq$ 50% of PAC/territory burned at high severity)

Objective 1. *Long-term recovery of owl habitat that experienced a high proportion of high severity fire.*

Priority 1: Determine whether PACs can be redrawn or retired.

Priority 2: Strategic reforestation within high severity patches, prioritizing areas of high site productivity.

Priority 3: Retention of remaining large/tall tree, high canopy cover habitat.

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Appendix I:
Ecological and Socioeconomic Prioritization

Map 1. Climate Exposure

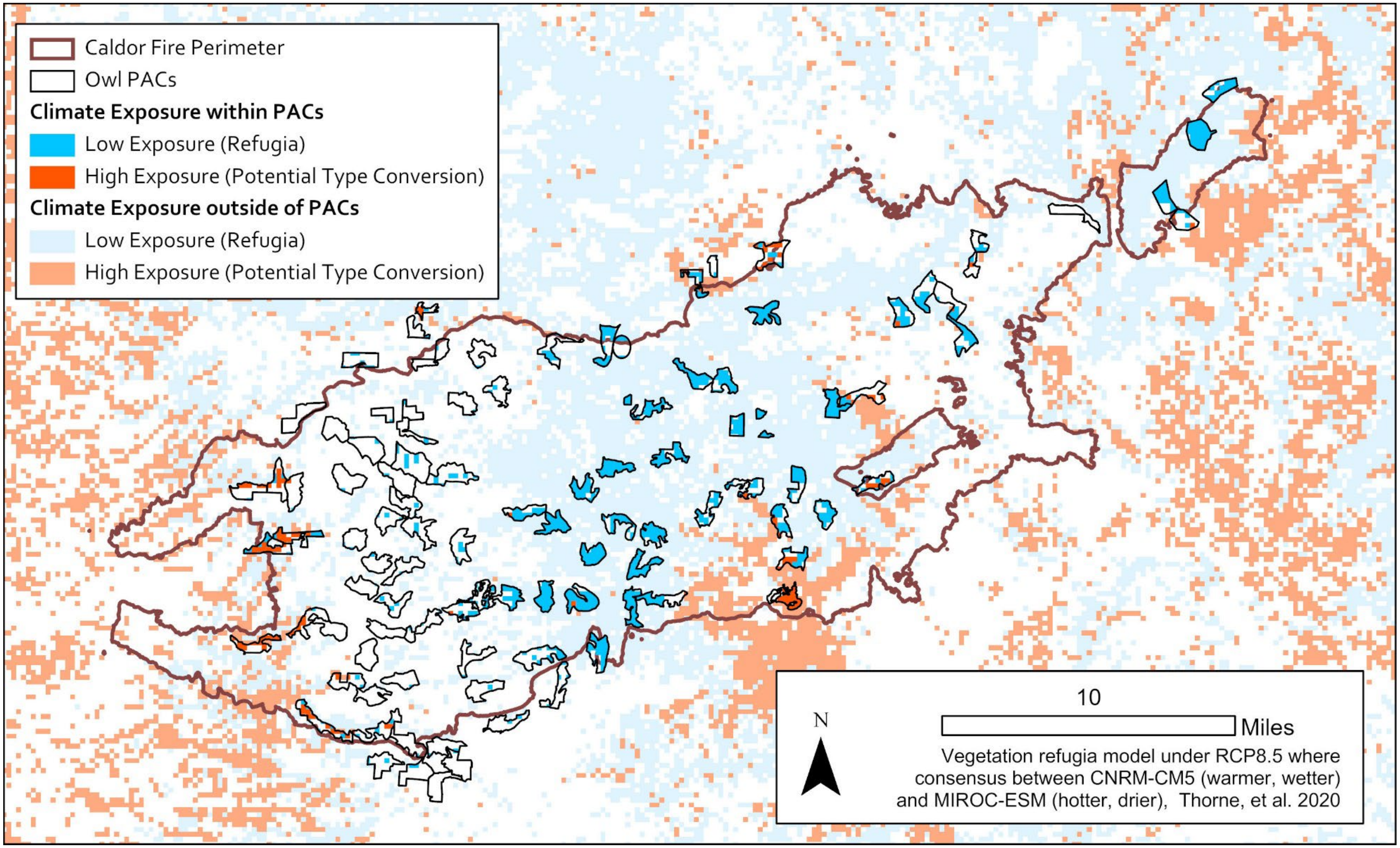
Map 2. Natural Regeneration Probabilities

