United States Department of Agriculture

Social and Ecological Resilience Across the Landscape 2.0

Draft Environmental Impact Statement

Volume I. Chapters 1 through 4 and References

Forest Service Stanislaus National Forest February 2024

Cover photo: Photo taken by Stanislaus National Forest staff from an active managed fire burning at low intensity in a mixed conifer forest.

Social and Ecological Resilience Across the Landscape 2.0 (63557)

Draft Environmental Impact Statement

Stanislaus National Forest

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Comment Period: Publication of the Notice of Availability (NOA) of this Draft Environmental Impact Statement (DEIS) in the Federal Register will initiate the 45-day public comment period. Once published, a copy of the NOA will be posted on the project website. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record.

Western Fireshed Emergency Action Declaration: Section 40807 of the Infrastructure Investment and Jobs Act of 2021 (Public Law 117-58), also known as the Bipartisan Infrastructure Law (BIL) authorized the Secretary of Agriculture to determine that an emergency exists on National Forest System (NFS) lands and allows vegetation and other treatments to be carried out pursuant to the Secretary's emergency determination. The SERAL 2.0 project received approval by the Chief of the Forest Service, Randy Moore, to use the Western Fireshed Emergency Action Determination (EAD; BIL 40807). With EAD authority, there are two key public participation opportunities: The 30-day scoping comment period (November 17, 2023, through December 18th, 2023) and this 45-day opportunity to comment on the draft EIS. The EAD does not require a pre-decisional administrative review opportunity (objection period).

Abstract: This DEIS presents proposed actions to reduce wildfire risk and to improve forest health and resilience. The actions proposed include forest thinning, fuel reduction, fuelbreak construction and maintenance, targeted grazing, prescribed fire, limited salvage, hazard tree abatement, and non-native invasive weed control. The DEIS also presents a focused analysis addressing the potential direct, indirect, and cumulative environmental effects related to issues that may occur from the proposed actions as well as the effectiveness of the proposed actions in meeting the purpose and needs of the project.

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LIST OF ACRONYMS

APS Area of Potential Salvage
BA Biological Assessment or Basal Area
BMP Best Management Practices
Cal-IPC California Invasive Plant Council
CC Condition Class
CCF Hundred Cubic Feet
CDFA California Department of Food and Agriculture
CDFW California Department of Fish and Wildlife
CFR Code of Federal Regulations
CSO California Spotted Owl
CWA Clean Water Act
CWE Cumulative Watershed Effects
CWHR California Wildlife Habitat Relationship
DBH Diameter at Breast Height
DEIS Draft Environmental Impact Statement
EAD Emergency Action Determination
EEC Expected Environmental Concentration
EIS Environmental Impact Statement
ERA Equivalent Roaded Acreage
ESA Endangered Species Act
ESD Emergency Situation Determination
FERC Federal Energy Regulatory Commission
FIA Forest Inventory and Analysis
FRID Fire Return Interval Departure
FSH Forest Service Handbook
FSIM the large-fire simulation system
FSM Forest Service Manual
FVS Forest Vegetation Simulator
GIS Geographic Information System
GTR General Technical Report
HRCA Home Range Core Area
HQ Hazard Quotient
HUC Hydrologic Unit Code
HVRA Highly Valued Resource and Asset
IRA Inventoried Roadless Areas
LIDAR light detection and ranging
LMU Land Management Unit
LOP Limited Operating Period
MC Mixed Conifer
MCL Maximum Contaminant Level
MDBM Mt. Diablo Base and Meridian
MIS Management Indicator Species
MR Management Requirement
MSDS Material Safety Data Sheet
NCFS Northern California Fire Severity Prediction System
NEPA National Environmental Policy Act
NF National Forest
NFS National Forest System
NOA Notice of Availability
NOAEC No observed adverse effect concentration
NOEL No-observed-effect-level
NRIS Natural Resource Information System
NRV Natural Range of Variation
NWCG National Wildfire Coordinating Group
OHV Off-highway vehicle
ORV Outstandingly remarkable values
PAC Protected Activity Center
PIF Project Input Form
POD Potential Operational Delineations
PPE Personal protective equipment
QMD Quadratic Mean Diameter
RfD Human Reference Dose
ROD Record of Decision
SDI Stand Density Index
SERA Syracuse Environmental Research Associates, Inc.
S&G Standards and Guidelines
SPI Sierra Pacific Industries
TOC Threshold of Concern
TPA Trees Per Acre
USDA United States Department of Agriculture
USFS United States Forest Service
USFWS U.S. Fish and Wildlife Service
WCS Wildfire Crisis Strategy
WHR Wildlife Habitat Relationship
WSR Wild and Scenic River (also W&S)
WUI Wildland Urban Interface
YSS Yosemite Stanislaus Solutions

SUMMARY

The Social and Ecological Resilience Across the Landscape 2.0 (SERAL 2.0) project has been developed to restore forest resilience and the ability of the landscape across the project area to persist with fire as a natural process.

Like the first SERAL project, the SERAL 2.0 project area is located within the 304,841-acre US Forest Service Wildfire Crisis Strategy (WCS) Stanislaus Landscape (Figure 1) on the Stanislaus National Forest. The SERAL 2.0 project area spans approximately 162,000-acres and includes 118,282-acres of National Forest System (NFS) lands with portions on the Calaveras, Groveland, Mi-Wok, and Summit Ranger Districts. The project area is bordered by the Clavey River to the east and the Tuolumne River to the south.

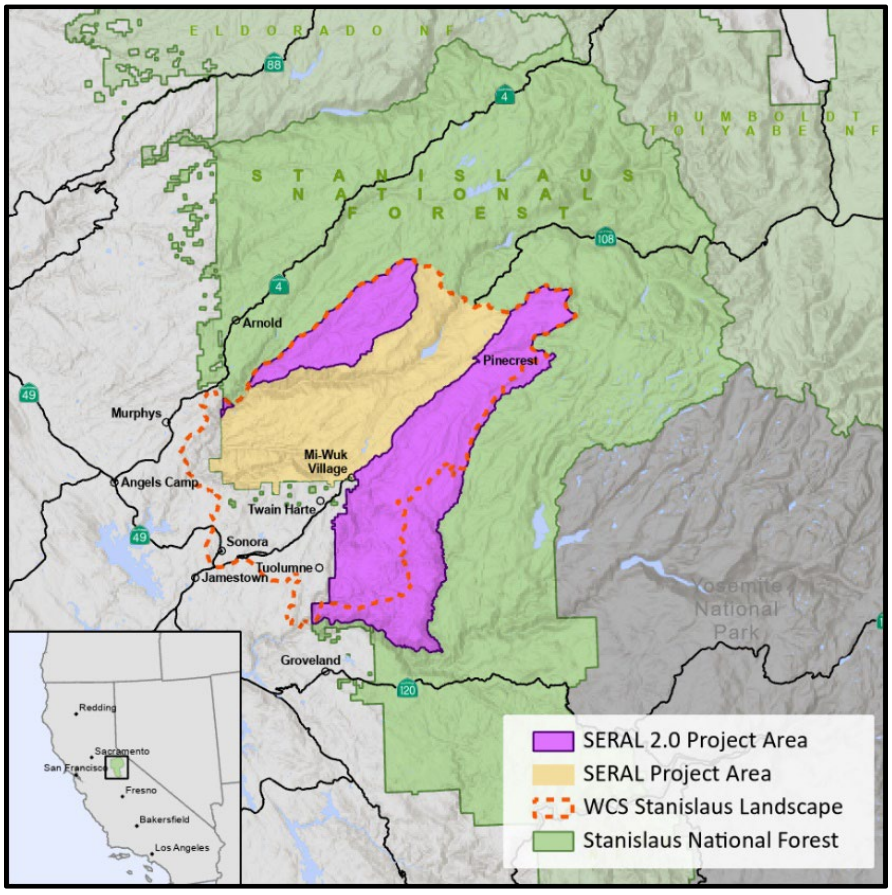

Figure 1. Project area vicinity.

Emergency Action Determination, Multiple Decisions, and Administrative Review Opportunity

Public comments received during scoping suggested the proposed use of herbicides for fuelbreak maintenance and the salvage of insect-, disease-, drought-, and fire-killed trees may not warrant use of the Western Fireshed Emergency Action Determination (EAD, BIL 40807) because they may not be imminently implemented. In response to this feedback the responsible official will prepare more than one decision after close of this 45-day DEIS comment period, review of the DEIS comments, and preparation of the Final Environmental Impact Statement (FEIS).

The first SERAL 2.0 record of decision (ROD) will be prepared in accordance with the EAD authority ("SERAL 2.0 EAD ROD"). With EAD authority, the SERAL 2.0 EAD ROD is not subject to administrative review. The SERAL 2.0 EAD ROD will include the decision and rationale related to the proposed actions presented in Chapter 2.01, 2.02, 2.03, 2.05, 2.06, 2.08, 2.10, 2.11, and 2.12. The SERAL 2.0 EAD ROD will be signed no sooner than 30-days after the Notice of Availability (NOA) of the FEIS is published in the Federal Register (NOA publication expected in early May 2024).

A more deliberative process will be used to reach a decision related to the proposed use of herbicides for fuelbreak maintenance (DEIS Chapter 2.04) and the salvage of insect-, disease-, drought-, and fire-killed trees (DEIS Chapter 2.07). A draft of the responsible official's decision related to the use of herbicides for fuelbreak maintenance and salvage will be made available for a 45-day administrative review opportunity, also known as an objection period, sometime in the summer or fall of 2024. Anyone submitting comments related to these two categories of actions during a designated comment period (i.e., the 30-day scoping period or this 45-day DEIS comment period) will be eligible to submit a written objection to the second SERAL 2.0 record of decision and participate in the objection resolution process.

Public Involvement and Response to Scoping Comments

A Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on November 17, 2023, initiating a 30-day public scoping comment period. In addition to the NOI, the Responsible Official sent a letter to over 3,000 individuals and groups potentially affected by, or interested in, the SERAL 2.0 proposal. In this letter the Responsible Official solicited feedback on the proposed action. The proposed action and other supporting documentation were made electronically available on the project website for review.

We received 50 unique comment letters from private individuals, organizations, groups, agencies and industry professionals. Letters included comments expressing support for and / or concerns regarding certain aspects of the proposed action. We updated or clarified aspects of the proposed action based on this feedback and addressed other concerns in the DEIS analysis and supporting documentation. Written responses to each comment, including reference to updates made are provided in the SERAL 2.0 DEIS Vol. II, available on the project website.

Purpose and Need

- Increase Landscape Resilience to Natural Disturbances
    - Increase forest heterogeneity (within- and between stands).
    - Reduce stand densities.
    - Retain large, old, and structurally diverse trees and snags.
    - Increase the abundance and distribution of fire-resilient and resistant species (pines and oaks) and decrease the abundance of shade-tolerant species (firs and cedars).
    - Reduce surface and ladder fuels.
    - Increase management by fire, both prescribed and managed wildfire.
    - Construct and maintain a network of fuelbreaks to support prescribed fire and wildfire operations.
    - Salvage drought, insect, disease, and wildfire disturbed areas.
- Reduce the Spread of Invasive Non-Native Weeds.
- Provide Economic Opportunities to Local Communities.

Issues

Public participation helped to identify fourteen main issues.

- The proposed forest thinning in California spotted owl PACs and territories may reduce the quality of California spotted owl (CSO) habitat and contribute to the decline of the owl.
- The proposed forest thinning and fuel reduction may reduce marten habitat and impact their persistence.
- The proposed DBH limits and other forest thinning constraints will leave stand densities too dense and structurally homogenous to effectively reduce the landscape's susceptibility to wildfire-, drought-, and insect and disease- related mortality or to achieve NRV-based objectives.
- The proposal to thin trees greater than 30-inch DBH and up to 40-inch DBH is not necessary to increase landscape resilience.
- Smoke emissions from prescribed fire may adversely affect air quality and human health.
- The proposed DBH limits will impact the Forest's ability to provide timber (wood product) to local and regional communities and the likelihood of treatment implementation.
- The Forest Service should evaluate and weigh the potential social and economic impacts from the loss of businesses, residences, tourism, and outdoor recreation cause by a catastrophic fire event.
- The proposed action may impact the IRA characteristics and diminish their eligibility for future wilderness designation.
- The proposed action may impact the outstanding remarkable values of Wild & Scenic river corridors.
- The proposed forest thinning may impact the amount and distribution of mature and old growth forests.
- Delineating a circular territory could result in an insufficient quantity and quality of habitat conserved and protected for California spotted owl as compared to home range core areas (HRCA).
- The proposed use of herbicides to treat non-native invasive weeds and to maintain fuelbreaks may adversely affect human health and the health and diversity of other native species, including local and migratory bird species.
- Due the conditional natural of the proposed salvage the site-specific environmental impacts of those action are not clear.
- The construction of temporary roads that are not properly decommissioned lead to erosion, unauthorized cross-country travel by wheeled motor vehicles, and introduction of noxious weeds.

Alternatives Considered in Detail

The proposed action and the no action alternative are considered in detail. Complete details of the proposed action, including management requirements are found in Chapter 2 of this document.

Proposed Action –Actions proposed include, forest thinning, fuel reduction, fuelbreak construction and maintenance, targeted grazing, prescribed fire, limited salvage, hazard tree abatement, and non-native invasive weed control.

The proposed action was developed to apply the management approaches and conservation measures presented in the 2019 *Conservation Strategy for the California Spotted Owl in the Sierra Nevada* (hereafter referred to as the **CSO Strategy**). Application of the CSO Strategy is made possible by the proposed suite of proposed project-specific forest plan amendments (Appendix C, Table C.02-1).

Comparison of Alternatives

Summary Table S- 1. Summary of proposed treatments.

Proposed Activity		Proposed Action (acres)	No Action
Forest Thinning	Timber Harvest and Biomass Removal	28,587	0
Fuel Reduction	Mastication or Machine Pile and Burning	18,471	0
Prescribed Fire	Primary Rx Fire Opportunities	37,667	0
	Additional Rx Potential	83,294	0
Fuelbreak Construction and Maintenance	Timber Harvest and Biomass Removal; Mastication; Hand or Machine Pile and Burning	13,825	0
Fuelbreak Maintenance	Herbicide Application	Approx. 7,500	0
Area of Potential Salvage	Insect-, Disease-, Drought-, or Fire-Killed Trees	58,149	0
Invasive Weed Control and Eradication	Known Occurrences	770	0
Project-Specific Forest Plan Amendments	Land Allocations, Goals, Desired Conditions, Standards, Guidelines, and Potential Management Approach	Table C.02-1	None

Summary of Major Conclusions

The analysis presented to address issues related to the proposed actions (Chapter 3.01) and the ability of the proposed actions to meet the purpose and need of the project (Chapter 3.02) clearly demonstrate that the proposed action meets the purpose and needs of the project.

1. Purpose of and Need for Action

1.01 Increase Landscape Resilience to Natural Disturbances

Over the past century and a half, forests, watersheds, and landscapes have become increasingly susceptible to threats such as large, high severity wildfires, widespread drought, and insect- and disease-induced tree mortality (Safford and Stevens, 2017). National Forests in California's Sierra Nevada region are now in a state of emergency.

California's current wildfire and forest health emergency has emerged from the altered state of Sierra Nevada forested ecosystems and the effects of a changing climate. Forested ecosystems were once balanced by periodic moderate and low severity fires ignited by lightning or as part of Native American burning practices. In the absence of these periodic fires, forested landscapes have become more homogeneous, characterized by tightly packed small and medium-sized trees, increased canopy cover, fewer large-diameter trees, heavy concentrations of fuels on the forest floor, an abundance of low growing vegetation (ladder-fuels), and a shifted dominance from fire-resistant species like pines to shade tolerant-fire susceptible tree species such as white fir (USDA 2023 – [4], USDA 2019, Mallek et al. 2013, Miller et al. 2009, Steel et al. 2015). Forests in these conditions are composed of stressed trees that are vulnerable to high-severity wildfire and tree mortality from insects and disease.

In just the past ten years, the Stanislaus National Forest and surrounding communities have experienced extensive mortality of mature forest and infrastructure loss from wildfires. Local wildfires have also created significant impacts to watershed functions and have contributed to air quality concerns across a large portion of the region. The size and severity of wildfires have been increasing and most scientists and managers see this trend continuing. These larger fires coupled with a greater expanse of high severity fire

effects cause exponentially greater environmental damage and disrupt layers of processes that rely on properly functioning ecosystems (Stevens et al. 2017, Miller and Safford 2012).

Modelled estimates for the Sierra Nevada indicate temperatures will increase by 5.4 to 10.8 degrees Fahrenheit (3 to 6 degrees Celsius) during the twenty-first century (USDA 2019). Climate change projections indicate many of the low- and mid-elevation forests in the Sierra Nevada are vulnerable to conversion to woodlands, shrublands, and grasslands (USDA 2019). Warmer conditions have led to an increased frequency of extreme fire weather that contributes to larger, more severe fires. Warmer springs, longer summer dry seasons, and drier soils and vegetation cause fuels to dry out, allowing fires to start more easily and burn hotter, extending the duration and severity of fire seasons (USDA 2023 – [8]). The trends of longer wildfire seasons, larger, more severe fires, and declining forest health are expected to continue as temperatures rise and the state experiences more frequent and severe droughts.

Natural Range of Variation (NRV) assessments provide baseline information on the composition, structure, and function of forested ecosystems. The NRV can be compared to current conditions to develop an idea of trend over time and an idea of the level of departure from their natural state (Safford and Stevens 2017, Meyer and North 2019). Restoring forest composition, structure, and processes based on NRV conditions has been linked to greater resilience to wildfire, climate change, and other stressors and is a central and guiding principle of the Conservation Strategy for the California Spotted Owl in the Sierra Nevada (USDA 2019). The concept of restoring the landscape into closer alignment with historic reference conditions is rooted in the assumption that the structural composition of forests occurring in pre-settlement times were, and would still be, more resilient to disturbances such as insects, disease, drought, wildfire, and climate change.

The current forest structure in the SERAL 2.0 project area shows considerable departure from the reference conditions described in Safford and Stevens (2017) (Figure 2). In general, there is a deficiency in the mid-open and late-open successional classes and an abundance in the mid-closed class for each forest type. There is also a deficiency of late-closed in moist-mixed conifer vegetation types and an abundance in the late-closed class for dry-mixed conifer.

Designing and implementing treatments to best achieve resiliency requires a suite of complimentary objectives including those which will: (1) increase within- and between-stand heterogeneity; (2) reduce stand densities; (3) increase the large tree component on the landscape; (4) increase the relative abundance of fire-tolerant and shade-intolerant tree species; (5) reduce surface and ladder fuels; (6) increase management by fire, both prescribed and managed wildfire; and (7) actively restore habitat after disturbances that do not align with NRV (USDA 2019). A discussion of each of these objectives are further addressed in Appendix A.