Map 3. Large High Severity Patches

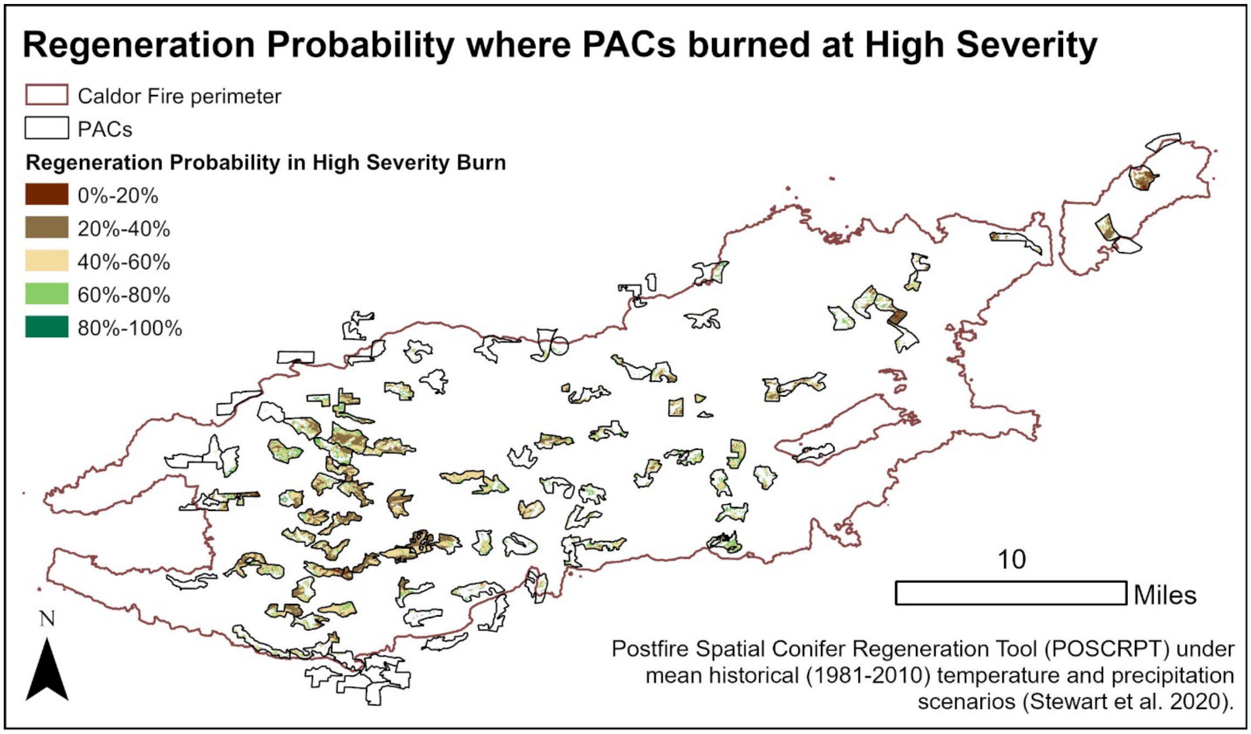
Map 4. Remnant Stands within High Severity