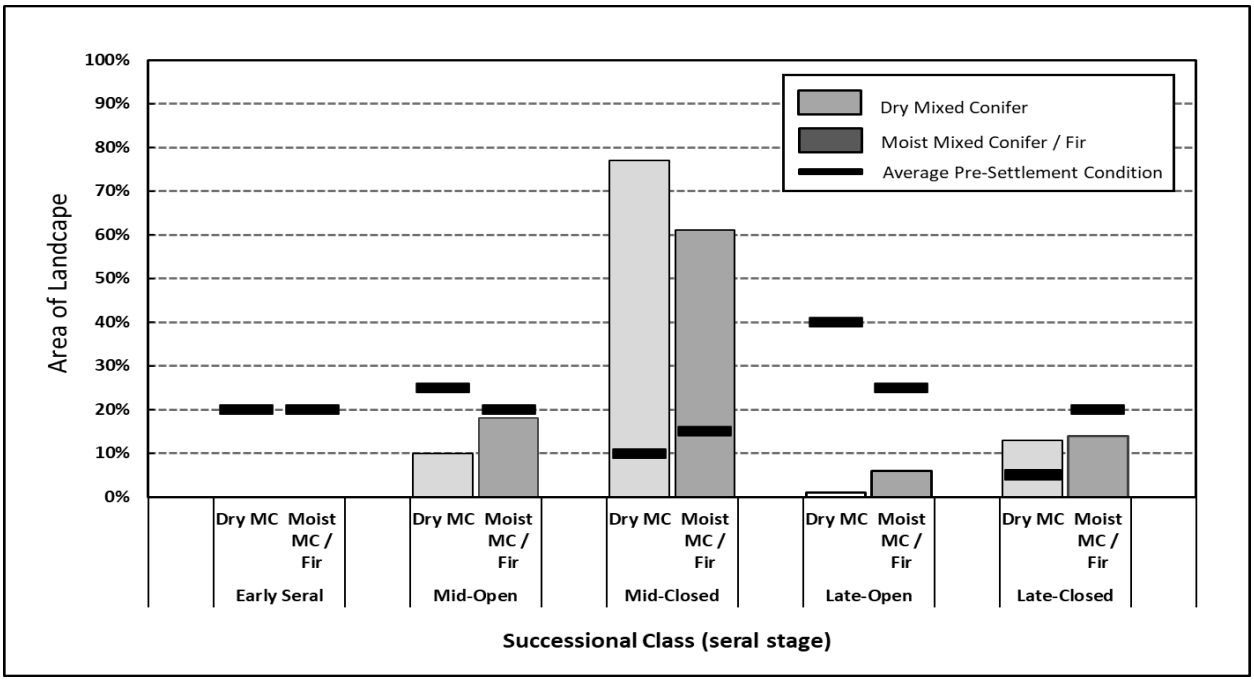

Figure 2. Current landscape structure compared to pre-settlement conditions by dominant forest type.

1.02 Reduce the Spread of Invasive Non-Native Weeds

Invasive plants are species that are non-native, whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). The Stanislaus National Forest Land and Resource Management Plan incorporates the Forest Service Manual 2900 Invasive Species Management Goals and Strategies, stating, "the overriding objective for managing invasive plants is to manage them using an integrated pest management approach prioritizing response actions as deemed necessary by the Forest within the following strategic objectives: 1) prevention, 2) early detection rapid response; 3) control and management; 4) restoration; and 5) organizational collaboration" (USDA 2017). There are known infestations of invasive plants within the SERAL 2.0 project area, and a likely risk of the establishment of new infestations if left uncontrolled. Annual rates of spread vary from 10 to 24 percent for many invasive plant species in the western United States (Asher and Dewey 2005). Since non-native plants have proliferate seeding rates that quickly colonize disturbed settings, major travel routes pose a risk for high rates of weed spread into areas where vegetation is being treated to reduce the risk of wildfire or to provide conditions supporting more natural fire regimes. Coordinating an invasive plant eradication and management plan to enable proactive response and treatment of weeds is needed to reduce the risk of spread from roadsides and into natural forest settings. Timely treatment of known infestations as well as small, newly discovered infestations before they have a chance to spread is critical to maintaining an effective invasive plants control program. This approach is referred to as Early Detection Rapid Response. Once weeds establish in the natural setting, the costs and potential damages increase because weeds affect the natural successional response to disturbance and create large, infested areas too difficult to eradicate with existing control measures.

1.03 Provide Social and Economic Opportunities to Local Communities

The surrounding communities near the project area have social and economic ties to National Forest System lands. Management decisions made by the Forest Service can often impact the economies of smaller, natural resource-based communities nearby as well as tourism and outdoor recreation opportunities. Economic effects can include changes in local employment and income, as well as changes

in local services and community infrastructure. Businesses in small rural towns often rely on tourism and wood product revenue throughout the year, so maintaining safe and consistent access to National Forest System lands for recreation and industry uses (timber and concessionaire businesses operated on or nearby NFS lands) contribute to resilient communities.

Forest products resulting from restoration and management activities on National Forest System lands contribute to the local economy and to the sustainability of the local forest products industry. In addition to two lumber mills (Sierra Pacific Industries' Standard Mill and Chinese Camp Mill), and Pacific Ultrapower Chinese Station biomass power plant, new markets and associated facilities have become or are in the process of becoming established in the area due to the proximity of potentially available material, coupled with the need to remove this material from National Forests and the surrounding communities. These industries provide jobs and contribute to the cashflow into the economy but are heavily dependent on the availability of forest products to keep their businesses running. Improved recreation opportunities and conservation and restoration of terrestrial habitats also sustain livelihoods and provide economic benefits to businesses and industries supporting recreation, hunting, fishing and other such uses on and nearby public lands.

Additionally, the National Forest's ability to efficiently perform mechanical thinning and fuel reduction treatments is often dependent on a viable, local forest products industry, which in turn is dependent on a reliable and predictable flow of wood products. Implementation of the restoration actions to increase landscape resilience proposed in this project will provide jobs, and the benefits to those workers contributes to social resilience.

Forest management can also impact tourism and recreation opportunities. Socioeconomic loss from catastrophic wildfire has both immediate and long-term impacts that ripple out from the local community to far-reaching corners of regional, state, and even national economies. Immediate, local impacts include loss of homes and businesses when structures burn, loss of jobs for those employed in local businesses, loss of total financial viability for those who own local businesses that are destroyed, and loss of infrastructure (i.e., power, water, utility services, damage to roads and transportation) that impacts both those who do and do not suffer loss of homes or businesses from the fire. Long-term and broader-reaching local impacts include loss of economic viability across the community due to forest closures that halt public access, outdoor recreation, and tourism across the region from regular seasonal ventures such as camping, hiking, hunting, fishing, foraging, OHV and snowmobile excursions, and related activities. When considering the broader range of impact beyond the local communities where a fire incident occurs, costs continue to mount quickly. Catastrophic wildfire is the attributed cause of an estimated $150 billion in financial loss in California in 2020. In addition to the immediate forms of loss as noted above, this estimate also includes economic losses related to highway closures, evacuations, increased insurance premiums, firefighting costs, and flight cancellations. The Rim Fire of 2013, as cited in an article in Wildfire Today, had a financial impact that included "structures burned, crops and pastures ruined, economic losses from decreased tourism, medical treatment for the effects of smoke, salaries of law enforcement and highway maintenance personnel, counseling for post-traumatic stress disorder, costs incurred by evacuees, infrastructure shutdowns, rehab of denuded slopes, flood and debris flow prevention, and repairing damage to reservoirs filled with silt." Mitigating fire danger through more forest thinning can reduce the risks of catastrophic wildfire and the extremity of socioeconomic impact that they cause. Designing and implementing treatments to best increase forest resiliency as described in Section 1.01 is needed in order to ensure social and economic opportunities are provided and maintained.

2. THE ALTERNATIVES

Alternative 1: The Proposed Action

2.01 Forest Thinning (28,587 acres, Table 1, Map 1)

Forest thinning treatment areas are located in dense conifer stands, where average diameters are greater than 6 inches and canopy covers exceed 40% (CWHR 3,4,5 M&D)[1]. Existing forest structure and densities in these stands are at elevated risk of tree mortality due to bark beetles and drought, and also have a high likelihood of experiencing stand-replacing wildfire (Figure 3). Forest thinning is proposed to occur within California spotted owl PACS and territories, but the majority of the proposed forest thinning is located outside of CSO PACs and territories (Table 1). No forest thinning is proposed within inventoried roadless areas or within wild and scenic river corridors (Table 1).

Figure 3. Examples of forested stands that would benefit from mechanical thinning.

[1] Additional details regarding the location of forest thinning treatment areas are provided in Appendix B and E.

Table 1. Proposed forest thinning summary.

Treatment Type	Successional Class[2], Forest Type	Other Forest	CSO PAC[A]	CSO Territory	IRA[B, D]	W&S River[C, D] Corridor	Project Total
Forest Thinning	Mid-Closed, Pine	5,780	189	1,817	0	0	7,786
	Mid-Closed, Dry Mixed Conifer	5,319	1,298	2,584	0	0	9,202
	Mid-Closed, Moist Mixed Conifer	4,556	818	1,189	0	0	6,563
	Late-Closed, Pine	309	8	184	0	0	500
	Late-Closed, Dry Mixed Conifer	1,075	457	480	0	0	2,011
	Late-Closed, Moist Mixed Conifer	0	0	0	0	0	0
	Total	17,039	2,770	6,253	0	0	26,062
Forest Thinning Alternative System	Mid-Closed, Pine	73	0	9	0	0	82
	Mid-Closed, Dry Mixed Conifer	1646	3	319	0	0	1968
	Mid-Closed, Moist Mixed Conifer	191	0	111	0	0	301
	Late-Closed, Pine	0	0	0	0	0	0
	Late-Closed, Dry Mixed Conifer	98	0	76	0	0	174
	Late-Closed, Moist Mixed Conifer	0	0	0	0	0	0
	Total	2,008	3	515	0	0	2,525

[A] CSO PAC = Protected Activity Center; [B] IRA = Inventoried Roadless Areas; [C] W&S = Wild and Scenic River [D] Some of the acres reported in IRA and W&S River Corridor overlap with PAC and Territory acres. Therefore, these acres are not mutually exclusive.

Forest thinning treatments are restricted by a suite of DBH limitations which vary according to certain land allocations, tree species, proximity to proven rust resistant sugar pines and live aspen stands, or whether occurring within a meadow (Table 2). Another important constraint included in the proposed action requires that mechanical treatments within CSO PACs do not exceed 100 acres and do not reduce habitat quality in the highest quality habitat. The 100-acre mechanical treatment limitation is not specific to forest thinning, but the forest thinning contributes to the total acres mechanically treated —forest thinning plus any other mechanical fuel reduction treatment may not exceed 100 acres.

Table 2. Forest thinning DBH limits.

Location		Tree Type	DBH Limit
California Spotted Owl PAC		All Trees	20”
California Spotted Owl Territory		Shade-Intolerant[A]	24”
		Shade-Tolerant[B]	30”
Outside of California Spotted Owl PACs, Territory	Everywhere	Shade-Intolerant	30”
		Shade-Tolerant	34”[C]
	Within 66-feet of Proven Rust Resistant Sugar Pine	All Conifers	40”
	Within 66-feet of Live Aspen Stand	All Conifers	40”
	Within a Meadow	All Conifers	40”
Everywhere		Oaks and other hardwoods	12”

[A] shade-intolerant = pines; [B] shade-tolerant = firs, cedars; [C] Where at least one 30-inch DBH shade-intolerant tree is left within one tree height of the shade-tolerant tree being removed

Forest thinning treatments will reduce stand densities (Figure 4) and promote heterogeneity both within individual stands and among stands on the landscape by creating a mosaic of individual trees, clumps of

[2] See Table B.01-3. CWHR Classification

trees, and openings of various sizes. Residual stand density will be determined based on a combination of an individual operational unit's land allocation (i.e. PAC, Territory, General Forest, Fuelbreak), slope position (i.e. ridgetop, mid-slope, or drainage) as well as the existing condition (i.e., forest type, current density, forest health issues, etc.), and in accordance with the diameter limits in Table 2. Stand densities will be reduced to minimize the risk of drought- and insect-related mortality, as appropriate for a given forest type, while retaining large trees and snags.

Figure 4. Examples of forested stands after being mechanically thinned.

Fire-resistant and shade-intolerant species (e.g., ponderosa pine, Jeffrey pine, sugar pine, black oak) will generally be favored for retention, while shade-tolerant species (primarily white fir and incense cedar) will be favored for removal (Figure 5 and Figure 6). Surface and ladder fuels will be reduced to meet fuels objectives. Hardwoods (e.g., oaks, aspens, maples, dogwoods) would be retained unless removal is necessary to facilitate treatment efficacy and/or safety.

Openings will be located, where possible, adjacent to healthy, mature conifers and oaks to promote regeneration and reduce competition (Hood et al. 2018) as shown in Figure 6. The center tree of desired openings will be designated on the ground in appropriate locations prior to any treatments taking place. Openings created will be irregularly shaped, generally range in size from 0.25 to 1 acre, and have less than 10% tree cover.

Tree clumps are often retained in drainages, on steep slopes, or in other areas with operability challenges. Tree clumps may occur within or outside of an operational unit. Figure 7 presents an example where tree clumps were retained within a steep drainage located through the center of the operational unit. In other areas, where a similar steep drainage may be located along the edge of a treatment unit, the operational unit would not include the steep drainage. In both scenarios the same tree clump retention is achieved.

Figure 5. (Left) Large California black oak trees slowly being shaded out by competing incense cedars. In this scenario, silvicultural prescriptions would retain the oaks and remove the incense cedars growing within the driplines of the oaks; (Right) A large sugar pine tree in competition with younger white firs. In this scenario, the sugar pine would be retained and the white firs growing adjacent to the sugar pine would be removed.

Figure 6. Example of growing space being made available by removing small incense cedars adjacent to a large California black oak (left) and a large ponderosa pine (right).

Forest thinning will be achieved by ground-based or aerial yarding. Ground-based forest thinning is conducted using conventional logging equipment such as feller bunchers and tracked or rubber-tired skidders (Map 1, "Forest Thinning"). Operations using feller bunchers are typically limited to slopes less than 45 percent and skidders are typically limited to slopes less than 35 percent. Operating ground-based mechanized equipment on steeper slopes may occur, however, doing so requires special soil mitigation and precautions, such as the use of low ground pressure, flexible-track equipment or tethered operations to meet soil quality standards and to control erosion (see Chapter 2.12-F for more detail). Aerial yarding may also be used on slopes exceeding 45 percent. Aerial yarding requires specialized equipment such as skyline or yoaders (i.e., a yarder and loader tool combined) or helicopters. Together, these aerial and ground-based methods of forest thinning on steep slopes are referred to as Alternative Systems (Table 1, and Map 1, "Forest Thinning Alt. Systems"). Wherever ground-based or aerial forest thinning operations occur, skidding and/or wood product removal may occur. All cut-sawlogs and biomass will be removed to the greatest extent possible. After forest thinning is completed, follow-up prescribed fire is proposed to achieve and maintain desired conditions.

Figure 7. Tree clump retention.

Post-treatment density targets will be variable among treatment units (Table 3). At the stand-level, treatments will create more open canopy conditions on upper slope positions (ridges) and south-facing aspects, while denser canopy conditions will be retained on lower slope positions (drainages) and on north-facing aspects (Table 4), as guided by North et al. (2009) (Figure 8 and Figure 9). Post-treatment density targets are also influenced by various management constraints related to, for example, the conservation needs of sensitive wildlife, existing stand densities, or stand health.

Table 3. Desired structure within forested stands based on NRV.

Forest Type	Tree Basal Area (square feet per acre)	Tree Canopy Cover (percent overhead canopy)
Pine / Dry Mixed Conifer	20-200 (mostly less than 150)	10-50 (may exceed 50 in small patches)
Moist Mixed Conifer / Fir	50-300 (mostly less than 200)	20-75 (may exceed 75 in small patches)

Table 4. Approximate Stand Density Index (SDI) targets.

Forest Type	Ridge SDI Range	Mid-Slope SDI Range	Drainage SDI Range
Pine	50-100	75-125	100-150
Dry-Mixed Conifer	100-150	125-175	150-200
Moist-Mixed Conifer	150-200	175-225	200-250

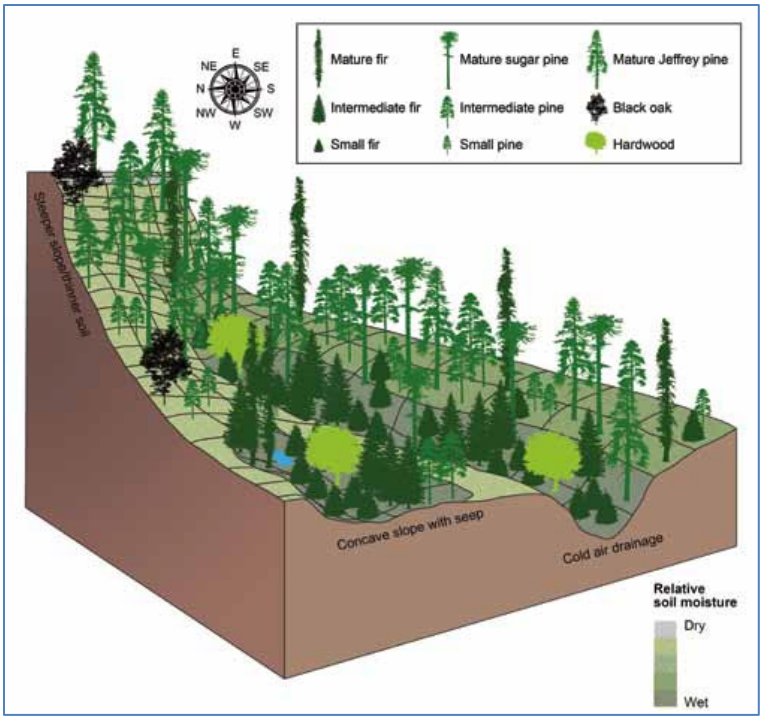

Figure 8. Desired post-treatment stand-level forest structure and composition (North et al. 2009).

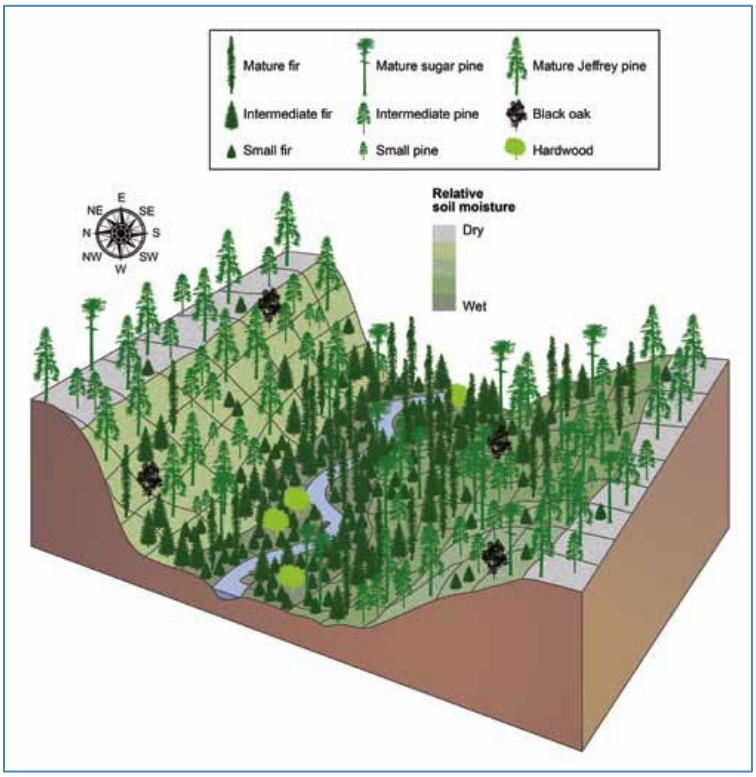

Figure 9. Desired post-treatment landscape scale variable forest conditions that differ by topographic factors such as slope, aspect and slope position (North et al. 2009).

Forest thinning also provides an opportunity to correct the species imbalance among shade-intolerant and shade-tolerant trees (Chapter 1.01 and Appendix A.03). Fire-resistant and shade-intolerant species (ponderosa pine, Jeffrey pine, sugar pine, black oak) will be favored for retention while shade-tolerant species (primarily white fir and incense cedar) will be prioritized for thinning and removal.

If insect-, disease-, or drought-induced tree mortality occurs prior to implementation – forest thinning treatment modifications may be necessary (Table 5). When mortality occurs in small, isolated patches, with minimal impact to the existing forest canopy, the dead trees may be salvaged to create desired openings in the forest (Scenario 1 and Scenario 2). When mortality is widespread, treatments and constraints would convert to those proposed in section Salvage for NRV-based Restoration and Conservation Benefits.

Table 5. Potential forest thinning modifications when faced with insect-, disease-, or drought-mortality.

Scenario	Live Tree Thinning	Dead / Dying Tree Salvage
1: Mortality present but removal of dead trees will meet opening objectives	Implement variable density thinning without modification. Targeted thinning on live trees.	Remove dead, salvageable trees to reduce fuel loading, meet individual tree, clumpiness, and opening objectives, and recover the economic value.
2: Moderate mortality present which has measurably reduced the proportion of live trees.	Implement a modified, more selective version of the forest thinning prescription. Both live and dead trees could be cut and removed, but the designation by description (D x D) would require the rate of live tree cutting and removal to be reduced in comparison to Scenario 1.	Remove dead, salvageable trees to reduce fuel loading, meet individual tree, clumpiness, and opening objectives, and recover the economic value.
3: Widespread, high mortality present and dead trees dominate the landscape. Forest thinning objectives can no longer be met.	None.	See Chapter 2.07

2.02 Fuel Reduction (18,471 acres, Table 6, Map 1)

Fuel reduction treatments are located in areas with slopes averaging less than 45% and composed of:

a. Small conifers where average diameters are less than 6 inches DBH (CWHR 1 and 2),
b. Conifers where average diameters are greater than 6 inches with canopy cover less than 40% (CWHR 3, 4, 5 S & P),
c. Conifers where average diameters are greater than 6 inches with canopy cover greater than 40% (CWHR 3, 4, 5, M&D) and the estimated combined biomass and sawlog volume is less than 7 CCF per acre or where located within an IRA or W & S River Corridor, or
d. Oaks, shrubs, or other herbaceous vegetation occurring within WUI, within 250 feet of a Maintenance Level 2, 3, 4, or 5 road, or as identified for resource benefit.

Fuel reduction treatments will primarily consist of mastication or machine piling and burning, although hand thinning and prescribed fire may also be used.

Table 6. Proposed fuel reduction summary

Treatment Type	Other Forest	California Spotted Owl PAC[A]	California Spotted Owl Territory	IRA[B,D]	W&S River [C,D] Corridor	Project Total
Fuel Reduction	11,620	333	3,226	3,180	778	18,471

[A] PAC = Protected Activity Center; [B] IRA = Inventoried Roadless Areas; [C] W&S = Wild and Scenic River. [D] Some of the acres reported in IRA and W&S River Corridor overlap with PAC and Territory acres. Therefore, these acres are not mutually exclusive.

Mastication and machine piling and burning affect forest structure differently than forest thinning via timber harvest (Table 7). Where mastication or machine piling and burning are applied, the objective is to generally change the size and arrangement of fuels to reduce wildfire risk and wildfire severity by creating better spacing among younger trees, breaking up the ground-to-crown vegetation connectivity, and eliminating undesirable levels of secondary growth. Mastication alone does not remove material from a site but rather rearranges its structure turning ladder fuels into surface fuels. Mulching-type mastication is used to incorporate material into the soil to reduce resulting surface fuels. Machine piling and burning does remove fuels from a site (once the material is burned). Neither mastication or machine piling and burning generally affect the overall canopy structure of forested areas. The vegetation treatment and retention specifications are described in Table 8. Treated material will remain on site as mulch or in piles for burning. Prescribed fire will also be applied in these areas as a follow-up treatment to achieve and maintain desired conditions.

Table 7. Treatment Types and Impacts on Forest Structure (based on Winford et al. 2015)

Fuels	Prescribed Fire (Broadcast or Machine Piling and Burning)	Mastication	Hand-Thinning	Forest Thinning via Biomass Removal only	Forest Thinning via Timber Harvest
Surface Fuels	Reduction	Increase	Variable	Increase	Increase
Ladder Fuels	Reduction	Reduction	Reduction	Reduction	Reduction
Canopy Continuity	Slight Reduction or No Change	Slight Reduction or No Change	Slight Reduction or No Change	Conditional Reduction	Reduction

Table 8. Fuel Reduction Prescription Specifications

Desired Condition	Fuel Reduction
Tree Retention: Live Tree DBH Limit	Except where necessary for equipment operability or to abate a safety hazard, retain live trees greater than 10 inches DBH.
Dominant and Codominant Crown Classes Retention	Conifers retained should be dominant and codominant trees, with a single leader, straight bole, full crowns, dark green foliage, and no signs of insect or disease or physical damage.
Standing Dead Trees (i.e., snags) Removal and Retention	Mixed conifer, pine, and hardwoods Retain 4 of the largest per acre. Red fir forest type Retain 6 of the largest per acre.
Dead and Downed Logs Removal	Retain 4 of the largest downed logs per acre (average 20-inch diameter and 20-feet long).
Understory Vegetation Retention and Removal (e.g., small trees)	Retain **some** conifers less than or equal to 10" DBH by removing trees less than 10" DBH to a spacing of 25 feet.
Shrub Retention: where there is oak and conifer overstory	To provide wildlife habitat and soil cover, retain all shrubs less than 12 inches in height. Retain **some** shrubs greater than 12 inches by removing shrubs greater than 12 inches to a spacing of 25 feet.
Shrub Retention in shrub-dominated areas lacking oak and conifer overstory	Retain **some** large, dominant, live shrub stems where they exist to create isolated clumps of the largest, healthiest vegetation.

Desired Condition	Fuel Reduction
Oak and other Hardwood Tree Retention	Retain all hardwoods with a DBH of 12 inches or greater unless tree poses a threat to human life or property, or if removal is needed to maintain and enhance a hardwood stand. Hardwoods less than 12-inches DBH may be removed.
Blue Oak and Valley Oak Tree Retention	Retain **all** blue and valley oak.
Sugar Pine Retention	Retain healthy sugar pine without evidence of white pine blister rust or bark beetle attack.

2.03 Fuelbreaks (13,825 Acres, Map 1)

Fuelbreak locations were identified by Stanislaus National Forest fire and fuels specialists (Map 1). Fuelbreaks are generally located along ridgelines or other strategic areas near communities or with known control features. Fuelbreaks will be constructed and maintained to widths ranging between 250 and 500 feet through a combination of forest thinning, fuel reduction, prescribed fire and herbicide application[3] **(**Table 9**).** Some of the proposed fuelbreaks require new construction while others are existing fuelbreaks or previously used fuelbreaks needing treatments to restore their functionality. Fuelbreak treatment specifications are presented in Table 10.

Table 9. Summary of proposed fuelbreak treatments.

Treatment Type		Other Forest	California Spotted Owl PAC[A]	California Spotted Owl Territory	IRA[B]	W&S River[C] Corridor	Project Total
Forest Thinning	Mid-Closed, Pine	963	0	607	0	0	1,570
	Mid-Closed, Dry MC	1,097	14	1,186	0	0	2297
	Mid-Closed, Moist MC	602	0	125	0	0	727
	Late-Closed, Pine	98	0	24	0	0	122
	Late-Closed, Dry MC	180	9	508	0	0	697
	Late-Closed, Moist MC	0	0	0	0	0	0
	Subtotal	**2,940**	**23**	**2,450**	**0**	**0**	**5,413**
Mechanical Fuel Reduction		5,133	24	1,798	30	104	7,009
Possible Handwork *(steep slopes)*		993	0	251	135	43	1,403
Total		**9,066**	**47**	**4,499**	**165**	**147**	**13,825**

[A] PAC = Protected Activity Center; [B] IRA = Inventoried Roadless Areas; [C] W&S = Wild and Scenic River. [D] Some of the acres reported in IRA and W&S River Corridor overlap with PAC and Territory acres. Therefore, these acres are not mutually exclusive.

The objective in shaded fuelbreaks is to create and maintain vegetated areas resistant to fire spread, both vertically and horizontally (e.g., no fire spread to tree crowns). This is accomplished by retaining discontinuous patches of vegetation across these features, which also facilitates safer work conditions for firefighters. The retention of overstory trees, and some understory trees, especially if no overstory trees exist at the time of first treatment, is key to creating shaded conditions that suppress understory vegetation regrowth. Vegetation prescribed for removal (Table 10) will be accomplished via forest thinning timber or biomass removal, mastication, hand-thinning, or machine piling and burning.

Spacing for residual trees would vary depending on the level of stand mortality and healthy trees at the time of implementation. Where fuelbreaks occur in non-conifer dominated vegetation types (e.g., oak woodlands), the desired conditions for understory vegetation and hardwood species will generally be the

[3] See section 2.04

same as they are in conifer-dominated fuelbreaks. Once fully implemented, fuelbreaks in conifer forests and oak woodland areas will look similar to the examples displayed in Figure 10 and Figure 11.

Table 10. Fuelbreak Prescription Specifications

Desired Condition	Fuelbreak
Tree Retention: Live Tree DBH Limits when conducting forest thinning.	Except where necessary for equipment operability or to abate a safety hazard: Abide by DBH limits described in Table 2.
Dominant and Codominant Crown Classes Retention	Retain **some** dominant and codominant size class trees creating an average crown spacing of ½ to 1 ½ crown widths.
Oak and other Hardwood Tree Retention	Retain **all** hardwoods with a DBH of 12 inches or greater unless tree poses a threat to human life or property, or if removal is needed to maintain and enhance a hardwood stand. Hardwoods less than 12-inches DBH may be removed.
Blue Oak and Valley Oak Tree Retention	Retain **all** blue and valley oak.
Sugar Pine Retention	Retain healthy sugar pine without evidence of white pine blister rust or bark beetle attack.
Understory Vegetation Retention and Removal (e.g., small trees)	The intention is to remove **all** conifers less than or equal to 10" DBH where overstory is abundant. In areas where large trees are sparse, **some** small trees will be retained by thinning trees less than 10" DBH to a spacing of 25 feet.
Shrub Retention: where there is oak and conifer overstory	To provide wildlife habitat and soil cover, retain **all** shrubs less than 12 inches in height. Remove **all** shrubs 12 inches and greater.
Shrub Retention in shrub-dominated areas lacking oak and conifer overstory	Retain **some** large, dominant, live shrub stems where they exist to create isolated clumps of the largest, healthiest vegetation.
Standing Dead Tree Removal (i.e., snags)	Remove **all** snags.
Dead and Downed Log Removal and Retention	Retain **some** downed logs where resource specialists deem appropriate and doing so will not meaningfully weaken the effectiveness of the fuelbreak.
Hazard Trees Removal	Remove all hazard trees.
Slash and other debris	Remove **all** slash and other woody debris.

Figure 10. Example of a shaded fuelbreak in a conifer forest (left) and young oak woodland (right).

Figure 11. Example fuelbreak conditions before (left) and after mastication before understory has regrown (right).

2.04 Fuelbreak Maintenance Using Herbicides (Approximately 7,500 acres)

Effectively maintaining fuelbreaks is critical to the long-term success of the project. Herbicides may be used as a tool to suppress or prevent the growth or re-growth of sprouting brush, tree species, herbaceous fuels, or noxious weed populations.

In response to public scoping comments related to the EAD authority and no opportunity to object to the proposed use of herbicides to maintain fuelbreaks, the responsible official has expressed his intent is to prepare a separate draft decision and offer a 45-day administrative review (objection period) opportunity related to the proposed use of herbicides to maintain fuelbreaks.

In further response to scoping comments concerned about the broad use of herbicides, the team conducted reconnaissance to refine where it would be most beneficial to apply herbicides as a tool to maintain the condition of the fuelbreak. As a result of this reconnaissance, the team has reduced the proposal to use herbicides as a tool to maintain fuelbreaks to approximately 7,500-acres, as opposed to the original proposal which spanned the entire 13,825-acre fuelbreak network (Map 2). This reduction includes, for example, eliminating the use of herbicides in the fuelbreaks in the Herring Creek Loop and fuelbreaks located directly parallel to other fuelbreaks identified as being most beneficial to having herbicides applied. The updated proposal to retain the option to use herbicides across the lesser, 7,500-acres identified in Map 2 is important. In many of these areas, the Forest fire and fuels specialists identified these specific areas as having strategic Fuelbreak value. Additionally, vegetation analysis and field reconnaissance identified herbicide need on main transportation routes, such as 3N01 and 1N01, in order to maintain effective ingress and egress routes. Ridgelines were also identified for herbicide treatment due to their strategic nature and the desire to maintain these areas for fire management activities. Additionally, areas for herbicide maintenance were identified where access or terrain would impact the ability to use mechanical equipment.

The proposed SERAL 2.0 fuelbreak network represents only part of the forest's larger fuelbreak maintenance needs. Maintaining fuelbreaks, across the forest, and not just within the SERAL 2.0 project area, is critical to meeting the Forest's objectives and to maintain our valuable assets. Including herbicides as a tool to maintain fuelbreaks on a subset of the proposed fuelbreak network will enable our implementation teams to assess regrowth and available resources and choose the most effective and efficient option to maintain the full functionality of the fuelbreaks.

The intent of this proposal is to have herbicides as an *option* (emphasis added) to maintain fuelbreaks, not as the primary or only option. Herbicides won't be applied across every acre of the 7,500-acres identified in Map 2. The responsible official has made it clear that his priority is that prescribed fire will be used whenever possible for fuelbreak maintenance; however, because we have very small burn windows and

many acres to burn annually, it is important to include additional tools to maintain the desired condition of these important features.

To mitigate or minimize the potential human health and other resource concerns related to the use of herbicides, a suite of management requirements (DEIS Chapter 2.12 J) are included as mandatory requirements and targeted application methods will be used. Through targeted foliar application herbicides will be sprayed directly onto resprouting shrubs such as manzanita, deerbrush, and whitethorn, as well as non-native invasive species.

The timing of when herbicide application may occur in relation to the initial construction of a fuelbreak will vary. On occasion herbicides may be applied immediately following a mechanical treatment, in other instances herbicides may not be applied until one-to-many years after initial construction. Where herbicides are used, application frequency will also vary, but application rates are expected to decrease over time. Periodic evaluations will be used to determine the need and timing for reapplication to maintain fuelbreak desired conditions. Herbicide application when applied by hand is effective at avoiding non-target plants.

Five herbicides following label and national application rate standards may be used. This includes aminopyralid, chlorsulfuron, clopyralid, glyphosate, and triclopyr. Each of the five proposed herbicides have been approved for use in the state of California and have a label certifying that the chemical has been approved for use by the Federal Environmental Protection Agency and the California Department of Pesticide Regulation. To reduce the risk of populations developing herbicide tolerance from repeated application with the same herbicide, herbicides with different modes of action would be applied when appropriate.

The non-selective herbicide Glyphosate may be applied to control a broad range of vegetation including non-native invasive plants and native woody species. The more selective herbicides Aminopyralid and Triclopyr may be used for selective treatment of plants being targeted for treatment while reducing impacts to non-target plant species.

2.05 Targeted Grazing

The term targeted grazing is used in reference to livestock grazing that is managed to accomplish very specific outcomes. Targeted grazing uses animals to consume, break off, or trample vegetation in order to reduce the amount or density of fuels. This is in contrast to grazing that is conducted for broader purposes such as forage utilization and animal production. Traditionally, grazing in the Stanislaus National Forest has been conducted primarily for the economic production of animal products, including meat and fiber. With targeted grazing, grazing contractors would be paid for their services and be under Forest Service direction and monitoring to achieve specified fuel reduction objectives.

Grazing can be a relatively inexpensive treatment method and goats and sheep can effectively create fuel reduction zones (Lovreglio et al. 2014).

For SERAL 2.0, targeted grazing using sheep or goats would be utilized in selected areas of fuelbreaks to control shrubs and maintain post treatment understory fuels conditions in fuelbreaks. Targeted grazing does not need to occur annually to be effective. However, although targeted grazing will reduce the need for mechanical and hand treatments and the need for herbicide application in the locations where it is applied, targeted grazing alone cannot control shrubs and maintain understory fuels. Mechanical and hand treatments will still be needed roughly every 10 years to treat larger-diameter woody regrowth.

Proposing the use of targeted grazing to help maintain fuel loading will provide some degree of economic opportunities to the local community. The scale of opportunity would be evaluated based on the potential

for sheep and goat predation, the need to concentrate animals in order to get meaningful vegetation consumption, and other relevant issues.

Having the ability to use herbicides and targeted grazing to maintain fuelbreaks would provide treatment options that may cause minimal soil disturbance and an acceptable level of impacts to other resources. Both herbicide application and targeted grazing could potentially be used in areas where mechanical treatments may not be appropriate (e.g., steep slopes or resource sensitive areas).

Control of sheep and goat movements and prevention of the impacts of overgrazing, including increased erosion from ground cover loss and soil compaction, is critical for successful use of this treatment method. Professional herders often use portable fences as an alternative to fixed fencing where the treatment is ephemeral. Fences can be placed, and goat herds can be rotated in ways that minimize or avoid unacceptable impacts. Additional standards and guidelines may be employed for protection of sensitive resources, and to prevent erosion or other undesirable environmental impacts.

The proposed targeted grazing would be implemented as follows:

Implementation Schedule: Targeted grazing may be introduced two years after initial fuelbreak construction or fuel reduction treatments then utilized to maintain the desired condition on a two-year cycle. Maintaining fuelbreaks adjacent to WUI or closest to communities at risk is the highest priority.

Where herbicides are used to control undesirable vegetation, grazing would not follow herbicide application in the same season.

Scale and Location: To be effective, the goal will be to implement targeted grazing on approximately 300 acres of fuelbreaks per year. The locations where targeted grazing will be the most appropriate and effective will be determined through a grazing suitability analysis (USDA 2004 – Appendix K).

Timing: Targeted grazing would most commonly occur between June and October depending on rangeland readiness, soil dryness, and the units planned for implementation.

Numbers of Animals: Bands of 1000-1500 sheep and goats may be used to keep woody growth to 18-24-inches in height.

Acres per day: With a band of 1000-1500 animals, targeted grazing may cover 8 to 10 acres per day.

Fencing or Herding: Grazing animals would be either fenced (physically or with virtual fencing technology) or herded within the confines of the fuelbreak and would be moved regularly between contiguous treatment units. Targeting grazing operators will be required to install, move, and maintain temporary electric fences as needed. When using targeted grazing in fuelbreaks located on either side of a road, operators must ensure that animals are kept off of roads by confining the grazing to one side of the road then the other.

Watering: Animals are watered approximately twice per day, either by herding animals to water sources within the unit or by trucking water to a trough within the unit.

Additional Best Management Practices: In general, best management practices (BMPs) associated with grazing address the potential impacts of exposing bare ground as a result of over-grazing and/or excessive hoof traffic.

Mandatory Design Features:

TARG-1: Prior to implementation of targeted grazing, develop and implement a site-specific grazing management plan that quantifies resource and fuel load objectives. The plan should include rangeland readiness standards, detailed stocking levels, length of grazing periods, and seasons needed to achieve these goals, as well as monitoring activities and performance criteria to adequately assess the effectiveness of grazing activities.

TARG-2: Livestock operators generally install infrastructure improvements, such as water sources and salt/supplements, needed to ensure even and consistent grazing patterns across treatment areas. Salt blocks and other supplements should be placed outside of riparian areas and at least ¼ mile from water sources. Bedding areas should also be located outside of riparian areas.

TARG-3: Prior to the introduction of goats or sheep, all animals (especially goats) will be quarantined (dry lot) and fed only weed-free forage to ensure that invasive or otherwise unwanted plant species from offsite are not introduced through contact or carried on hooves, or through collection and deposition in manure. Equipment (trailers, off-road vehicles, etc.) will be cleaned and inspected for weed seeds prior to entry into units. Known invasive plant populations can be avoided where possible to prevent the spread of invasive species; invasive species phenology, population extent, and potential for impacts to natural resources should be considered. Grazing will be managed to minimize or avoid creating bare soil.

TARG-4: Livestock grazing will be monitored to determine when performance criteria are achieved. As soon as desired fuel reduction objectives have been reached, livestock shall be removed in a timely manner to avoid overgrazing and/or excessive hoof traffic.

TARG-5: Livestock operators with specific experience in grazing operations for fuel reduction should be prioritized for targeted grazing contracts or agreements. Multiple year contract(s) are the preferred mechanism.