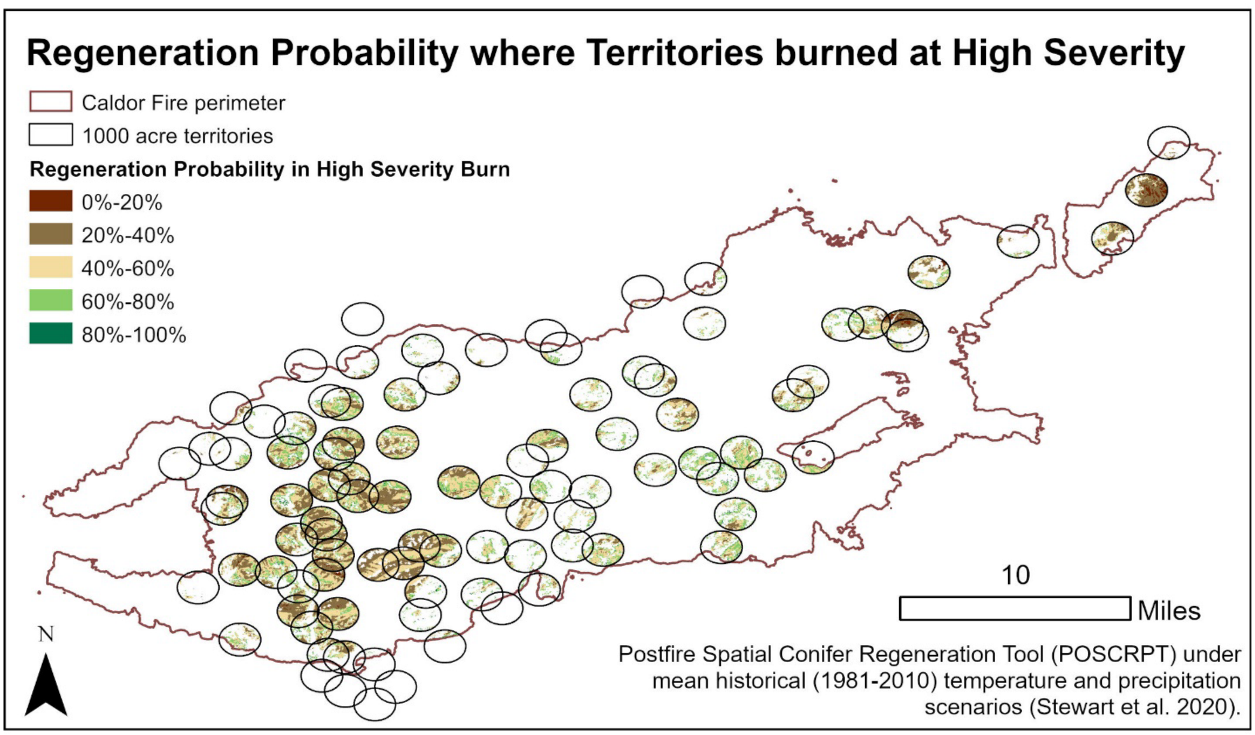
Map 5. PODs and WUIs

Map 1. Climate Exposure (2040-2069). Consensus vegetation refugia model under RCP8.5 emissions scenario.

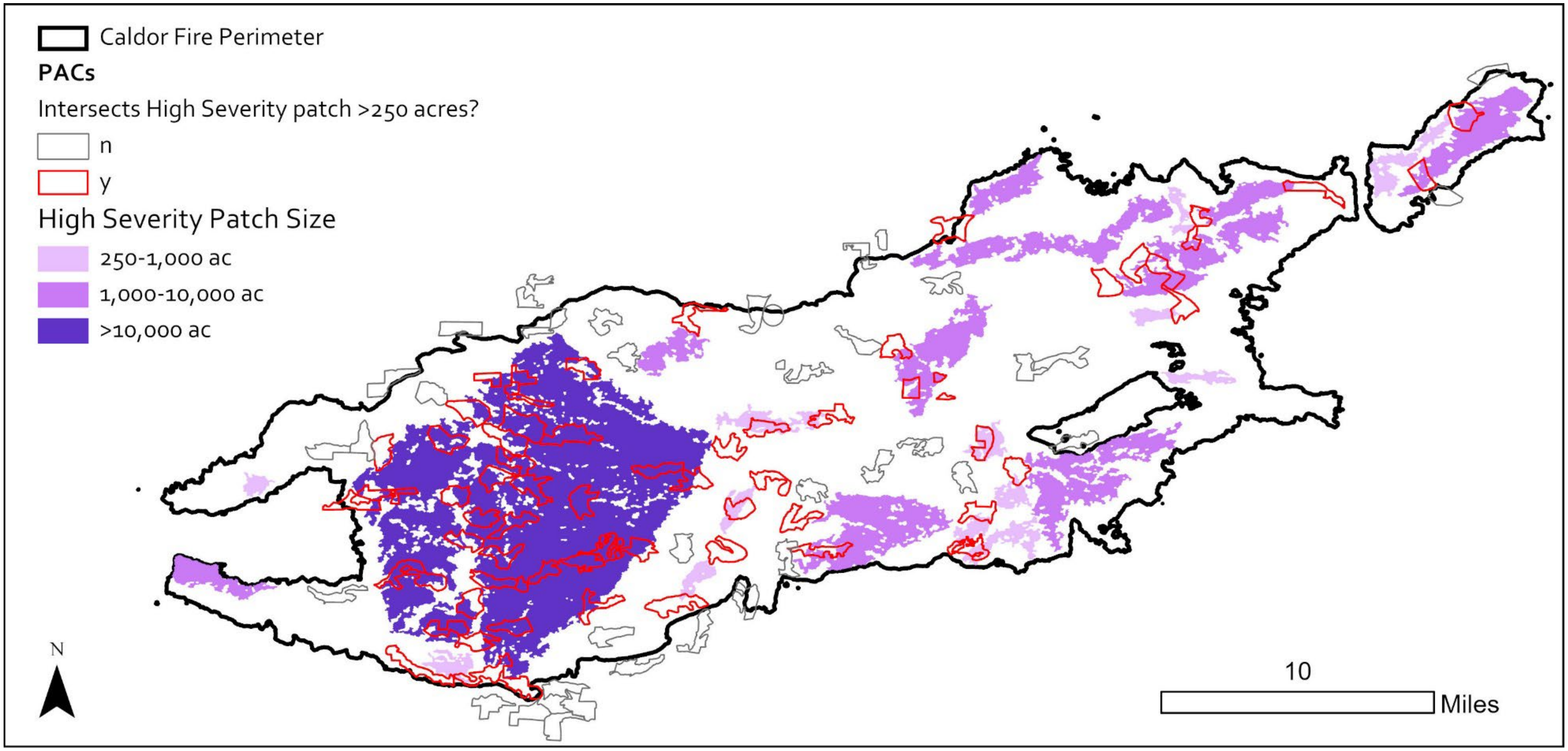


Map 2. Predicted Natural Regeneration in High Severity Patches

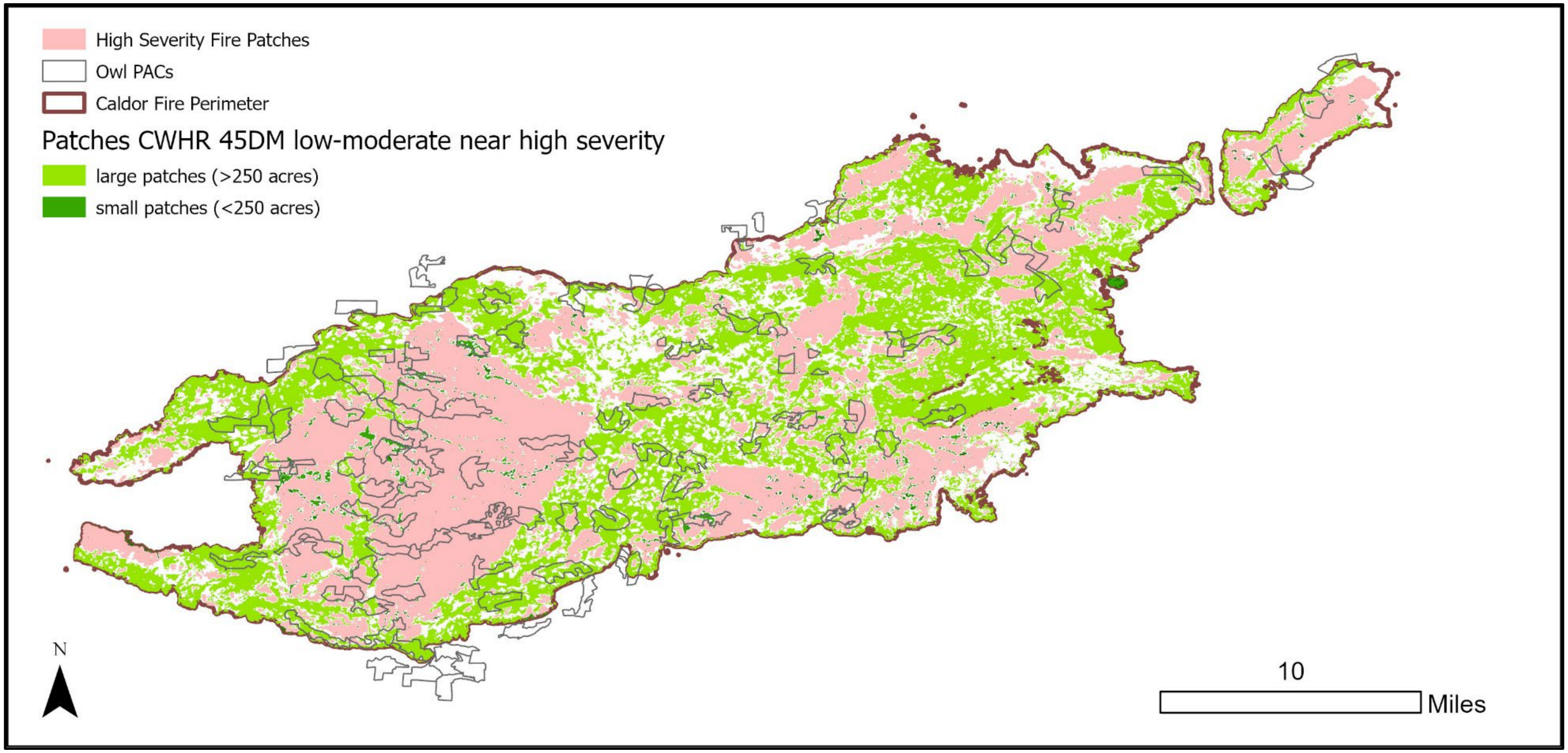