TARG-6: In areas where fuelbreaks overlap with riparian areas in proximity to water, providing a water trough or other water supply options within the targeted grazing unit should be considered so that the animals do not trample, overgraze, pock, crumble streambanks, or degrade riparian habitat. If animals are allowed to be herded to nearby water, all streambank standards and water quality BMPs would be applied.

2.06 Broadcast Burning (Table 11, Map 1)

The overall objective is to apply broadcast burning regularly wherever possible throughout the project area. However, much of the project area needs preparation. The bulk of the broadcast burning needed across the project area will be initial entry burning. Initial entry burning applies fire in areas that either have no fire history or within areas that were exposed to fire so long ago that vegetation has regrown to its pre-fire decadent state.

First entries require more resources and attention to ensure the applied fire remains within the desired outcomes. Applying fire in areas that have already had a fuels reduction treatment of some sort, especially forest thinning that removes potential fuels such as timber or biomass, rather than rearranging fuels, is preferable when applying fire in a completely untreated area.

The suite of other proposed actions described in sections 2.01 through 2.05 all contribute to preparing the landscape for regular, large-scale broadcast burning. As more treatments are implemented, the area prepared for burning will increase. As a result, the rate and size of individual burning opportunities will expand.

In the interim, broadcast burning opportunities will occur opportunistically in areas that have known control features, have been burned previously or adjacent to previously burned areas, and which have terrain and accessibility that support safe and controlled burning operations (Table 11, Map 1 – “Primary Rx Fire Opportunities”). Additional broadcast burning potential (Table 11, Map 1 - “Additional Rx Fire Potential”) may have broadcast fire applied but those areas will require additional preparation and review as other treatments are implemented, or a larger set of resources in order to conduct the operation in a safe and controlled manner.

Table 11. Proposed Broadcast burning summary.

Treatment Type	Other Forest	California Spotted Owl PAC[A]	California Spotted Owl Territory	IRA[B]	W&S River Corridor[C]	Project Total
Primary Rx Fire Opportunities	**26,523**	**2,751**	**6,092**	**2,284**	**3**	**37,667**
Additional Rx Potential	**41,241**	**10,380**	**16,497**	**12,753**	**7,308**	**83,294**
Total	**67,764**	**13,131**	**22,589**	**15,037**	**7,311**	**120,961**

[A] PAC = Protected Activity Center; [B] IRA = Inventoried Roadless Areas; [C] W&S = Wild and Scenic River.

Yearly treated acres will vary depending on fire program staffing, budgets, weather conditions and air quality. Implementation of other proposed vegetation management actions (e.g., forest thinning and mechanical fuel reduction treatments) which overlap with operational burn units may often times occur prior to applying prescribed fire, but that is not mandatory. There are many factors considered to identify burning windows. Where and when fire and fuels specialists deem it appropriate and weather and air quality control opportunities align, prescribed fire may be applied at anytime and anywhere within the project area. Fire control lines may be constructed after a resource specialist review, in compliance with management requirements, wherever necessary to keep prescribed burns from spreading outside of treatment areas and for unit segmentation to facilitate sequenced burning of larger units. Fire control lines may consist of natural barriers of unburnable materials (e.g., rocky areas, rivers, or meadows), and existing management barriers like fuelbreaks (Chapter 2.03 above), trails, and roads. Prescribed fire preparation may include falling trees for efficient burn tactics and firefighter safety and include the use of utility task vehicles, heavy equipment (e.g., dozers or excavators), chainsaws, hand tools, and past wildfire containment and contingency lines. Where new temporary control lines are constructed, they will be rehabilitated after use.

2.07 Salvage (Map 10)

In response to public scoping comments related to the EAD authority and no opportunity to object to the proposed condition-based salvage actions, the responsible official has expressed his intent to prepare a separate draft decision and offer a 45-day administrative review opportunity (objection period) related to the proposed salvage.

Area of Potential Salvage:

The area of potential salvage (APS) defines the area where the salvage of insect-, disease-, drought-, or fire-killed trees may be considered. No salvage of insect-, disease-, drought-, or fire-killed trees may occur outside of this defined APS.

The defined APS represents National Forest System (NFS) lands that meet **each** of the following criteria:

- Within 0.25 miles of maintenance level 2, 3, 4, and 5 NFS roads – included to eliminate the need for temporary roads to conduct the potential salvage operation.
- Within forested areas composed of CWHR size classes 3, 4, 5 and 6 with mixed conifer/fir; mixed conifer/pine, or pine dominated forest types
- Outside of protected activity centers (PACs)
- Outside of wild and scenic (W&S) river corridors (1/4-mile buffer along W&S river)
- Outside of inventories roadless areas (IRAs)

The APS is a similar concept to a project area boundary. Within a project area, rarely will actions be proposed or implemented on every single acre. Within the APS, insect, disease, drought, or wildfire

salvage **may only occur** where the criteria described in each spatial, temporal, and conditional constraint described in Section 2.07 A (Insect, Disease, and Drought-Killed Trees) and 2.07 B (Fire-Killed Trees) have been met. Collectively the constraints included for both categories of salvage are designed to ensure desired patches of insect, disease, drought, and even wildfire killed trees are retained, snags and large down logs are retained for wildlife and soil stability and impacts to resources are limited and confined to acceptable levels. In meeting each of the constraints within the APS, not every acre of the APS will be salvaged because the areas that will meet each of the conditional constraints and experience the mortality rates that would trigger the salvage need will be limited. Further reducing the extent of and likelihood of salvage occurring is the amount the APS overlaps with the forest thinning, mechanical fuel reduction, fuelbreaks, and broadcast burning areas. This is meaningful because the suite of those other treatments has been designed to increase landscape resilience to natural disturbances such as insect, disease, drought, and wildfire. Therefore, as the other treatments are implemented, the expectation is the likelihood of mortality rates prompting the need for salvage will lower measurably across the project area. Therefore, salvage will not occur across all or even most of the APS.

A. Insect, Disease, or Drought Killed Trees

Low levels of scattered individual tree mortality caused by insects and disease was historically natural in the Sierra Nevada and ecologically beneficial to forested ecosystems such as providing edge habitat for foraging owls (Fettig 2012; USDA 2019). Present day, episodic, large-scale mortality events, have become common due to current forest conditions and climate change driven drought and warmer temperatures. When mortality becomes chronic, occurring in large clusters with greater than 75% mortality (high severity), ecosystem resistance and resilience may be compromised (Fettig 2012). High severity (> 75% mortality) occurring across greater than 15% of a landscape (i.e., a HUC 6 Watershed) or in patch sizes exceeding 10 acres, is indicative of "high" levels of tree mortality outside the natural range of variation and poses a threat to landscape resilience.

At present mortality rates are low and sparse across the project area, but until the other suite of proposed actions are implemented, at least in part, the landscape will remain highly vulnerable to insect-, disease-, and drought mortality. In the interim, a mechanism to rapidly respond to large scale mortality events to remove the accumulation of fuels and prevent an increased risk of wildfire effects on the landscape is necessary.

The desired outcomes of the proposed salvage are 2-fold: (1) maintain a proportion of mortality pockets akin to what would have occurred naturally when regular fire regimes were intact; (2) to rapidly respond to tree mortality events exceeding natural desired levels to mitigate the excess fuels while contributing to the local economy. The value of dead trees declines rapidly, especially that of insect-killed pine. A delayed response to the mortality creates the need for more costly, and more dangerous treatments as the trees weaken. Thus, even this very limited proposal to salvage insect, disease, and drought killed trees will play a pivotal role in achieving and maintaining a resilient landscape and local economy.

To be clear, the salvage proposed is designed to react to a potential future condition that does not currently exist. This type of proposed action is commonly referred to as "condition-based". The inclusion of condition-based management in project planning is not universally accepted as an appropriate methodology. Those opposed to condition-based management believe that condition-based management does not provide the site-specificity necessary to meaningfully assess the potential environmental impacts, to inform the responsible official's decision-making process or the public's ability to provide feedback on the project.

In recognition of these concerns, the proposed salvage includes spatial, temporal, and conditional constraints. These constraints identify the area of potential salvage, when the salvage would occur – or what would trigger a salvage action, and other specific constraints which limit the salvage actions.

Bounding the proposed salvage spatially, temporally, and conditionally helps to support the analysis of potential environmental impacts.

The following mandatory spatial, temporal, and conditional constraints describe when mortality rates would prompt the salvage need (CON-1 and CON-2), post-disturbance evaluation and documentation requirements (CON-3 and CON-10), temporary road limitations (CON-4), prohibited salvage areas (CON-5), a static temporal limitation (CON-6), snag and down log retention requirements (CON-7 and CON-8), and the desired dead and downed fuels and understory vegetation post-salvage conditions (CON-9).

Mandatory Design Features:

CON-1 Salvage of insect-, disease-, or drought-killed trees may **only** occur when mortality rates exceed 75% (i.e., high severity) in patch sizes exceeding 10 acres, or when mortality rates exceed 75% across greater than 15 percent of a HUC 6 watershed in a continuous pattern or across multiple patches (USDA 2019, Approach 2, 7D).

CON-2 Insect-, disease-, and drought-killed trees must be identified following current regional standards and direction. At present, the current guidance is presented in USDA 2022.

CON-3 Salvage of insect-, disease-, or drought-killed trees may **only** occur after a cumulative watershed effects (CWE) analysis is completed to determine whether the post-disturbance watershed condition exceeds the threshold of concern (TOC[4]) for each HUC 6 watershed affected. The CWE analysis must determine that the post-disturbance watershed condition is and would remain below the TOC if salvage occurs. If the watershed condition exceeds the TOC prior to a salvage action, or because of the salvage action, no salvage is authorized to occur.

CON-4 Salvage areas may be accessed using existing roads and already constructed temporary roads. Salvage areas requiring a new temporary road to provide access for timber removal may **not** exceed 500 feet and must ensure all sensitive resources are protected from harm. Because the APS is located within 0.25 miles of existing roads, temporary roads will rarely be needed. Skidding is most commonly utilized to remove trees from units located within 0.25 miles of an existing road. Therefore, any need for new temporary road segments within the APS is expected to be extremely minimal.

CON-5 Salvage of insect-, disease-, or drought-killed trees may not occur within ¼ mile of an eligible Wild and Scenic River, or within designated protected activity centers (PACs). If new PACs or W&S Rivers are designated after the decision, salvage must avoid those newly designated areas as well.

CON-6 Salvage of insect-, disease-, or drought-killed trees may **only** occur within 7 years of the date I signed the decision.

CON-7 Snag Retention Requirements: S&G 11 defines a snag as a dead standing tree greater than 15 inches in diameter (USDA 2017) and at least 20 feet in height. Snags should be as defined in Management Requirement 2.13 F.x below.

CON-8 Large Down Log Retention Requirements: Large down logs should be retained as defined in Management Requirement 2.13 F.x below.

CON-9 Post-salvage Desired Conditions for Dead and Downed Fuels and Understory Vegetation: The

[4] 1 The threshold of concern (TOC) is a measure of watershed sensitivity. This method assumes that the potential for cumulative watershed effects increases with land-use intensity or natural processes, like wildfires in a watershed. TOC is calculated based on channel sensitivity, relief ration, geology, and precipitation regime of each watershed.

remaining amount of understory vegetation or downed branches of trees should be similar to the conditions found pre-disturbance (e.g., before the insects, disease, drought, or wildfire event) ranging to amounts that would be found post-prescribed fire (patchy mosaic). The goal is to create conditions for low fire behavior and low flame lengths. It is not intended that salvage operations will leave loads of woody material (e.g., limbs, bark, small trees, that would be equivalent to fuel models above 6 tons/acre), nor will salvage operations leave an area devoid of all woody material, litter, and duff (thus making it vulnerable to soil erosion). Instead, adequate dead and downed fuels and understory vegetation to protect soils and other ecosystem services while meeting fuels reduction objectives will be maintained. In order to meet these criteria, the area may require the removal of woody material by means of chipping, removing, burning, or piling and burning methodologies.

CON-10 Post-Disturbance Evaluation Requirement: After a disturbance occurs and before any salvage action occurs, the implementation team must conduct a post-disturbance evaluation to ensure each of the mandatory constraints / conditions will be met and to determine whether any additional or supplemental analysis would be necessary. The post-disturbance evaluation process must include the following:

- Determine the extent of the mortality.
- Determine if each spatial, temporal, and conditional constraint / condition itemized above has been met and provide written documentation of those findings in a post-disturbance evaluation.
- Include in the written post-disturbance evaluation document how the salvage action meets each spatial, temporal, and conditional constraint / condition, and how the salvage is consistent within the scope of the decision and associated analysis. Salvage may proceed only when it is determined in the written post-disturbance evaluation document that all conditions / constraints are met, and the anticipated impacts of the salvage action are within the scope of the decision and associated analysis. Otherwise, additional or supplemental analysis must be performed in compliance with NEPA.
- Identify the size and location of the salvage action in the written post-disturbance evaluation document and provide a map that displays the disturbed area and the area where the salvage will occur.
- The implementation team must ensure that the post-disturbance evaluation documentation and map(s) are made available on the project website / public Pinyon folder[5] for a minimum of 15 days prior to initiating any insect-, disease-, or drought-killed tree salvage. Inform all interested parties via GovDelivery or USPS of the availability of the post-disturbance evaluation. The 15-day waiting period will be initiated at the time the GovDelivery notice is distributed.

B. Salvage of Fire-Killed Trees (Wildfire or Prescribed Fire)

Historically, regular, low-intensity fires would have commonly occurred across the landscape maintaining low levels of surface and ground fuels and less dense forests. Generally, historic fire effects would have produced high severity patches across 1 to 10 percent of the landscape, naturally (USDA 2019). Therefore, to mimic the natural range of fire effects, retaining severely burned stands comprising 1 to 10

[5] The public Pinyon folder is an electronic storage space that provides a public web-based view of documents. The SERAL public Pinyon folder is accessible via the project website: https://www.fs.usda.gov/project/?project=56500

percent of the landscape is desirable, particularly in areas more likely to have experienced severe fire effects under NRV, such as upper portions of south-facing slopes (USDA 2019 Approach 1, 7C).

Generally, proportions of fire effects desired to mimic the NRV are approximately unburned (10 to 30 percent), low severity (30 to 60 percent), moderate severity (15 to 35 percent) and high severity (1 to 10 percent). Tree mortality is most common in areas burned at high severity. When high severity patches (i.e., tree mortality > 75%) exceed 10 acres, the fire related tree mortality is outside the natural range of variation and poses a threat to landscape resilience.

The conditions that would prompt fire-killed tree salvage **do not** currently exist. The following mandatory spatial, temporal, and conditional constraints (WCON-1 through WCON-12) describe when mortality rates would prompt the salvage need (WCON-1 and WCON-2), post-disturbance evaluation and documentation requirements (WCON-3 and WCON-12), temporary road limitations (WCON-4), maximum allowable fire salvage acreage (WCON-5), prohibited salvage areas (WCON-6), a static temporal limitation (WCON-7), the desired relative location of salvage within a burned area (WCON-8), snag and down log retention requirements (WCON-9 and WCON-10), and the desired dead and downed fuels and understory vegetation post-salvage conditions (WCON-11).

WCON-1 Salvage of fire-killed trees may **only** occur when mortality rates exceed 75% (high severity) in patch sizes exceeding 10 acres, or when mortality rates exceed 75% across greater than 10 percent of a HUC 6 watershed in a continuous pattern or across multiple patches. Any dead or damaged trees located in areas with greater than 75% mortality in excess of 10 percent of a HUC 6 watershed are eligible to be salvaged.

WCON-2 Fire-killed and fire-injured trees **must** be assessed following current regional standards and direction. At present the current direction and guidelines are presented in USDA 2011, USDA 2021, and USDA 2022. If any or all of these guidance documents are updated, or superseded, implementation practices must adhere to that updated direction for identifying fire-killed and fire-injured trees.

WCON-3 Salvage of fire-killed trees may occur after a cumulative watershed effects (CWE) analysis is completed to determine whether the post-fire watershed condition exceeds the threshold of concern (TOC) for each HUC 6 watershed affected by a fire. The CWE analysis must determine that the post-disturbance watershed condition is and would remain below the TOC if salvage occurs. If the watershed condition exceeds the TOC prior to a salvage action, or due to the proposed salvage action, no salvage is authorized to occur.

WCON-4 Salvage areas may be accessed using existing roads and already constructed temporary roads. Salvage areas requiring a new temporary road to provide access for timber removal may not exceed 500 feet and must ensure all sensitive resources are protected from harm. Because the area of potential salvage within each HUC 6 watershed is very minimal (WCON-5), effort should be taken to locate fire salvage areas where a temporary road is not needed.

WCON-5 Salvage of fire-killed trees may not exceed 500 acres per HUC 6 watershed totaling approximately 3,000 acres within the project area.

WCON-6 Salvage of fire killed trees may not occur within ¼ mile of an eligible Wild and Scenic River (W&S River), or within designated protected activity centers (PACs). If new PACs or W&S Rivers are designated after the decision, salvage must avoid those newly designated areas as well.

WCON-7 Salvage of fire-killed trees may **only** occur within 7 years of the date I signed the decision.

WCON-8 In an effort to promote California spotted owl and other focal species conservation, where feasible, fire salvage should be located within the interior portions of larger patches. This consideration is to reflect the findings presented in Jones et al. 2020 that found owls have a

tendency to avoid large, but not necessarily small, patches of severely burned forest and also avoid traversing into interior portions of larger patches. Therefore, intentionally locating salvage within interior portions of larger patches would be less likely to affect spotted owls.

WCON-9 Snag Retention Requirements: Same as described under the insect-, disease-, and drought-killed tree salvage subsection above.

WCON-10 Large Down Log Retention Requirement: Same as described under the insect-, disease-, and drought-killed tree salvage subsection above.

WCON-11 Post-salvage Desired Conditions for Dead and Downed Fuels and Understory Vegetation: Same as described under the insect-, disease-, and drought-killed tree salvage subsection above.

WCON-12 Post-Disturbance Evaluation Requirement: Same as described under the insect-, disease-, and drought-killed tree salvage subsection above.

WCON-13 Salvage of trees killed by prescribed burning operations may not occur until at least 1 year after the burning was implemented. This is to prevent the unintentional removal of living trees. Often times, immediately following a prescribed burn trees may appear dead until regrowth occurs.

2.08 Temporary Road Construction

Temporary road construction includes the construction of new "temp roads" and/or the improvement of old temp roads (or other existing unauthorized roads) followed by decommissioning after its intended use period is over. Temporary road construction is generally constructed on slopes less than 10% and may include clearing of trees and brush, stumps, rock, and other materials to allow for construction; surface blading, spot placement of gravel, improvement or installation of drainage structures (i.e., culverts and bridges are installed in specific locations to account for drainage and stream crossing requirements), and erosion control.

Temporary roads are generally short, around 250 feet or less, and are intended to provide short-term access to landings within forest thinning or salvage areas where the existing system roads do not provide adequate access. On occasion, a temporary road may also be needed to provide access to mastication or machine piling areas as well, although those instances would be very few. Typically, treatment areas needing temporary road access are located greater than 0.25 miles from an existing road. When timber harvest operations occur within 0.25 miles of a road, tree removal most commonly occurs via skidding. Skidding at lengths greater than 0.25 miles, may cause greater resource damage and is more costly for operations, so it rarely occurs. Temporary roads providing access to treatment areas further than 0.25 miles from an existing road most often provide safer, economically feasible, less impactful access and shorter skidding distances for tree removal.

Due to known concerns related to "condition-based" proposed actions, the area of potential insect, disease, drought, or fire killed tree salvage has been constrained to less than 500 feet (see CON-4 and WCON-4). However, other temporary roads constructed for purposes other than to access and remove salvage, such as forest thinning or fuel reduction treatments, may be utilized for salvage actions prior to decommissioning.

Some examples of situations where a 500 foot or less temporary road segment may be constructed to access and remove salvage material may include: (1) when the areas right next to a road are too steep to construct a landing – landings need to occur on slopes less than 15%; (2) when a road is located "above" a unit thus requiring an uphill skid rather than downhill, as skidding downhill is best for soil erosion and fuel consumption so constructing a temporary road to access a unit on the downhill side enables skidding

to occur with less impacts; (3) to avoid really steep, rocky areas, arch sites, meadows, or other sensitive areas that prevent skidding to the nearest road.

We estimate that forest thinning which will remove timber product may require reopening up to 28 miles of previously used temporary roads and constructing 10 miles of new temporary roads (approximately 1 mile total per 1,000 acres of forest thinning). Temporary roads are primarily located over previously used logging roads or old skid trails, but occasionally, temporary roads are located over existing foot trails, existing motorized trails, or in an entirely new location. No temporary road construction will occur in Inventoried Roadless Areas or Wild and Scenic River corridors.

In all instances, an existing temp road, skid trails, or other trails will be utilized before any new temporary roads are constructed. Using existing temp roads, skid trails, or other trails will minimize impacts to resources and help to maintain the economic viability of management actions.

As part of the Forest's commitment to fully implement the SERAL 2.0 project as soon as possible, all temporary roads constructed as part of the SERAL 2.0 implementation will be decommissioned / closed within 5-years from the time they are constructed, or within 2 years after the temporary road is no longer needed, whichever is sooner.

2.09 Reconstruction and Maintenance of Roads and Trails

Reconstruction generally includes work to improve and restore roads or trails to provide access to treatment units, provide for safe and efficient haul of forest products, and enhance hydrologic function and stream protection in accordance with applicable best management practices (BMPs; USDA Forest Service2012). Reconstruction and maintenance of existing roads or trails is mutually beneficial for maintaining safe access to public lands. Actions may include surface improvement; construction of drainage dips, culverts, riprap fills or other drainage or stabilization features with potential disturbance outside the established roadway (toe of fill to top of cut); realignment; and widening of curves as needed for log trucks and chip van passage. Reconstruction also includes the actions identified in the maintenance category, such as blading.

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

All roads and trails within the project area are subject to reconstruction or maintenance. No changes to public access would occur on any existing road or trail. Any roads or motorized trails currently closed to public access that are necessary for project implementation would be re-closed following use.

2.10 Non-Native Invasive Weed Control and Eradication (770 acres, Map 3)

Annual non-native invasive plant control and eradication treatments are proposed.

Currently, there are approximately 770 acres of mapped known occurrences of 27 invasive plant species, (Table 12, Map 3) within the project area. Yellow star-thistle, Maltese star-thistle (tocalote), Italian plumeless thistle, bull thistle, and Medusahead account for approximately 730 acres of the known, mapped occurrences. Occurrences are found across the project area, and about 80 percent are less than one acre in size. Often, several years of treatment are required to eradicate or control an infestation.

An early detection rapid response approach will be used within the project area and newly discovered populations would be treated when they are small, so that the likelihood of adverse effects from

treatments are minimized, and before the invasive plants cause measurable ecological damage. This approach assumes that new occurrences will be similar to current infestations and within the same variety of conditions. Thus, the impacts would be predictable. Although the precise location or timing of the treatment may be unpredictable; management requirements have been designed to keep potential effects limited to those disclosed for the current inventory.

A. Treatment Strategy

Four treatment strategies are proposed to control and eradicate non-native invasive plant infestations: eradication, control, contain, and limited or no treatment. Where eradication efforts occur, infestations will be annually treated and monitored with the goal of complete elimination of the species. In a control effort, a portion of the infestation is treated and monitored each year with a focus on reducing the acreage and percent cover over time. In a containment effort, the leading edge of an infestation, new satellite infestations, or infestations in areas where high-value resources are present are treated. Limited treatments may also occur related to site-specific restoration needs.

Infestations would be prioritized for treatment based on the following four factors:

1. Early invaders with high environmental impacts (per California Department of Food and Agriculture (CDFA) and California Invasive Plants Council (Cal-IPC) ratings and/or small or few isolated infestations on the Forest.
2. Infestations in high value areas and associated points of access.
3. Infestations with a high potential for future spread – prolific species found in high traffic areas such as administrative or recreation sites, trailheads, major access points for the Forest, and systems vulnerable to invasion (recent fires or fuelbreaks).
4. Leading edge or satellite occurrences of larger more established infestations.

The treatment strategy assigned to a particular species or infestation may change over time based on new information concerning changes in the occurrence and abundance of invasive plants, and the effectiveness of treatments. Table 12 presents the list of known invasive plant species in the SERAL 2.0 project area.

Table 12. Non-native Invasive plants known to occur within the project area.

Scientific Name	Common Name	Rating (Cal-IPC/CDFA[17])	Number of populations	Acres
Aegilops cylindrica	Jointed goatgrass	Watch/NL*	1	0.05
Aegilops triuncialis	Barbed goatgrass	High/NL*	79	2.06
Ailanthus altissima	Tree of heaven	Moderate/C/*	3	0.05
Bromus tectorum	Cheatgrass	High/C	3	0.01
Carduus pycnocephalus	Italian plumeless thistle	Moderate/NL*	705	42.53
Carthamus lanatus	Wooly distaff thistle	High/NL*	2	0.07
Centaurea melitensis	Maltese star-thistle, tocalote	Moderate/NL*	872	423.72
Centaurea solstitialis	Yellow star-thistle	High/NL*	342	52.31
Centaurea stobe ssp. micranthos	Spotted knapweed	High/NL*	25	.43
Cirsium vulgare	Bull thistle	Moderate/NL*	999	144.81
Convolvulus arvensis	Field bindweed	NL/C/*	3	0.09
Cynodon dactylon	Bermuda grass	Moderate/NL	1	0.002
Cytisus scoparius	Scotch broom	High/NL*	1	0.001

Scientific Name	Common Name	Rating (Cal-IPC/CDFA[17])	Number of populations	Acres
Dactylis glomerate[6]	Orchardgrass	Limited/NL	1	0.86
Digitalis purpurea	Purple foxglove	Limited/NL	1	0.001
Elymus caput-medusae	Medusahead	High/NL	245	65.24
Genista monspessulana	French broom	High/C	20	5.61
Hordeuum murinum	Mouse barley	Moderate/NL	1	0.001
Hypericum perforatum	Common St. Johnswort	Limited/C	51	0.73
Lathyrus latifolius	Perennial pea	Watch/NL	24	3.17
Lepidium latifolium	Broadleaved pepperweed	High/NL*	1	0.007
Leucanthemum vulgare	Oxeye daisy	Moderate/NL	116	5.66
Rubus armeniacus	Himalayan blackberry	High/NL	167	18.1
Saponaria officinalis	Bouncing-bet	Limited/NL	2	0.005
Silybum marianum	Blessed milkthistle	Limited/NL	11	0.42
Spartium junceum	Spanish broom	High/NL*	4	0.05
Verbascum thapsus	Common mullein	Limited/NL	28	3.72

B. Treatment Methods

Non-native invasive plant control and eradication efforts will employ a combination of treatment methods. Successful treatments often require multiple years of treatment, and sometimes require multiple treatments per year. The number of infestations and acreages treated each year will vary based on available funding and personnel. Treatments are tailored depending on the biology of the target invasive plant species, population size and density, site type, and prior treatment effectiveness. Complete eradications typically require annual treatment over 3-5 years or longer to ensure there is no regrowth or new seed germination. Treatments aimed at reducing numbers or preventing further spread may occur on a less frequent but ongoing schedule.

Non-chemical methods are typically considered feasible when populations are smaller than a few hundred plants in size, and/or when woody species are still small enough to be hand-pulled, although many factors, such as the age of the plants and number of people available to participate in the control effort are also factors. Some biennial and perennial species, either those with deep or rhizomatous roots, or those that re-sprout or regrow from root fragments, can only be effectively controlled with herbicide.

Assuming a treatment method complies with all management requirements (Chapter 4) and it is effective, practical, and cost-efficient, treatment methods would be selected in the following order of preference:

1. **Manual and mechanical methods**: hand pulling, pulling using tools, clipping, cutting, mulching and tarping, and mowing or cutting with hand-held string or blade trimmers.
2. **Cultural methods:** tarping, flaming
3. **Herbicide application (chemical methods):** stump cutting, wiping onto foliage, drizzle, directed foliar spray, spot spray.

Herbicide use is **only** proposed to treat: (1) the 854 acres of known mapped infestations (Map 2) plus an additional 20% to account for potential spread that has occurred since initial discovery and mapping; and (2) potential new infestations discovered within the proposed fuelbreak network (Map 1). Fuelbreaks pose a higher risk of invasive weed spread because the desired condition of a fuelbreak provides conditions where invasive weeds could thrive. To mitigate this risk, having every tool available to control and prevent invasive weed spread, including herbicides will be most effective.

[6] *This plant is included in the California Code of Regulations Section 4500 list of California State Noxious Weeds but is otherwise not rated.

If and when a new infestation is discovered in a fuelbreak, an evaluation must occur prior to the use of herbicides. The evaluation must include the following:

- Identify the size and extent of the new infestation.
- Consider whether manual, mechanical, or cultural methods would be effective in controlling or eradicating the particular invasive species. If not, document why.
- Identify which herbicide will be used from the suite considered in the FEIS.
- Seek resource specialist review to ensure the herbicide use is consistent with and within the scope of the decision and associated analysis.
- Document the review and findings and include the documentation in the project record.

Five herbicides following label and national application rate standards may be used. This includes aminopyralid, chlorsulfuron, clopyralid, glyphosate, and triclopyr. Each of the five proposed herbicides have been approved for use in the state of California and have a label[7] certifying that the chemical has been approved for use by the Federal Environmental Protection Agency and the California Department of Pesticide Regulation. To reduce the risk of populations developing herbicide tolerance from repeated application with the same herbicide, herbicides with different modes of action would be applied when appropriate.

Methylated seed oil surfactants, such as Hasten or equivalent product, may be added to herbicide solutions to enable herbicide penetration of the plant cuticle (a thick, waxy layer present on leaves and stems of most plants). Surfactants are materials that facilitate the activity of herbicides through emulsifying, wetting, spreading or otherwise modifying the properties of liquid chemicals. Water soluble dyes, such as Colorfast Purple or Hi-Light Blue, may also be added to the herbicide solution to assist targeted application of the herbicide and avoid over spraying plants which have already been treated.

Revegetation of gaps in vegetation or bare areas created by invasive plant treatments is a critical component of an integrated invasive plant management strategy. In some cases, re-colonization from the existing seedbank and propagules may be sufficient; in other situations, active restoration may be needed to provide competition with highly aggressive species. Revegetation of bare areas created by invasive plant treatments, particularly with perennial grass species, may suppress re-growth of invasive species. Site restoration and revegetation may be helpful in preventing re-infestation by the invasive plant that has been treated, or a new infestation by another invasive species. Revegetation will be implemented by spreading native seed, or by planting native plants, either as bare root stock or potted plants. Non-native species would not be used. Revegetation may include mulching with native litter or duff, or certified weed-free straw, raking to establish the seed bed, and treatment of invasive plants, as required, using the methods proposed above.

2.11 Project-Specific Forest Plan Amendments

The suite of proposed project-specific Forest plan amendments are described in detail in Appendix C, Table C.02-2.

[7] The label contains information about the product, including its relative toxicity, potential hazard to humans and the environment, directions for use, storage and disposal, and first aid treatment in case of exposure. Label directions provide for public and worker safety by requiring posting of treated areas, pre-designation of mixing, storage and filling sites, and transportation and handling practices in accordance with toxicity of each formulation.

2.12 Management Requirements

Management requirements are additional measures or constraints that must be adhered to during implementation, and are included to ensure compliance with laws, regulations, or policy. Management requirements are most often focused restrictions, constraints, or retention requirements rather than a proposed treatment and therefore do not present well within the body of a proposed action. The management requirements are mandatory components of the proposed actions and many aid in ensuring that the proposed action is compliant with the proposed project-specific amended Forest Plan (Appendix B).

A. All Project Treatments

i. Follow the soil and water quality BMP checklists during project implementation.

ii. For all logging contract operations, implement the equipment cleaning requirements in the standard contract provision (FSM 2902(1); FSM 2903(6)).

iii. For all non-logging operations and activities: all shredding equipment, road grading or construction equipment, clothing, particularly footwear, and other equipment, including the transport vehicle should be free of soil, mud (wet or dried), seeds, vegetative matter or other debris that could contain seeds in order to prevent new infestations of invasive weeds in the project area. Dust or very light dirt, which would not contain weed seed, is not a concern. (FSM 2902(1); FSM 2903(6); FSM 2903(7)).

iv. Where possible, manually treat dense infestations of bull thistle and woolly mullein in landings and skid trails prior to using these facilities to prevent spread, if flowers or seeds are present on the plants. In the years following use of landings and skid trails, monitor for invasive weeds and manually treat dense infestations of bull thistle and woolly mullein. Manual treatment would entail hand pulling, digging, cutting and bagging of flower heads, or solarization with clear plastic. (FSM 2902(1); FSM 2902(2); FSM 2903(1)).

v. When needed for soil stabilization, use certified weed-free mulches where available, mulches with low risk of weed introduction where certified weed-free is not available, and certified weed-free seed mixes. When project-generated logging slash or chipped biomass is used for soil stabilization, it should be obtained from sites free of invasive weeds. Seed mixes must conform to the Region 5 Policy on the Use of Native Plant Material in Restoration or Revegetation Projects. (FSM 2902(1); FSM 2903(7)).

vi. Crushed rock, drain rock, riprap and soil fill for road restoration, reconstruction and maintenance shall be obtained from weed-free sources. Do not stockpile or stage these or other construction materials in sites with invasive weeds.

vii. Monitor the project area through time for invasive weeds to determine if existing weeds are being spread, or if weeds were accidentally introduced by project activities. Hand pull any small, newly discovered infestations of high priority weeds. Assess the need for a long-term eradication strategy, if needed.

viii. To minimize impacts from emissions from heavy equipment utilized for removal and thinning of vegetation, idling trucks used for transportation, and dust generated during proposed activities the following requirements should be followed:
    a. Limit idling of heavy equipment and transportation vehicles;
    b. Require USFS heavy diesel equipment to use cleanest available engines or retrofits with diesel particulate control technology in air quality sensitive areas (and request contractors to do so);
    c. Keep engines and vehicles well maintained;

d. Use low-sulfur or alternative fuels (when available and when equipment specifications allow);
e. Require dust abatement measures on haul roads or where activities will lead to excessive traffic contributing to abnormal levels of dust;
f. Implement dust control plans particularly where dust is expected near occupied dwellings.

ix. Where it is not possible to meet the purpose and need of the project while avoiding sites infested with high priority noxious weeds:

a. Clean heavy equipment so that it is free of soil, seeds, vegetative matter or other debris prior to being moved from infested sites to uninfested sites and prior to being transported out of the project area. Within infested units, conduct project activities in uninfested portions first.

b. To the extent possible, avoid shredding in units infested with high priority weeds while seed is on the plants. Time shredding for before seed set as much as possible.

x. Avoid operating mechanized equipment, vehicle use, parking, skidding, creating piles, and fireline construction over volcanic (lava caps) openings that have limited vegetation (e.g., less than 50% vegetation) to protect existing sensitive plants and to discourage the invasion of non-native plants (e.g., cheatgrass) which can establish in a continuous pattern, and behave as a flashy fuel.

B. Aquatic Wildlife

i. Prior to implementation during burn plan development, consult with the District or Forest Aquatics Biologist to review existing information about threatened, endangered, or sensitive species, to identify if and where the proposed burn unit(s) overlaps current suitable and/or occupied habitats, and whether surveys are warranted in the specific areas planned for activity (Plan-2 in USFS 2012).

ii. Broadcast and underburn prescribed fire would not be ignited in Riparian Conservation Areas. However, fire will be allowed to back into these areas (USDA 2004, USDA 2012 - Fire-1, Fire-2).

iii. Do not store equipment fuels, hydraulic fluid, oils, fire ignition fuels, and other toxic materials within habitats occupied by aquatic threatened, endangered, and sensitive species unless specific locations are authorized by the district or forest aquatic biologist (USDA 2004, Standard and Guideline #92 and #99; USDA 2012 - Road-10).

iv. In general, water drafting sites should be at least 500 feet (152 meters) away from hydrologically connected habitats occupied by threatened, endangered or sensitive aquatic species unless the sites have been reviewed by the district or forest aquatic biologist (USDA 2012 - Plan-1, WatUses-3). Not all sites have been surveyed for occupancy, therefore water drafting candidate sites should be reviewed by the district hydrologist and aquatic biologist.

v. In the Riparian Conservation Areas that are occupied by ESA-Listed or Forest Service Sensitive species do not use chemicals (e.g., salts) or oils for dust abatement. Use water in these locations.

vi. Species Specific Management Requirements for Aquatic Species

a. Recurrence of treatments in occupied habitat or designated critical habitat would be within the natural range of historical fire frequency based on both elevation and vegetation community type (USDA 2012 -Plan-1).

b. In Yosemite toad occupied habitat, all operations would cease for at least 48 hours after rainfall (more than 0.1 inch) occurs to allow for dispersal across terrestrial habitats.

c. In Yosemite toad occupied habitat, avoid piling in open dry areas with lupine unless the area is surveyed and approved for piling by the district aquatic biologist (USDA 2012 -, Plan-1).

d. No direct lighting of stumps would occur within occupied Yosemite toad habitats (USFWS 2014).

e. In Yosemite toad occupied habitat, no piling and burning would occur on or around (i.e., within 20 feet from) preexisting stumps (USFWS 2014).

f. If appropriate and feasible, a forest qualified biologist shall move observed Sierra Nevada yellow-legged frogs, Yosemite toads, northwestern pond turtles, and foothill yellow-legged frogs from within burn units where prescribed fire is being implemented to a safe location if they are in danger. Each encounter shall be treated on a case-by-case basis, but the general procedure is as follows: (1) leave the non-injured animal alone if it is not in danger or (2) move the animal to a nearby safe location if it is in danger.

g. Helicopter ignition by spherical ignition devices or fire launchers will not occur in occupied habitats. If fire ignition is needed in these areas, site specific analyses would be conducted and propane torches may be required to minimize residual materials from drip-torch gasoline (USDA 2004, Standard and Guideline #99).

vii. Limited Operating Periods

a. To minimize or avoid detrimental effects to threatened, endangered, or sensitive species during key times when species are most vulnerable to disturbance such as breeding or dispersal, a limited operating period may apply. Work with the biologist to obtain current data that will determine when and where limited operating periods may need to be applied for a specific species and project area. Limited operating periods (Table MR 1) apply in places such as areas of known suitable habitats or occupied habitats as indicated below (USDA 2012 - AqEco-2, Plan-1, Plan-3). When protocol surveys are conducted for a particular species, the limited operating period applies in habitat or nest sites found to be occupied by a qualified biologist. If the habitat is determined to be unoccupied or inactive, the limited operating period will be waived. Conversely, if/when protocol survey are not completed, then all areas of known suitable habitat would be assumed occupied and, therefore, subject to the limited operating period. The timing and buffer distances of the limited operating periods vary by species and can vary depending on local seasonal conditions that trigger breeding or dispersal (see Table MR 1).

b. A qualified biologist should conduct surveys or evaluate a particular site to determine whether such activities are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location. If so, they may recommend to the decision-maker to modify (shorten) or waive a limited operating period or adjust the buffer distance and document their rationale for doing so. For example, if a nest site would be adequately shielded from planned activities by topographic features that would minimize disturbance, then the limited operating period buffer distance may be modified.

c. Burning (e.g., pile or under burning) will not occur when threatened, endangered, and sensitive species are dispersing to or from upland habitats (See Table MR 1).

d. Limited operating periods would not apply to activities needed to address hazards to firefighter safety, such as hazard tree removal. These activities may occur in preparation for other actions during the limited operating period.