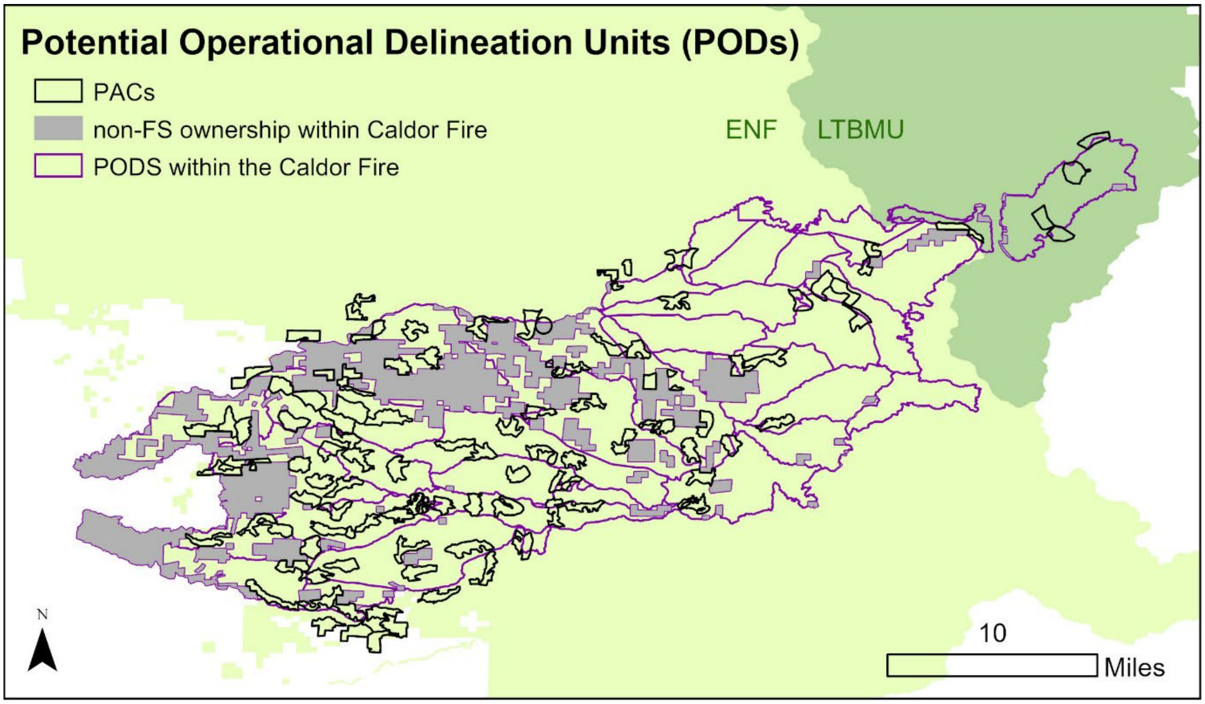
Map 3. PACs and high severity patches (>75% Basal Area loss) greater than 250 acres.