Table MR 1. Limited Operating Periods for Aquatic ESA-Listed Species in the Project Area

Species	Limited operating period (LOP)	Activity and location to which it applies (source)
Northwestern pond turtle	October 1 to June 15	Project activities would not occur in areas within 325 feet of sites occupied by northwestern pond turtles (e.g., the ordinary highwater mark of streams or ponds) during the LOP. Project activities may occur between October 1 to June 15 on a case-by-case basis. If treatment is needed during this time, a forest or district biologist may conduct a field review of habitat conditions to evaluate for appropriateness of timing and additional effect to habitat and species based on site specific conditions.
Yosemite toad	October 1 to 60 days after breeding is completed in spring (determined annually)	Project activities would not occur within 4,101 feet of known occupied Yosemite toad meadows during the LOP. Occupancy and the timing of breeding would be determined annually by surveys coordinated by the forest or district aquatic biologist. Project activities may occur during the limited operating period on a case-by-case basis. If treatment is needed during this time, field review of habitat conditions will be conducted to evaluate for appropriateness of timing and additional effect to habitat and species based on site specific conditions.
Sierra Nevada yellow-legged frog	October 15 to June 15	Project activities would not occur within 82 feet of occupied aquatic species sites or perennial aquatic features including wet meadows occurring above 5000 feet in elevation during the LOP. Project activities may occur during the limited operating period on a case-by-case basis. If treatment is needed during this time, field review of habitat conditions will be conducted to evaluate for appropriateness of timing and additional effect to habitat and species based on site specific conditions.
Foothill yellow-legged frog	December 1 to May 1	Project activities would not occur in areas within 165 feet of occupied aquatic species sites or perennial streams occurring below 5000 feet in elevation. Project activities may occur between December 1 and May 1 on a case-by-case basis. If treatment is needed during this time, field review of habitat conditions will be conducted to evaluate for appropriateness of timing and additional effect to habitat and species based on site specific conditions.

C. Cultural Resource Protection

i. Flag and avoid known historic properties during project implementation.

ii. Follow specific protection measures as outlined in the Regional Programmatic Agreement compliance letter.

iii. If cultural materials are encountered during the course of the project, cease all ground disturbing activities in the immediate vicinity of the discovery until the Forest Archeologist is notified, and the California State Historic Preservation Office and potentially affected Native American tribes are consulted.

D. Prescribed Fire and Smoke Emissions

i. Design and implement prescribed burn units following national rules and guidelines (e.g., NWCG [2020] Smoke Management Guide for Prescribed fire [PMS 420-3], NWCG [2019] Standards for Ground Ignition Equipment [PMS 443], NWCG [2019] Standards for Transporting Fuel [PMS 442], Interagency Prescribed Fire Planning and Implementation Procedures Guide [PMS 484] by NWCG [2022], and NWCG [2021] Prescribed Fire Plan Template [PMS 484-1]).

ii. Consult with a Forest Archeologist prior to implementing any fire control line through potential cultural resource sites. Do not prescribed burn in a cultural resource site that cannot be protected from damage. Protect historic wood features by hand-constructing fire control lines, using foam wetting agents or fire shelter fabric.

iii. Design fire treatments in occupied owl territories to limit high severity patch sizes to generally less than 10 acres (potentially up to 100 acres) to minimize adverse impacts to occupied habitat (USDA 2019, Approach 2, 6.C.2).

iv. Do not place burn piles in volcanic (lava caps) or granitic openings and outcrops.

v. Do not place burn piles within certain distances of stream courses defined in the soil and water quality BMPs.

vi. Avoid prescribed burning closer than 500 feet from active nests of all sensitive raptors during the breeding season.

vii. Minimize impacts to known sensitive plant populations through prescribed fire planning. For planned spring (growing season) ignitions, the following must be met: prescribed fire can only be introduced to 20% of the known plant populations within the project area in any one year, and those same populations must not be burned in consecutive years. Avoid direct ignition in sensitive plant populations, but fire is allowed to back into populations. Some populations may require exclusion.

viii. Actively plan, communicate, and manage burning operations and associated smoke emissions to limit negative effects to populated areas and Class I airsheds (designated wilderness areas and Yosemite National Park) in accordance with Tuolumne County Air Pollution Control District and regional or zone coordination efforts to prevent exceedances of the air quality health standards. Also see #Ci above (national rules and guidelines).

ix. Work with National and Regional U.S. Environmental Protection Agency partners to develop more targeted and appropriate smoke messaging to be distributed via incident public information officers. Ensure smoke messaging and timing of prescribed buns are coordinated with Tuolumne County Public Health to ensure widest possible smoke mitigation strategies and messaging.

x. Rollout public awareness campaign centered around the positive impacts of prescribed fire along in conjunction with smoke ready messaging leveraging.

E. Fuelbreaks

i. Where necessary sparse understory shrubs will be retained or physical barriers installed to prevent motor vehicles from traveling cross-country or off designated routes, such as where fuelbreaks border roads or are near trailheads and designated trails. This is a common problem along treated roadsides especially over flat terrain with no natural barriers. The intent is to avoid the need for expensive, intensive installation of bollards (known examples of this issue e.g., Clark Fork Road, across from Camp Blue Road, across from Bumblebee cabin tract, many powerline rights of way, and many fuelbreaks with lava caps).

ii. Lava caps should be avoided, and a physical barrier, such as shrubs, should be retained or installed to protect sensitive lava cap plant species.

iii. Where possible, use manual, mechanical, or chemical methods to treat infestations of medusahead, goatgrass, broom, bull thistle, Italian thistle, star thistle, or tree of heaven within the fuelbreaks prior to implementing fuelbreak treatments if flowers or seeds are present on these plants. Additional priority and attention should focus on treating broom species and must include preventing seed set if not eradicated. Broom are difficult to eradicate once established and broom can render a fuelbreak ineffective.

iv. In years following fuelbreak implementation, prioritize non-native invasive weed monitoring and manually treat dense infestations of medusahead, goatgrass, broom, bull thistle and star thistle. Where authorized also treat the "stumps" of manually cut broom with appropriate herbicide or pull roots.

v. Where possible and prior to implementation, a botanical resource specialist will be consulted and will provide the following information to the responsible implementation official:

   a. Are any non-native invasive weeds present within the treatment areas?

   b. If yes, where? What species?

   c. Will the proposed treatment cause the existing infestation to spread? If yes, propose potential remedies to eliminate the risk of spread.

vi. If it is determined by the implementing official that the risk of weed spread is too great, then the existing infestation should be avoided until proper control and/or eradication efforts can occur.

vii. If unknown, or information is lacking, prioritize new survey efforts or post treatment invasive weed monitoring in these areas.

F. Vegetation Management

i. During forest thinning operations, except where necessary for operability or to abate a safety hazard, the DBH limits listed in Table 2 (Chapter 2.01) must be adhered to. When a DBH limit must be exceeded for operability, such as creating landings, particularly within CSO PACs or territories, a wildlife biologist should be consulted prior to implementation.

ii. During forest thinning operations, healthy sugar pine without evidence of white pine blister rust should be retained and protected from harm and damage during implementation.

iii. Mastication: Vegetative debris created through mastication shall not exceed 2-feet in length, and on slopes less than 35%, debris shall be mulched into soil to a depth of 6 inches. On slopes greater than 35%, or in areas with thin soils, debris depth shall not exceed 6 inches. 'Mulching-type mastication' is prohibited on shallow soils, less than 20 inches deep. Consult soil scientist to identify where thin soils are likely to occur.

iv. Soil cover: On slopes less than 25%, maintain a well-distributed soil cover of 50% (except in fire salvage, maintain existing or increase cover if it is less than 50% before operations begin). Maintain 60% cover on steeper slopes. Soil cover consists of unburned or partially consumed duff, needle fall, basal live plant cover, fine woody debris, and downed logs.

v. Slope limitations:

   a. Limit skidding with rubber-tired or fixed track equipment to slopes less than 35%; limit low ground pressure tracked equipment (e.g., traditional masticator or feller buncher) to less than 45%; and limit heel-boom loaders / shovel yarding to less than 40% unless

otherwise approved by a soil scientist. Limit dozer piling to slopes less than 25% and mulching mastication treatments to less than 35% slope.

b. Tethered logging, or skyline hybrid: Consult soil scientist during unit layout to determine need for site-specific requirements. May be needed if Erosion Hazard Ratings are predicted to be higher than moderate, or displacement hazard is high in more than one third of a treatment unit.

vi. Subsoil or decompact all landings and temporary roads to a depth of 24 inches, and all main skid trails to a depth of 18 inches once no longer in use. Exceptions can be made in areas with high rock content; steep slopes; high moisture content; or where depth to restricting layer and/or erosion hazards would limit subsoiling feasibility.

vii. Do not construct temporary roads within ¼ mile of an eligible Wild and Scenic River.

viii. White bark pine (*Pinus albicaulis*), if found, will be protected from harm and effects during implementation.

ix. Retain all blue oak and valley oak trees except: (1) stand restoration strategies call for tree removal; (2) trees are lost to fire; or (3) where tree removal is needed for public health and safety.

x. Retain all large hardwoods (oaks, maples, etc.) except where: (1) large trees pose an immediate threat to human life or property or (2) losses of large trees are incurred due to prescribed or wildland fire. Large montane hardwoods are trees with a DBH of 12 inches or greater. Allow removal of larger hardwood trees (up to 20 inches DBH) if research supports the need to remove larger trees to maintain and enhance the hardwood stand.

xi. During forest thinning harvest operations, encroaching conifers and shrubs may be removed from meadows or aspen stands where large numbers of conifers have not historically occurred. The objective is to reestablish the historic meadow edge and enhance meadow function, or to promote and/or stimulate aspen growth. Outside of CSO PACs and territories, all conifers up to 40-inches DBH growing within a meadow or within 66-feet of a live aspen stand may be marked and removed. Within CSO PACs and territories conifer removal must adhere to the PAC and territory specific DBH limits (Table 2). Falling may be done manually or mechanically, and felled material may be removed or piled for later burning. Mechanical harvesters must remain 15-feet outside of meadow and reach in to fall or remove encroaching conifers. All encroaching conifers outside of reach of mechanical harvesters may be manually felled and left onsite where there are no fuels or other resource concerns.

xii. A registered borate compound may be applied to freshly cut stumps to limit the spread of annosus root disease and to reduce the risk of new infection centers from developing. Borate stump treatments would follow regional guidance from Forest Health Protection, as summarized in the table 'Priorities for borate stump treatments to prevent Heterobasidion Root Disease.' Application of borate compound will also follow all state and federal rules and regulations as they apply to pesticides, including the label requirement.

xiii. Prior to hardwood and fuelwood cutting and removal in hardwood ecosystems, pre-mark or pre-cut hardwood trees to ensure that stand goals are met. Retain a diverse distribution of stand cover classes (USDA 2017, S&G 24).

G. Salvage

i. For fire salvage: In high erosion hazard areas: On main skidtrails with gradient steeper than 15 percent, apply organic mulch cover (slash, weed-free straw mulch, etc.) to the skid trail footprint and waterbar outlets. Achieve at least 50 percent cover on skidtrail footprint.

ii. If soil cover is less than 50% before operations begin, maintain existing or increase well-distributed soil cover.

iii. Subsoil or decompact all landings and temporary roads to a depth of 24 inches. In insect, disease, or drought killed salvage, subsoil all main skid trails to a depth of 18 inches once no longer in use (for fire salvage only, skid trail subsoiling requirement is waived). High rock content, slope, moisture content, depth to restricting layer, and erosion hazard also limit subsoiling feasibility.

H. Sensitive and Watchlist Plants

i. Prior to implementing activities, complete appropriate sensitive plant surveys based on current Forest and Regional direction.

ii. A Forest Service botanist will identify necessary protective measures based on sensitive plant surveys prior to implementation to ensure viable populations remain intact. Avoidance areas limited operating periods (LOPs), or other appropriate measures will be mapped and administered during implementation. Region 5 Sensitive and local concern plant species will be subject to treatment buffers (typically 10 feet), in which heavy equipment will be prohibited and other treatment activities may be limited, unless otherwise agreed upon by the botanist and deciding official. Specific buffer distances will depend on plant and habitat characteristics and will be determined at time of discovery.

iii. Minimize impacts to known sensitive plant populations through prescribed fire planning. For planned spring (growing season) ignitions, the following must be met; planned fire can only be introduced to 20% of the known plant populations within the project area in any one year, and those same populations must not be burned in consecutive years. Avoid direct ignition in sensitive plant populations, but fire is allowed to back into populations. Some populations may require exclusion.

iv. Avoid vehicle use, parking, and fire line construction over volcanic openings (lava caps) that have limited vegetation (e.g., less than 50% vegetation) to protect existing sensitive plants and to discourage the invasion of non-native plants (e.g., cheatgrass) which can establish in a continuous pattern, and behave as a flashy fuel.

v. Do not place burn piles in volcanic (lava caps) or granitic openings and outcrops.

vi. White bark pine (*Pinus albicaulis)*, if found, will be protected from disturbance and effects during implementation.

vii. **Watchlist Specific Management Requirements** – Although surveys will not be specifically conducted to look for watchlist species, if they are encountered while doing other sensitive plant surveys, or if already known, implement the following where possible:

   a. Flag, map, and avoid occurrences of Yuba Pass willowherb (*Epilobium howellii*), Tuolumne button celery (*Eryngium pinnatisectum*), and Gowen's navarretia (*Navarretia miwukensis*).

   b. Flag, map, and avoid occurrences of Bacigalupi's yampah (*Perideridia bacigalupii*) and Tanoak shrub (*Notholithocarpus densifolia var. echinoides*) smaller than 0.25 acres. Up to 10 percent of occurrences larger than 0.25 acres and containing 100 or more individual plants can be impacted by tree felling, tree yarding, and fuels reduction treatments. In these cases, avoid heavy concentration of plants when the occurrences are of unequal

density throughout the occurrence. Placement of new roads and trails as well as targeted grazing and fuel break creation and maintenance with herbicide should be avoided.

c. Flag, map, and avoid occurrences of Crawford's spring beauty (*Claytonia crawfordii*) to avoid direct impacts from mechanical operations during the spring growing and flowering season (March – May). Avoid prescribed fires in known populations during the spring growing season (March – May) or protect known sites from direct impacts of prescribed fire.

d. Flag, map and avoid occurrences of Pacific Yew (*Taxus brevifolia*). Do not remove canopy cover over Pacific yew. Avoid prescribed fires in known occurrences of Pacific yew by utilizing minimal line creation (e.g. narrow hand line or wet line) and lighting techniques to backfire away from known occurrences of Pacific yew.

e. Flag, map, and avoid occurrences of phantom orchid (*Cephalanthera austiniae*) during prescribed burning. Utilize minimal line creation and lighting techniques to backfire away from known occurrences.

I. Terrestrial Wildlife

i. Prior to implementation and before any habitat modification, route a site-specific Project Input Form (PIF) and conduct surveys in compliance with the USFS Pacific Southwest Region's survey protocols to establish or confirm current locations of sensitive species and sites, such as nest activity centers and roost sites for spotted owl and goshawk. There are no great gray owl PACs in the project area, but reliable sightings will be followed up with surveys to established protocols (USDA 2017).

ii. Prior to implementing activities within PACs, the responsible Forest Service Line Officer, in consultation with the wildlife biologist, will approve treatment area layout to ensure current survey results are incorporated and that appropriate buffer distances are in place to avoid nest activity centers and roost sites, including alternate nests and roosts for California spotted owl, great gray owl, and goshawk. Activities will be reviewed and approved on an annual basis until treatments within the PACs are completed.

iii. Mechanical treatments (e.g., forest thinning, mastication, machine piling) within CSO PACs may not cause a reduction in CWHR classifications of the highest-quality nesting and roosting habitat (CWHR 6, 5D, or 5M). Where forest thinning is conducted in areas classified as CWHR 5D, the canopy cover must be retained above 60%. In areas classified as CWHR 5M, the canopy cover must be retained above 40%. Silviculture prescriptions must be written to ensure both 5M and 5D classifications are maintained. This may be achieved by adjusting the residual basal area requirement for operations within units to a higher threshold.

iv. Mechanical treatments may only occur in up to one-third (100 acres) of each individual California spotted owl PAC.

v. California spotted owl survey results are constantly being updated because owls sometimes move their nest locations. PACs must be remapped when surveys discover birds have moved or a new nest site location is discovered. Any remapping should incorporate the best habitat associated with an activity center and should avoid areas not compatible with PAC desired conditions (e.g., fuelbreaks). To ensure the most current PAC boundaries are respected during implementation, a pre-implementation PAC treatment evaluation must occur to ensure, (1) treatment unit boundaries avoid the 10-acre nest stand; (2) treatments within the remapped PAC acres adhere to all CSO PAC management requirements; (3) the total acres of any mechanical treatments planned within a single CSO PAC **do not exceed** 100 acres; and (4) that the *up to* 100 acres selected for

treatment within a PAC align with the treatment area selection rules which informed the CSO Departure index.

vi. Mechanical treatments are not permitted to occur within the designated 10-acre nest stand control areas within CSO PACs and designated 18-acre nest stand control areas within AMGO PACs.

vii. Maintain the average canopy cover of each CSO PAC above 50 percent.

viii. Maintain a limited operating period (LOP) prohibiting mechanical operations within 0.25 mile of active nests and 100 acres surrounding marten dens **and** prescribed fire within 500 feet of active nests/dens during the breeding season for each of the species below. LOPs may be lifted by a Forest Service biologist based on non-nesting/denning status, when activities are of small scale and short duration, when the benefit of management to habitat resilience outweighs the potential short-term risk to spotted owls, to facilitate the benefits of prescribed fire, or for existing road and trail use and maintenance.

   a. California spotted owls and great gray owls (March 1 through August 15), American goshawks (February 15 through September 15), marten (May 1 through July 31), and bald eagle (January 1 through August 31).

ix. Avoid removal of overstory trees within 330 feet of Bald Eagle nests at any time.

x. Retain the largest snags and down logs available at the rates listed in Table MR 2 below. Snag retention should be prioritized by size as follows (from highest to lowest priority): (1) very large snags (>36-inch DBH); (2) large snags (> 24-inch DBH); (3) medium snags (>15-inch DBH). A snag is defined as a standing dead tree greater than 15-inches DBH and at least 20-feet in height. Large down log retention should prioritize the largest size classes of logs with a minimum of 20 inches diameter at midpoint and decay classes 1, 2, and 3 (Figure 12, USDA 2017, S&G 10).

Table MR 2. Snag and down log retention rates.

Location		Snag Retention Rate	Down Log Retention Rate
Fuelbreaks	All	No retention required	Retain **some**
Outside of Fuelbreaks	Mixed Conifer and Pine Forest Type	4 of the largest per acre	4 of the largest per acre
	Hardwood Forest Type	4 of the largest per acre	4 of the largest per acre
	Red Fir Forest Type	6 of the largest per acre	4 of the largest per acre

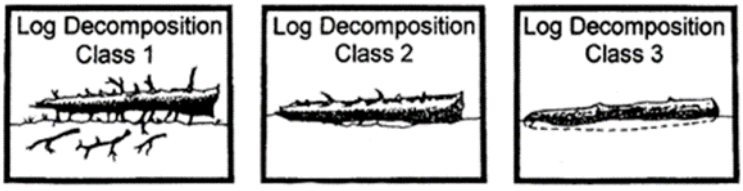

Figure 12. Log decay classes.

xi. Notify a US Forest Service Wildlife Biologist if any Federally listed or Region 5 Forest Service Sensitive species are discovered during project implementation so that LOPs or other protective measures can be applied, if needed. Include necessary clauses in agreements and contracts to require notification.

xii. Ensure PAC and Territory DBH limits are met as defined in Table 2.

   a. There may be limited exceptions for safety and operability. In CSO PACs and Territories exceptions must be discussed and approved by a Forest Service Line Officer in

consultation with a wildlife biologist. Approval may be delegated to a forest service biologist. Examples include the need for landings.

xiii. If any PAC is retired, a post-retirement evaluation of the proposed treatments within that area must be conducted prior to any adjustments are made pertaining to treatment type (i.e., PAC treatment DBH limit and habitat quality retention requirements vs. general forest requirements) or acres of treatment (i.e., relaxing the 100-acre PAC treatment limit). Ensure that treatments comply with the requirements presented in Appendix C for the new management area (e.g., see TERR-SERAL-STD-01 or SPEC-CSO-STD-05).

xiv. Effort will be made to avoid the need for temporary roads and landings within PACs. Where temp roads or landings are needed to treat in PACs, previously used temporary roads (as opposed to new temp road construction) and landings will be used to the greatest extent possible. Temporary road decommissioning in PACs will occur soon after their use (<1 year).

J. Herbicide Application

i. Herbicide label directions, as well as all laws and regulations governing the use of pesticides, as required by the U.S. Environmental Protection Agency, the California Department of Pesticide Regulation, and Forest Service policy pertaining to pesticide use, would be followed.

ii. Herbicides would be applied in accordance with 1) product label directions; 2) California Department of Pesticide Regulation requirements; 3) Forest Service best management practices for water quality (USDA 2011b); and 4) Forest Service direction (FSM 2080, 2150 and 2200) and Handbook (FSH 2109.14). This project includes a Pesticide Use Spill Plan that is prepared and reviewed prior to herbicide use each year. In addition, prior to any herbicide use, a Pesticide Use Proposal (FS-2100-2) and safety plan (FS-6700-7) would be completed by the project lead and approved by the Forest Supervisor.

iii. Coordination with the appropriate County Agricultural Commissioners must occur.

iv. All required licenses and permits should be obtained prior to any pesticide application.

v. Where herbicide treatments are proposed, the lowest effective label rates would be used.

vi. Inspect sites prior to herbicide application to ensure that no one is present who is not officially participating in the application process.

vii. Post signs after application, identifying the date and chemical used, adjacent to common entry points. Posted information includes the type of herbicide applied, date of treatment, and contact name and phone number.

viii. Restrict access into the treated areas until the liquid herbicide solution has dried.

ix. Follow all label requirements for personal protective equipment (PPE).

x. Use minimum protective clothing, unless specified otherwise on the label. This includes coveralls over shirt and pants, socks, boots, safety glasses or goggles, hardhats, and chemical resistant gloves. All clothing will be clean at the start of the day. Change clothing and clean the skin with soap and water if the herbicide mixture penetrates the clothing.

xi. Provide soap and clean water at the work site. Wash with soap and water immediately after contact with the herbicide mixture. Wash with soap and water before eating, smoking, or going to the bathroom.

xii. Apply herbicides only when meteorological conditions are suitable (heat, wind speed and direction, humidity, and precipitation), as defined on the label.

K. Infrastructure Protection (Forest Service Owned / Permitted Uses)

Throughout the SERAL 2.0 project area, both Forest Service owned and permitted infrastructure exists. Examples include Forest Service administrative sties and recreation facilities (campgrounds, day use areas, system roads and trails) and other infrastructure authorized through a variety of permits (special use authorizations or grazing permits, etc.). Examples of authorized improvements include communication sites, powerlines, roads, water system infrastructure, recreation residences, etc.

i. For any action Alternative, existing improvements will be protected during project implementation. Protection measures to be taken will depend on specific treatments and distance to infrastructure.

ii. Protect range resources:

   a. Avoid damage to rangeland infrastructure (fences, water developments, cattleguards) during project implementation.

   b. Any serviceable or intact infrastructure that is damaged during implementation must be repaired to Forest Service standards.

   c. Avoid snag retention adjacent to critical range infrastructure.

iii. Infrastructure damage sustained during project implementation will be the responsibility of project contractors to repair, returning improvements to pre-implementation status.

iv. Infrastructure removed to accommodate project implementation shall be replaced / returned to pre-implementation locations (signs, boulders, barriers, fences).

v. Should staging areas or trail head parking facilities be used during implementation, such sites will be rehabilitated immediately following their use. Pre & post photographs to document conditions are required.

vi. Visitors / permittees can expect short term facility / area closures to ensure the safety of contractors and the general public during project implementation.

vii. Public notification / project implementation progress will be provided at routine intervals. Methods may include news releases; website and Facebook updates; area newsletters.

viii. If designated system off highway vehicle routes (roads and trails) are used during project implementation, routes will be rehabilitated immediately following their use to ensure OHV use is able to continue. This may include cleaning tread, drainage structures, placement of barriers, replacing / installing signs, etc.

Alternative 2: The No Action Alternative

Alternative 2 is the no action alternative as required by 40 CFR 1502.14(c). No management activities will occur. The no action alternative provides the baseline for assessing the comparative impacts of the proposed action to the existing condition.

3. THE ENVIRONMENTAL CONSEQUENCES

3.01 Issues Related to the Proposed Action

Issues serve to highlight effects or unintended consequences that may occur from the proposed action and no action giving opportunities during the analysis to compare trade-offs for the decisionmaker and public to understand. Issues were identified during scoping and informed the refinement of the proposed action, and which effects related to the proposed action to analyze in detail (40 CFR 1501.7) Each issue is written

as a cause-effect statement to describe a specific action and the environmental effect(s) expected to result from that action (Table 13). The cause-and-effect statements provide a way to focus and structure the issues analyzed in detail. Issues addressed via refinement of the proposed action are not included in the environmental consequences analysis. Table 13 also provides a summary column of how each issue was addressed.

Table 13. Issues

Issue/Element	Cause and Effect	Addressed
1. Forest Thinning and Fuel Reduction	A. The proposed forest thinning in California spotted owl PACs and territories may reduce the quality of California spotted owl habitat and contribute to the decline of the owl.	Analysis Issue 1A
	B. The proposed forest thinning and fuel reduction may reduce marten habitat and impact their persistence.	Analysis Issue 1B
	C. The proposed DBH limits and other forest thinning constraints will leave stand densities too dense and structurally homogenous to effectively reduce the landscape's susceptibility to wildfire-, drought-, and insect and disease- related mortality or to achieve NRV-based objectives	Analysis Issue 1C
	D. The proposed thinning of trees greater than 30-inch DBH and up to 40-inch DBH is not necessary to increase landscape resilience	Analysis issue 1D
2. Prescribed Fire	Smoke emissions from prescribed fire may adversely affect air quality and human health.	Analysis Issue 2
3. Socio-Economics	A. The proposed DBH limits will impact the Forest's ability to provide timber (wood product) to local and regional communities and the likelihood of treatment implementation.	Analysis Issue 3A
	B. The Forest Service should evaluate and weigh the potential social and economic impacts from the loss of businesses, residences, tourism, and outdoor recreation caused by a catastrophic fire event.	Purpose and Need 1.03, Response to Comment #78, 3.02 Need 2
4. Inventoried Roadless areas and Wild and Scenic River	A. The proposed action may impact the IRA characteristics and diminish their eligibility for future wilderness designation.	Analysis Issue 4A
	B. The proposed action may impact the outstanding remarkable values of Wild & Scenic river corridors.	Analysis Issue 4B
5. Old Growth Forests	The proposed forest thinning may affect the amount and distribution of mature and old-growth forests.	Issue 5
6. Project-Specific Forest Plan Amendments	Delineating a circular territory could result in an insufficient quantity and quality of habitat conserved and protected for California spotted owl as compared to home range core areas (HRCA).	Analysis Issue 6
7.Herbicides	A. The proposed use of herbicides to treat non-native invasive weeds and to maintain fuelbreaks may adversely affect human health and the health and diversity of other native species, including local and migratory bird species.	Analysis Issue 7
8. Salvage	Due the conditional natural of the proposed salvage the site-specific environmental impacts of those action are not clear.	Issue 8
9. Temporary Roads	The construction of temporary roads that are not properly decommissioned lead to erosion, unauthorized cross-country travel by wheeled motor vehicles, and introduction of noxious weeds.	Issue 9

Issue 1A. The proposed forest thinning in California spotted owl PACs and territories may reduce the quality of California spotted owl (CSO) habitat and contribute to the decline of the owl.

Affected Environment

The existing characteristics of forest structure and composition across the project area, both within and outside of CSO PACs and territories are susceptible to high severity wildfire (e.g., overly dense, homogenous stands, with high vertical and horizon fuel continuity) as well as to drought, insect, and disease mortality because they are stressed for limited resources. Providing quality nesting and roosting habitat is critical to successful reproduction of California spotted owls and viability of owl populations. Maintaining and promoting resilient habitat to support long-term viability and persistence of owl populations takes precedence over calculated and minimized short-term impacts.

Survey results indicate that the SERAL 2.0 project area is at or near carrying capacity for CSO where carrying capacity is the maximum number of animals that can be sustained over the long-term on a specified land area (Verner et al. 1992). A gap analysis indicates limited potential space for additional CSO sites in the SERAL 2.0 project boundary. Protocol surveys will be implemented prior to implementation in gap areas to identify any unknown territories. At present, there are 52 known CSO PACs totaling 15,102 acres and 58 CSO territories totaling 46,186 acres within the project area. This represents about 1/3 of the CSO sites on the Stanislaus National Forest and about 5% of CSO sites in the Sierra Nevada.

When discussing CSO habitat quality, most attention is focused on nesting and roosting habitat characteristics. In general, the most important characteristics of highest-quality nesting and roosting habitat include large and tall trees with high canopy cover (USDA 2019, Jones et al. 2017). Although not the only way to define highest-quality nesting and roosting habitat, the CWHR classification system provides information related to tree size and densities. Using the CWHR classification system, highest-quality nesting and roosting habitat for the CSO is defined by areas including stands classified as CWHR 6, 5D, and 5M with average canopy cover greater than 50%. Where highest-quality CSO nesting and roosting habitat is lacking, stands including smaller size class trees with lesser canopy cover, may also support nesting and roosting behaviors as it becomes the best-available. For example, stands classified as CWHR 4D, 4M with average canopy covers greater than 40%.

Currently, approximately 8-percent of the SERAL 2.0 project area contains structural habitat characteristics associated with the highest-quality CSO habitat while an additional 55-percent contains structural characteristics associated within best-available habitat (Appendix A, Table A.02-3). At face-value these proportions can easily be interpreted as CSO quality habitat is significantly limited in the project area. And some may even conclude that great efforts should be made to avoid management actions in these areas – to no end. However, assessments of the desired distribution and proportion of late-seral closed forests at the landscape scale demonstrate that the goal is not for every acre of forested land to be homogeneously composed of trees classified as CWHR 6, 5D, 5M, 4D, and 4M. And further assessments of what the desired forest conditions are for other attributes indicative of forest health and resilience, demonstrate that vegetation across the landscape, even the forested areas composed of CWHR 5D, 5M, 4D, and 4M, are in conditions that put them at an elevated risk to natural disturbance. It is important to understand that a forest, PAC, or territory containing large trees and high canopy covers can also be overly dense, lack forest openings, contain lush understory vegetation which act as ladder fuels, and experience the same climate related stressors (lack of precipitation, warmer temperatures, higher winds) as the rest of the landscape across the Sierra Nevada. All of these stressors must be considered when analyzing the potential for forest thinning to reduce quality owl habitat and impact both short-term and long-term viability of owl populations (USDA 2019).

Indicators and Measures

The SERAL 2.0 proposed actions, including forest thinning were developed and located to maintain and promote CSO habitat. The indicators and measures selected enable an assessment of how effectively that objective is met.

Acres of Forest Thinning Proposed: Forest thinning has the potential to most directly affect key characteristics of best-available and highest-quality CSO nesting and roosting habitat (Table 14) . Therefore, assessing the frequency that forest thinning is proposed within both classifications of quality CSO habitat helps to assess the magnitude of the potential impacts.

Table 14. Habitat quality categories for CSO nesting and roosting based on structural characteristics.

CSO Habitat Quality Classification	CWHR Classification	Tree Size	Canopy Cover
Highest-Quality	5D, 5M, 6	More than 24-inches	40 to 100 Percent
Best-Available	4D, 4M	11 to 24 inches	40 to 100 Percent

The habitat needs of the CSO were considered during the development of the proposed action. The proposed action and treatment area selection process included constraints which informed where and how much CSO habitat is proposed for treatment (Appendix B, Table B.02-2 and Table B.02-3). As a result of these constraints the acres of proposed forest thinning vary among PACs, territories and outside of PACs and territories. Comparing the acres of proposed forest thinning within PACs and territories to the acres of proposed forest thinning acres outside of these land allocations demonstrates the selective nature in which treatments were located in these areas.

We present the results at four scales: (1) CSO PAC; (2) territories; (3) outside of PACs and territories; and (4) all lands by dominant forest type.

Changes to CWHR Classification: A reduction in CWHR classification is a common indicator of habitat quality reduction. For this analysis, habitat quality is measured based solely on CWHR size and density classifications.

Forest thinning is able to cause a shift in CWHR classifications. However, the proposed action includes DBH limits and other constraints designed to minimize the loss of large, old, and structurally diverse trees while implementing restoration treatments designed to increase the landscape's resilience to natural disturbances. CWHR types 6, 5D, 5M, 4D, 4M are recognized as important elements of a highest-quality and best-available CSO habitat, in descending order of priority. Therefore, it is important to assess the degree to which CWHR 5D, 5M, 4D, and 4M will be maintained or promoted by the proposed treatments in order to assess the effects of the proposed forest thinning on CSO habitat quality.

Not all highest-quality and best-available CSO habitat occurs within designated CSO PACs and territories. Thus, the results report the pre- (no action) and post-treatment (proposed action) acres of CWHR 4D,4M 5D, 5M in PACs, CSO territories, and in other areas outside of these designated land allocations.

To assess the potential effects to habitat quality as a result of the proposed forest thinning at a finer scale, the results are also reported as the acres of CWHR 4D,4M 5D, 5M pre- and post-treatment within each individual CSO PACs and territories (Table 19 and Table 20).

Direct and Indirect Effects

Acres of Forest Thinning Proposed:

In general, CSO PACs are located entirely within the 1,000-acre CSO territories. Forest thinning is proposed in approximately 22-percent of the existing PAC acres and approximately 18-percent of the

total, non-overlapping, territory acres in the project area when including the PAC acres. The percentage of CSO territories outside of the PACs with proposed forest thinning is approximately 27-percent.

Eleven-percent (11%) of the conifer forest types across the project area contain the structural characteristics associated with highest-quality habitat (Table 15). Despite this seemingly low proportion, a comparative NRV assessment indicates that there is an excess of CWHR 5D/5M (highest-quality habitat) in the dry-mixed conifer forest type across the landscape compared to pre-settlement conditions (Figure 2, Table B.01-4). This demonstrates that within the dry-mixed conifer forest type forest thinning to correct this imbalance is warranted (Appendix B.01). Conversely, the NRV assessment indicated that there is a deficit of CWHR 5D/5M (highest-quality habitat) in the moist-mixed-conifer forest type compared to pre-settlement conditions (Figure 2, Table B.01-4). Therefore, indicating CWHR 5D/5M classifications should be maintained in the moist-mixed conifer forest type. As such, there is no forest thinning proposed in areas classified as CWHR 5D/5M within moist-mixed conifer forest types anywhere across the project area (Table 15).

The large majority of the restoration needs, as indicated by the NRV assessment, are located in mid-closed, CWHR 3 and 4, M and D, classifications (Figure 2, Table B.01-4), in both dry-mixed conifer and moist-mixed conifer forest types. These dense, disturbance prone areas, are abundant and most exceed the natural range of variation. Correcting this excessive imbalance is critical to restoring resilience across the landscape, including within CSO territories and PACs. Table 15 demonstrates that the proposed forest thinning treatments were located preferentially to occur within dry-mixed conifer forest types classified as CWHR 4D or 4M (Table 15).

CSO PACs have the least amount of forest thinning proposed, intentionally, to conservatively consider the conservation needs of the owl, particularly while new management approaches are being applied. The proposed action was designed to limit mechanical treatments of any kind (including forest thinning) to a total of 100 acres (1/3) of each PAC. This provision, coupled with other factors considered (Table B.02-2) and accessibility limitations, results in only 22-percent of the existing PAC acres having a forest thinning treatment proposed.

A higher proportion of CSO territory acres (outside of PACs) have proposed forest thinning, however, the proportion of each territory which may be affected by forest thinning is still quite low. There are many factors which limit our options for meeting the project's restoration and resiliency objectives: land ownership, accessibility, operational feasibility, forest plan constraints (including species-specific), and other specific land constraints associated with land allocations designated by law such as inventoried roadless areas, and wild and scenic rivers. Resiliency is achieved at the landscape scale. Restoration needs are assessed at the landscape scale. After determining which lands are available for treatment to meet the project's objectives, approximately 23% of the NRV-based restoration targets are met via forest thinning within CSO territories (2023_SERAL2.0_vs_SNFPlan_CaseStudy_ppt). This highlights the importance of the proposed forest thinning, as well as the potential impacts of imposing any additional limitations to treatments within CSO territories.

Treatments in both CSO PACs and territories were designed to increase resiliency while promoting the development of future nest sites. As such, similar to CSO PACs, the proposed forest thinning within CSO territories was developed to include multiple constraints and treatment area selection criteria (Table B.02-3). Collectively, the constraints applied to the proposed forest thinning, within CSO PACs and territories help to ensure CSO habitat is maintained *and* restored to a more resilient state.

Table 15. Acres of existing highest-quality (CWHF 5D/5M) and best-available (CWHR 4D/4M) CSO habitat across the project area and within proposed forest thinning areas.

Land Allocation	Forest Type	Pre-Treatment (No Action)			Proposed Forest Thinning[1]		
		Total Acres	CWHR 4D/4M	CWHR 5D/5M	Total Acres	CWHR 4D/4M	CWHR 5D/5M
PAC	Pine	547	499	8	197	189	8
	Dry MC	8,426	5,706	2,503	1,758	1,301	457
	Moist MC	3,744	3,117	507	818	818	0
	Total	12,717	9,322	3,017	2,773	2,308	465
Territory[2]	Pine	5,194	3,502	209	2,010	1,826	329
	Dry MC	13,778	9,577	2,072	3,459	2,904	556
	Moist MC	6,068	4,277	470	1,299	1,299	0
	Total	25,040	17,356	2,751	6,768	6,029	885
Outside of PAC and Territory	Pine	20,160	13,512	519	6,162	5,853	309
	Dry MC	39,944	31,320	3,253	8,138	6,965	1,173
	Moist MC	25,134	13,998	3,951	4,747	4,747	0
	Total	85,238	58,830	7,723	19,047	17,565	1,482
All Lands	Pine	25,901	17,513	736	8,369	7,868	646
	Dry MC	62,148	46,603	7,828	13,355	11,170	2,186
	Moist MC	34,946	21,392	4,928	6,864	6,864	0
	Total	122,995	85,506	13,492	28,588	25,902	2,832

1 – includes forest thinning in fuelbreaks outside of PACs; 2 – territory acres are the acres outside of the PAC.

Changes to CWHR Classification:

Large, high-severity wildfire threatens CSO persistence across the landscape (Peery et al. 2019, Stephens et al. 2016b). A century of fire exclusion has resulted in an ingrowth of shade-tolerant (fire intolerant) trees (e.g., white fir and incense cedar) and an accumulation of surface and ladder fuels, increasing both amount and patch size of high-severity fire in the Sierra Nevada low- and mid-elevation conifer forest types (Keane and Gerard 2022, Mallek et al. 2013, Miller et al. 2009, Steel et al. 2015). Currently, many Sierra Nevada forests are dense and largely homogenous (Hessburg et al. 2005), with high vertical and horizontal fuel continuity; these conditions are conducive to high-severity fire. Recent examples of large, high- severity wildfires overlapping CSO habitat are the 2013 Rim Fire (250,000 acres) and the 2014 King Fire (100,000 acres). From 1993 to 2016, approximately 450,000 acres of forest within the CSO range of the Sierra burned at high severity (USDA Forest Service 2019). Over the same period, approximately 125,000 acres (22 percent) of owl PACs burned across the range, and 32 percent of the burned area was high severity (Keane 2017 updated by USDA Forest Service 2019). Trends in high-severity fire proportion and patch size are likely to continue to increase in the absence of active forest restoration (Stephens et al. 2016).