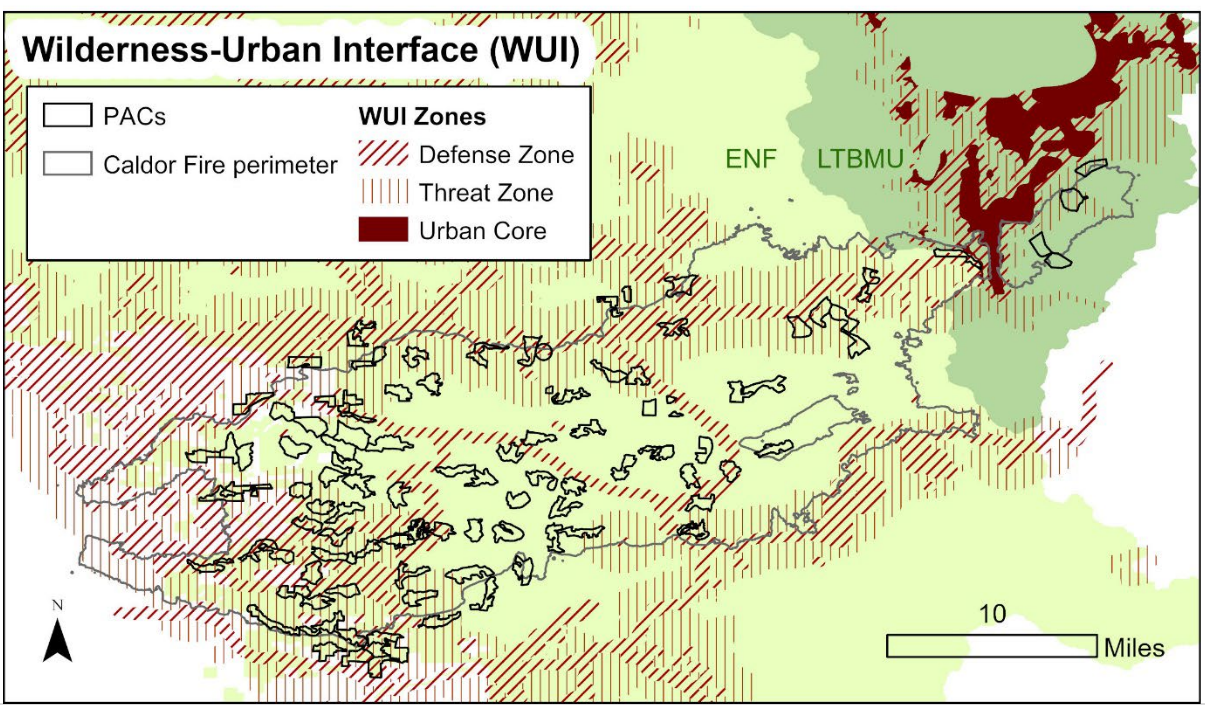


Map 4. PACs and remnant forest within high severity patches



Map 5. PACs and Potential Operational Delineation Units (PODs) within Caldor Fire (top panel); PACs and Wilderness Urban Interface (WUI) zones (bottom panel).





Appendix 2. Data Analysis Outputs

Guide to attributes of PAC, Territory, and HRCA features in Caldor_GTR270_CSO.gdb

in features **CSO_PAC_Caldor**, **CSO_Territory_Caldor**, **CSO_HRCA_Caldor**

Attribute	Description
SITE_NAME	Unique to each PAC, Territory and HRCA
LOCAL_ID	Common to associated PAC, Territory and HRCA
GIS_ACRES	Area of feature (in acres)
Cat	1 = Tier I, 2 = Tier II, 3 = Tier III
In_Perim	Whether feature is within Caldor Fire perimeter
ENF_Analysis	Whether feature is on the ENF
Per_BA75More	Percentage of PAC acreage that burned at high severity (>75% Basal Area Loss)
Terr_Avail_Acres	Acres CWHR 4M,4D,5M,5D that burned with <75% BA loss [Territory Layer Only]
HRCA_Avail_Acres	Acres CWHR 4M,4D,5M,5D that burned with <75% BA loss [HRCA Layer Only]
HRV_In	Whether <15% area burned at high severity
V_Lg_Patch_Int_Adj	Identifies features that are within or immediately adjacent to the 40K acre patch
Lg_Patch_Int	Identifies whether feature intersects patch >250 acres
Climate_Exp_High	Percentage of acres modelled as high or very high climate exposure (at risk for type conversion) [PAC only]
Climate_Exp_Low	Percentage of acres modelled as low climate exposure (refugia) [PAC only]
WUI_Threat_Acres	Acres within WUI Threat Zone
WUI_Defense_Acres	Acres wtihin WUI Defense Zone
POD	Potential Operational Delineation Units intersecting feature
Refugia_Acres	Acres of small patches (<250 acres) of CWHR 45DM that burned low-moderate severity within high severity patches

Natural regeneration probabilities (POSCRPT):

Caldor_GTR270_CSO.gdb/PAC/PAC_BA7_75More_POSCRPT_mean

Caldor_GTR270_CSO.gdb/Territory/Territory_BA7_75More_POSCRPT_mean

Data Summary by PAC:

PAC ID	Tier	Acres	High Severity (%)	Low Severity (%)	Redraw PAC?	Within or Adjacent to Large Patch?	Climate Exposure High (%)	Climate Exposure Low (%)	Acres WUI Defense Zone	Acres WUI Threat Zone	Acres of Small Patch Refugia	PODs
ELD0002	3	415.4	86	1	y	y		2	20.7		34.7	NSN_0172,NSN_0174
ELD0003	3	369.5	100	0	y	y		12	137.4	10.9		NSN_0185,NSN_0189
ELD0004	1	328.3	5	81	n	n	33	11		63.5		NSN_0173
ELD0005	1	400.5	0	100	n	n		0	212.3	188.3		NSN_0172,NSN_0173
ELD0006	3	379.5	65	17	y	y		9	246.0	133.6	34.4	NSN_0172,NSN_0188,
ELD0007	3	350.1	58	28	y	y			112.2	238.0	0.2	NSN_0180,NSN_0184
ELD0011	3	299.9	100	0	y	y	4	28	2.0	298.1		NSN_0184
ELD0017	1	300.2	0	94	n	n	58	0	143.7	156.6		NSN_0180
ELD0019	3	300.1	88	8	y	y	26	4	249.0	51.1	1.1	NSN_0180
ELD0020	1	368.4	0	100	n	n		8	225.8	142.7		
ELD0023	2	379.3	44	35	n	y	10	16		379.4	2.4	NSN_0195NSN_0227
ELD0026	2	376.1	39	38	n	y		48	67.5	308.9		NSN_0160,NSN_0212,NSN_0256
ELD0027	1	349.4	0	95	n	n				89.6		NSN_0172
ELD0028	3	300.2	71	19	y	y		97			5.4	NSN_0171
ELD0031	1	327.8	0	100	n	n		11	8.3	319.5		
ELD0035	3	300.1	86	5	y	y			94.8	205.4	0.2	NSN_0184
ELD0038	3	300.0	71	9	y	y	49	21		300.1	10.3	NSN_0174,NSN_0183
ELD0045	1	299.6	12	70	n	n		3		299.7	0.2	NSN_0157
ELD0046	1	300.7	1	96	n	n		9		104.2		NSN_0157
ELD0048	3	467.2	64	11	y	y		2			11.1	NSN_0172,NSN_0185
ELD0049	3	323.8	89	1	y	y		0			24.8	NSN_0172,NSN_0185
ELD0054	1	300.4	0	100	n	n	14	10	171.1	129.4		
ELD0055	1	364.1	0	100	n	n		10	128.2	236.0		NSN_0188
ELD0059	3	300.2	75	6	y	y		0		88.1	68.8	NSN_0174,NSN_0185
ELD0063	3	300.1	98	0	y	y		4	11.0	289.3	1.7	NSN_0166
ELD0070	1	395.1	10	82	n	n		78				NSN_0166
ELD0079	3	300.2	51	31	y	n	6	42			3.9	NSN_0190,NSN_0158

PAC ID	Tier	Acres	High Severity (%)	Low Severity (%)	Redraw PAC?	Within or Adjacent to Large Patch?	Climate Exposure High (%)	Climate Exposure Low (%)	Acres WUI Defense Zone	Acres WUI Threat Zone	Acres of Small Patch Refugia	PODs
ELD0089	1	340.3	0	100	n	n		10				
ELD0090	2	300.2	2	95	n	n	31	29				NSN_0210,NSN_0211
ELD0091	1	441.9	12	77	n	y	4	87				NSN_0171,NSN_0217
ELD0103	1	315.2	5	87	n	n	13	31	7.5	261.5		NSN_0294
ELD0104	2	299.4	49	38	n	n	2	94			0.1	NSN_0191,NSN_0213,NSN_0159
ELD0105	1	343.0	15	71	n	y	4	2		0.3	1.4	NSN_0173,NSN_0183
ELD0108	3	446.7	62	12	y	y		5		40.5	0.7	NSN_0172
ELD0109	3	377.8	95	0	y	y		12			8.6	NSN_0185
ELD0110	3	300.2	62	17	y	y		1	216.6	83.8	25.1	NSN_0174NSN_0184
ELD0111	3	299.9	93	3	y	y		5	4.2	295.9	0.9	NSN_0174
ELD0112	3	300.0	94	1	y	y		3		139.8	12.6	NSN_0174,NSN_0185
ELD0113	3	300.0	60	14	y	y		5		26.8	104.5	NSN_0188,NSN_0157
ELD0114	3	494.7	98	0	y	y		8			4.1	NSN_0172
ELD0115	2	474.4	21	57	n	y		34		114.7	1.6	NSN_0166
ELD0117	3	299.8	100	0	y	y	4	64	30.2			NSN_0189
ELD0118	1	300.1	11	78	n	y		69				NSN_0171,NSN_0189
ELD0119	3	300.2	78	13	y	y		100			2.0	NSN_0171,NSN_0189
ELD0121	2	300.0	23	62	n	y		97				NSN_0171,NSN_0189,NSN_0218
ELD0122	3	299.8	55	31	y	y	2	0		127.4	63.4	NSN_0217,NSN_0218
ELD0124	3	300.3	78	18	y	y		100	33.6		3.8	NSN_0158,NSN_0214
ELD0125	2	300.3	39	48	n	y		82			0.6	NSN_0158
ELD0126	2	300.2	19	64	n	n		89		299.9		NSN_0318,NSN_0190
ELD0127	2	300.2	48	34	n	y		74	104.4	196.0	1.4	NSN_0190
ELD0128	3	300.6	64	24	y	y		83	23.5			NSN_0190
ELD0133	3	299.9	71	16	y	y	21		37.2	262.9	6.6	NSN_0163,NSN_0217
ELD0134	3	299.7	87	4	y	y		69			6.7	NSN_0190
ELD0135	2	300.4	28	52	n	y		74	264.7			NSN_0163,NSN_0190,NSN_0210
ELD0137	2	300.2	15	73	n	n		0			0.6	NSN_0171,NSN_0217,NSN_0218
ELD0139	1	356.2	13	77	n	n		65	174.0	182.4		NSN_0318

PAC ID	Tier	Acres	High Severity (%)	Low Severity (%)	Redraw PAC?	Within or Adjacent to Large Patch?	Climate Exposure High (%)	Climate Exposure Low (%)	Acres WUI Defense Zone	Acres WUI Threat Zone	Acres of Small Patch Refugia	PODs
ELD0142	2	337.1	9	86	n	y	1	3	130.2	207.0		NSN_0195
ELD0143	1	320.3	0	100	n	n		0	177.0	143.5		
ELD0144	1	374.2	0	100	n	n		0		374.4		
ELD0145	1	339.9	0	100	n	n			258.3	81.8		
ELD0153	2	299.9	40	43	n	n		52				NSN_0158
ELD0154	2	299.7	35	51	n	n	0	84		85.7	0.0	NSN_0214,NSN_0318,NSN_0158
ELD0155	3	300.0	100	0	y	y		5		300.1		NSN_0184
ELD0156	1	309.2	0	97	n	n	25	5		309.3		NSN_0173
ELD0158	2	312.0	18	77	n	y	46	19	44.3	267.8	1.5	NSN_0183
ELD0159	2	402.8	25	37	n	y	38	15		403.0	0.4	NSN_0227
ELD0160	2	425.5	16	72	n	y	35	15	393.0	32.8		NSN_0260,NSN_0294
ELD0162	1	351.5	7	74	n	n		6		351.7		NSN_0166
ELD0163	2	313.2	23	67	n	y	1	68		144.6		NSN_0160,NSN_0212
ELD0164	3	632.0	91	2	y	y		17		20.8	32.9	NSN_0172
ELD0169 a	3	300.1	69	19	n	y		77		13.6	1.8	NSN_0346
ELD0169 b	2	300.0	0	100	n	n	10	20				NSN_0346
ELD0170	1	299.4	1	93	n	y		87	20.7			NSN_0189
ELD0171	2	300.2	42	32	n	y	9	46	88.4	6.4	0.2	NSN_0158,NSN_0163NSN_0190
ELD0177	2	312.1	33	60	n	y		0	230.8		0.1	NSN_0298,NSN_0345
ELD0196	3	427.8	67	23	y	y		98		427.8	16.9	NSN_0346
ELD0198	3	180.3	91	2	y	y		2	10.8	169.5	3.7	NSN_0188
ELD0199	2	300.5	41	49	n	n		94				NSN_0166,NSN_0171,NSN_0217
ELD0200	2	300.3	21	58	n	n		86	30.3		2.0	NSN_0171,NSN_0189
ELD0201	3	321.1	51	34	y	y	5	26	259.0	62.3	0.7	NSN_0192,NSN_0298
ELD0202	3	385.0	74	13	y	y	2	17	21.2	364.1	3.6	NSN_0160
ELD0203	2	340.9	26	56	n	y	5	61	67.2	273.9	1.1	NSN_0212,NSN_0256
ELD0208	2	300.3	49	43	n	y		5	109.7	109.3	0.1	NSN_0166
ELD0209	2	357.3	43	43	n	n	0	18			0.2	NSN_0191

ELD0214	1	298.6	3	80	n	n		3		298.7		NSN_0157,NSN_0188
PAC ID	**Tier**	**Acres**	**High Severity (%)**	**Low Severity (%)**	**Redraw PAC?**	**Within or Adjacent to Large Patch?**	**Climate Exposure High (%)**	**Climate Exposure Low (%)**	**Acres WUI Defense Zone**	**Acres WUI Threat Zone**	**Acres of Small Patch Refugia**	**PODs**
ELD0220	1	305.4	8	82	n	n		96	302.1	3.6		NSN_0256,NSN_0294
ELD0221	1	300.3	3	83	n	y	1	31	164.3	136.2		NSN_0214,NSN_0318
ELD0225	1	303.0	0	98	n	n		75		247.7		NSN_0346
ELD0316	1	315.2	0	100	n	n		10	5.5	309.9		
ELD0322	3	300.3	53	28	y	y		2	33.2	267.2		NSN_0166,NSN_0227,NSN_0195
ELD0323	3	300.4	89	1	y	y		17	194.9	105.6	19.1	NSN_0174,NSN_0184
ELD0324	3	300.0	100	0	y	y		24	148.8	151.4		NSN_0184,NSN_0217
ELD0325	3	299.9	66	12	y	y		5	22.7	277.4	0.4	NSN_0174
ELD0326	3	323.5	77	17	y	y		63	242.1	0.0		NSN_0184,NSN_0217
ELD0328	3	299.9	79	1	y	y		0	153.4	146.6	1.9	NSN_0180,NSN_0184
ELD0329	3	300.4	91	2	y	y	12	11	104.4	196.1	1.1	NSN_0180,NSN_0227,NSN_0166
ELD0331	2	300.0	34	44	n	n	15	60	57.0		0.9	NSN_0158,NSN_0163,NSN_0190
ELD0332	1	235.0	5	85	n	n		24	160.0	75.1		NSN_0318