In recent year's (2020 and 2021) record setting fire seasons demonstrate that trends in high-severity fire proportion and patch size continue to increase as well as alarming losses of habitat elements important to mature forest associates such as spotted owl (Keane and Gerard 2022). For example, the National Park Service estimates that over 20% of large (greater than 4-foot diameter) giant sequoia trees have been lost to high-severity fire within just the last two years (there are no sequoia groves in the SERAL 2.0 Project Area, but this illustrates the concern for large tree loss generally). Another alarming cause for concern is the Dixie Fire of 2021, now the second largest fire in California history. Early assessments of the Dixie Fire indicate that 1/3 to 1/2 of all owl PACs on the Lassen National Forest have just burned with enough large, high-severity patches as to negatively affect continued owl occupancy and reproduction (Tom Rickman, Lassen NF wildlife biologist, personal communication). Likewise in the Caldor Fire north of the SERAL 2.0 Project Area, preliminary data indicate that about 1/3 to 1/2 of all owl PACs on the

Eldorado National Forest have just burned with enough large, high-severity patches as to negatively affect continued owl occupancy and reproduction (Traci Allen, Eldorado NF wildlife biologist, personal communication). In summary, there is a clear and pressing need to increase the pace and scale of active management in the Sierra Nevada immediately to restore resiliency and maintain forested conditions within the Natural Range of Variation (North et al. 2021, Rojas 2021, Safford and Stevens 2017, York et al. 2021).

Extensive drought- and insect-related tree mortality also threatens CSO habitat, especially the large trees owls depend upon for nesting and roosting. Recent drought in dense forests has led to severe water stress (Asner et al. 2015, Young et al. 2017), which in turn attracts insects (bark beetles) and increases risks from pathogens and air pollution. CSO habitat overlaps with the western pine beetle, mountain pine beetle, Jeffrey pine beetle, pine engraver beetle, and fir engraver beetle. Depending on the bark beetle species and numerous other factors (Fettig et al. 2007), the extent of tree mortality may be limited to small groups of trees, or it may impact extensive areas. These insects are all native to conifer forests of the west, but populations can explode when forests are particularly stressed. Outbreaks occur when favorable forest and climatic conditions coincide, and climate change is likely exacerbating bark beetle impacts (Bentz et al. 2010). Warming temperatures have triggered population increases in many insect species, which have resulted in widespread outbreaks (Millar and Stephenson 2015). Bark beetle infestations are influenced by factors such as overall stand density, tree diameter, tree vigor, fire exclusion, and host species density. Slower-growing ponderosa pines (which are more fire tolerant than other mixed-conifer species) are more susceptible to attacks than other species (Craighead 1925, Miller 1926). For large sugar pine, results from Slack et al. (2021) suggest that forest thinning treatments result in neutral to positive trends in allocation to growth and defense and may contribute to conditions that reduce probability of large tree mortality from bark beetles in the future. Various measures of stand density, including stand density index or basal area, are positively correlated with levels of tree mortality from insects, drought, and disease (Fettig 2012, Hayes et al. 2009, Oliver and Uzoh 1997, Sherlock 2007).

CSO PACs and territories in the SERAL 2.0 project area location are of particular importance to the distribution of California spotted owl in the Sierra Nevada and potentially key to this subspecies' continued persistence, especially considering current projections for climate change (2024_SERAL_2.0_TerrestrialWildlife_BE.docx). Implementing treatments designed to reduce the landscape's susceptibility to natural disturbances such as high-severity wildfire, drought-, insect- and disease related mortality as discussed above, will contribute to ensuring continued CSO persistence on the Stanislaus National Forest. Creating shifts in the proportion of different CWHR classifications is one aspect of increasing landscape resilience.

Within PACs: At the landscape scale, the proposed forest thinning does not reduce highest-quality habitat within CSO PACs (Table 16). CWHR 5D is maintained as 5D, and CWHR 5M is maintained as 5M (Table 17). Further a portion of the forest thinning applied within areas classified as CWHR 4D and 4M (best-available habitat) are converted to CWHR 5D and 5M – thus increasing the acres of highest-quality habitat based on CWHR classification alone. The increase in acres of highest-quality habitat in PACs across the project area, occurs because the proposed forest thinning treatments in PACs selectively target smaller trees (less than 20-inch DBH) resulting in thinning essentially akin to a thin-from below silviculture prescription, while retaining larger trees (anything larger than 20-inch DBH). Although the silviculture prescription are designed to create heterogeneity by create small openings and individual trees where possible by radially thinning around large sugar pine and oaks. A portion of the CWHR 4D and 4M are converted to CWHR 5D and 5M because when smaller trees are thinned and larger trees are retained, the QMD is increased.

The maintenance of CWHR 5D and 5M and the additional acres created in these categories within CSO PACs is attributed to four specific features of included in the proposed action: (1) the 20-inch DBH limit; (2) the 100-acre mechanical treatment limit per PAC; (3) inclusion of a 60% canopy cover retention requirement within all areas classified as CWHR 5D and a 40% canopy cover retention requirement

within all areas classified as CWHR 5M (Chapter 2.12 I.iii); (4) and the deliberate PAC treatment area selection process (Appendix B.01).

Collectively these features allowed proposed forest thinning treatments to be located in areas of lower quality nesting and roosting habitat – areas containing smaller trees in dense stands with few openings – in order to most effectively reduce the threat of high-severity fire and promote faster recruitment of trees, while ensuring portions of CSO PACs already containing higher-quality nesting and roosting habitat are maintained. In order to increase landscape resilience, the conversion of some acres of CWHR 4D to 4M and some CWHR 4M to 4P (Table 17) is intentional and a justified and supported habitat modification which is expected to contribute to habitat resilience to natural disturbances and the long-term persistence of the species.

Table 16. Comparison between total pre- and post-treatment acres of CSO nesting and roosting habitat within PACs, territories, and outside of PACs and territories across the project area.

Land Allocation	Pre-Treatment (No Action)						Post-Treatment (Proposed Action)					
	4D	4M	4D/ 4M	5D	5M	5D/ 5M	4D	4M	4D/ 4M	5D	5M	5D/ 5M
PAC	6,621	2,700	9,321	2,475	542	3,017	5,177	3,354	8,531	2,532	1,066	3,598
Territory	8,614	8,742	17,356	1,583	1,168	2,751	4,526	6,517	11,043	679	3,778	4,457
Other	31,819	27,011	58,830	2,225	5,499	7,724	21,039	24,094	45,133	931	8,022	8,953
Total	47,054	38,453	85,507	6,283	7,209	13,492	30,742	33,965	64,707	4,142	12,866	17,008

Within Territories: There are more management options and discretion to implement treatments designed to increase landscape resilience in CSO territories outside of CSO PACs. The CSO Strategy (USDA 2019, p. 29) defines the CSO Territory desired condition as follows, "Desired conservation outcomes for an occupied territory are to maintain and promote 40 to 60 percent of a territory in mature tree size classes with moderate and high canopy cover for nesting, roosting and foraging. This corresponds to roughly the following CWHR size/density classes in descending order of priority: 6, 5D, 5M, 4D, and 4M. Those territories in more mesic conditions and at higher elevations within the watershed should contain relatively more of this habitat than those in drier conditions and at lower elevations. The remainder of the territory should represent a diversity of many different structure and canopy cover classes." SERAL 2.0 adopts desired condition directly from the CSO Strategy (2019) included as project-specific forest plan amendment SPEC-CSO-DC-07.

Suitable CSO habitat, as defined in the Strategy, consists of both highest-quality nesting and roosting habitat and sufficient habitat diversity/heterogeneity to provide for foraging. Preferred prey items of CSO are wood rats (*Neotoma macrotis*) and flying squirrels (*Glaucomys sabrinus*); habitat heterogeneity promotes the availability of these prey items (USDA Forest Service 2019). While PACs are designated to include the best 300 acres of nesting / roosting habitat in as compact an area as possible, in addition to nesting / roosting habitat, territories need to also include sufficient habitat diversity and heterogeneity to provide foraging habitat essential for survival, fitness, and reproduction. Foraging habitat is composed of a diversity of vegetation types and seral stages (Roberts et al. 2017). Foraging habitat may include areas with large and tall trees but is more often associated with areas of smaller trees and more open areas or areas with large trees more sparsely distributed (open canopy). A mosaic of mature closed-canopy forest intermixed with open-canopy patches may promote the highest prey diversity and abundance (Franklin et al. 2000, Tempel et al. 2014(a), Ward et al. 1998, Jones personal communication December 5, 2023). Wood rats, for example dwell in more open areas and studies show that wood rats are a higher energy, better meal for CSO than flying squirrels more commonly found in the dense closed canopy areas (Zulla et al. 2023). This highlights the importance of habitat heterogeneity outside the CSO nest stands and in areas of a territory outside of the PAC, for prey abundance and CSO foraging.

For foraging, some studies suggest CSOs tend prefer edge habitat and open patches including those created from forest thinning (Eyes 2014, Eyes et al. 2017, Roberts et al. 2017, Williams et al. 2011,

Hobart et al. 2019, Wilkinson et al. 2022, Kuntze et al. 2023, Zulla et al. 2023). Owls may benefit from mature forests with a mosaic of vegetation types and seral stages promoting higher prey diversity and abundance by increasing habitat diversity and heterogeneity in foraging areas (Franklin et al. 2000, Tempel et al. 2014a, Ward et al. 1998, Zabel et al. 1995, Kuntze et al. 2023; Zulla et al. 2023; Wilkinson et al. 2022; Hobart et al. 2019). Small open areas, areas of low canopy cover (less than 40 percent), and edges interspersed with highest-quality habitat are considered important for owl foraging and habitat diversity (USDA 2019).

At the landscape scale, the proposed forest thinning in CSO territories causes changes to CWHR classifications of the best-available (CWHR 4D and 4M) and highest-quality (CWHR 5D and 5M) CSO habitat (Table 16). Similar to the pattern seen within CSO PACs, the amount of CWHR 5M is increased within CSO territories relative to the existing condition (Table 16). The increases in CWHR 5M results from conversions of CWHR 5D to 5M, 4D to 5M, and 4M to 5M with the most significant increase occurring in the conversion from 4D to 5M (Table 18). An increase in CWHR 5M within the moist-mixed conifer forest type meets a restoration objective of the project (Figure 2), however, increases in CWHR 5M within dry-mixed conifer forest types do not align with the need to reduce CWHR 5D and 5M in dry-mixed conifer forest types at the landscape scale (Figure 2, Table B.01-4). This demonstrates trade-offs between conservation needs of sensitive species, like the CSO, and resilience needs across the landscape.

The effective maintenance of much of the acres classified as CWHR 5D and most of the acres classified as CWHR 5M and the additional acres of CWHR 5M created within CSO territories is attributed to a few factors (Table B.02-3): (1) inclusion of DBH limits; (2) consideration of topographic position when locating treatment areas; (3) and avoiding forest thinning in CSO territories significantly lacking quality CSO habitat (Table 20 and Table B.02-4), therefore not meeting the CSO territory desired condition as defined in SPEC-CSO-DC-07 (Table C.02-1).

Table 17. Comparison between total pre- and post-treatment acres of CSO nesting and roosting habitat within PACs.

	Post Treatment CWHR						
Existing CWHR	**5D**	**5M**	**5P**	**4D**	**4M**	**4P**	**Total**
5D	2,475	0[8]	0	0	0	0	2,475
5M	0	542 Error! Bookmark not defined.	0	0	0	0	542
4D	57	376	0	5,177	1,011	0	6,621
4M	0	148	36	0	2,343	174	2,700
Total	2,137	1,461	36	5,177	3,354	174	12,338

Table 18. Comparison between total pre- and post-treatment acres of CSO nesting and roosting habitat within Territories (excluding PACS).

	Post Treatment CWHR								
Existing CWHR	**5D**	**5M**	**5P**	**5S**	**4D**	**4M**	**4P**	**4S**	**Grand Total**
5D	660	884	39	0	0	0	0	0	1,583
5M	0	898	270	0	0	0	0	0	1,168
4D	19	1,760	353	0	4,526	1,807	148	0	8,614
4M	0	236	1,553	122	0	4,710	2,038	83	8,742
Grand Total	679	3,778	2,215	122	4,526	6,517	2,186	83	20,107

[8] The proposed action was updated to ensure the proposed forest thinning retains CWHR 5D as 5D and CWHR 5M as 5M as required by SPEC-CSO-STD-04 and Management Requirement 2.12 I.iii.

The observed shifts in CWHR 5D and 5M to CWHR 5M and 5P, respectively, occur specifically where *shade-intolerant* and *fire-prone* trees greater than 24-inches and up to 34-inches occur, because forest thinning for *shade-tolerant* trees is limited to only trees less than 24-inches DBH. CWHR 5M and 5D areas are composed of trees greater than 24-inch DBH with canopy cover of 40-60% and greater than 60%, respectively. The intent of including DBH limits is to ensure the proposed treatment minimize the loss of and to promote the growth and recruitment of trees greater than 24-inches DBH and especially those greater than 30-inch DBH, but also to increase the abundance and distribution of fire-resilient and resistant species (*shade-tolerant p*ines and oaks) and decrease the abundance of shade-tolerant species (firs and cedars). Many decades of fire suppression have led to a major shift from a dominance of fire-resilient species such as pines and oaks, to the dominance of shade-tolerant firs and cedars. The proposed action is designed to correct this imbalance by removing the fire-sensitive shade-tolerant tree species that should not have survived under a natural fire regime and which are outcompeting the other fire-resilient and resistant species. Further, the inclusion of these DBH limits also help to retain clumps or patches of large/tall trees. Collectively, this demonstrates the deliberative nature in which the proposed forest thinning were designed and located to increase landscape resilience and consider the conservation needs and long-term habitat needs of the owl.

Similar to the pattern seen within CSO PACs, forest thinning treatments were preferentially located in areas of lower quality nesting and roosting habitat – areas containing smaller trees in dense stands with few openings – in order to most effectively reduce the threat of high-severity fire, promote faster recruitment of trees, and increase forest diversity and heterogeneity while maintaining and promoting other areas with higher-quality nesting and roosting habitat. The proposed action is effective at meeting this objective because the proposed forest thinning includes DBH limits to retain large and very large trees while allowing trees to be thinned to create greater spacing between trees and more openings, while leaving other clumps of dense trees to achieve the desired heterogeneric structure referred to as ICO (individual, clumpy, open) forest structure. When the canopy is opened CWHR classifications do shift, as demonstrated in Table 18 and Table 20.

Despite preferentially locating forest thinning treatment in areas classified as CWHR 4D and 4M areas, the large majority of acres classified as CWHR 4D and 4M are maintained as CWHR 4D or 4M (or increased to CWHR 5M or 5D) within CSO territories (Table 18). There is more variability at the individual territory scale (Table 20), results of the post-treatment territory desired condition assessment indicate that only one individual territory (TUO0165) will no longer meet the desired condition specific in SPEC-CSO-DC-07, missing the desired threshold of CWHR 5D/5M/4D/4M by only 1-percent (Table 20 and Table B.02-4). This is territory in particular has very little mesic conditions (i.e., drainage or ne facing slopes) and zero vegetation classified as moist therefore a lesser proportion of the territory should be composed of larger and more dense trees. Adjustments could be made to this territory to ensure more CWHR 4D/4M are retained, but much of this territory is located within the WUI and proposed fuelbreaks – both areas identified as excluded from the retention requirements identified in SPEC-CSO-STD-08 (Table C.02-1). Therefore maintaining 39-percent of this territory classified as CWHR 5D/5M/4D/4M complies with the proposed project-specific forest plan amendments and is justified as important for increasing landscape resilience and community protection and maintaining the long-term persistent of the species.

Summary: In summary, results demonstrate that the SERAL 2.0 proposed forest thinning within CSO PACs and territories was designed and located to effectively maintain large/tall tree habitat, increase forest heterogeneity, reduce stand densities, increase the abundance and distribution of fire-resilient and resistant species (e.g., pines and oaks) and decrease the abundance of shade-tolerant and fire-prone species (e.g., firs and cedars), and to maintain and promote conditions to meet the desired condition of CSO territories. Each of these objectives benefit the owl both in the short-term and long-term and potential near-term impacts have been minimized.

Nonetheless, although informed by the best available science, the SERAL 2.0 proposed forest thinning implements new management approaches and conservation measures whose potential impacts have not yet been monitored. Therefore, although there is inherent uncertainty related to the proposed treatments within CSO PACs and territories, overall the proposed forest thinning appears to have long-term benefits with minimal or at least equivocal short-term impacts (Gutiérrez et al. 2017, Jones et al. 2021a and b). Research conclusions have been mixed on the magnitude and duration of both negative and beneficial impacts to owl habitat suitability and owl populations from forest management activities (2024_SERAL_2.0_TerrestrialWildlife_BE.docx).

In general, best available science indicates that the potential short-term costs of modifying owl habitat through forest thinning and other treatments is outweighed by the longer-term benefits of reducing the risk of severe fire and insect/disease/drought mortality affecting owl habitat. This general finding is also supported by local case studies that indicate fuel reduction treatments that include mechanical thinning are compatible with continued owl occupancy and reproduction (e.g., Rich 2007 showing outcomes in 3 case studies). Similarly, another case study monitoring of CSO Territory TUO007 in the Stanislaus-Tuolumne Experimental Forest (STEF) in 2021 also showed continued CSO occupancy and reproduction following forest thinning resiliency treatments. While these case studies were not part of large research, they nonetheless provide evidence of positive outcomes to owls after forest thinning treatments on the Stanislaus National Forest. Considering empirical studies and case studies overall, the conservation measures and management approaches adopted from the CSO Conservation Strategy (USDA Forest Service 2019) and applied to the SERAL 2.0 proposed actions appears to provide a sound approach to forest management that balances the tradeoffs of high-quality habitat retention with necessary forest management treatments to increase resiliency.

Shifts in CWHR classification are desirable and a critical aspect of meeting the purpose and needs of the project. So, despite the perception that any change in CWHR classifications, and particularly shifts in CWHR 5D or 5M is detrimental to the owl, it is important to recognize that it is not the goal to provide nesting and roosting habitat on every acre across the landscape. Historically, the structural characteristics associated with nesting and roosting habitat made up a small proportion of the landscape during pre-settlement times (Safford and Stevens 2017; DEIS Appendix B.01, Table B.01-1). Further there is more and more studies and publications supporting the need to restore our forests to more closely resemble pre-settlement times to become more resilient to natural disturbances but to also restore forest health. These concepts do not conflict with the needs of the owl. A resilient and healthy forest is a forest where owls can survive and persist.

Table 19. Comparison between pre- and post-treatment acres of CSO nesting and roosting habitat within each individual PAC (acres).

PAC ID	Pre-Treatment (No Action)						Post-Treatment (Proposed Action)					
	4D	4M	4D/4M	5D	5M	5D/5M	4D	4M	4D/4M	5D	5M	5D/5M
TUO0007	274	28	302	0	0	0	u	28	302	0	0	0
TUO0035	97	38	135	158	6	164	76	25	101	158	30	187
TUO0036	222	63	285	0	0	0	222	63	285	0	0	0
TUO0053	33	43	76	202	26	228	33	40	73	201	28	229
TUO0054	165	8	173	80	11	91	142	12	154	80	31	111
TUO0057	269	12	281	21	0	21	207	60	267	34	0	34
TUO0059	29	46	75	196	17	213	20	30	50	195	42	237
TUO0061	37	70	107	4	0	4	37	70	107	4	0	4
TUO0062	136	152	288	0	15	15	99	154	253	0	50	50
TUO0063	129	11	140	0	0	0	109	31	140	0	0	0
TUO0068	292	3	295	11	0	11	260	35	295	11	0	11
TUO0069	278	0	278	22	0	22	252	26	278	22	0	23
TUO0070	26	75	100	13	87	100	7	93	100	13	87	100
TUO0101	281	32	313	0	0	0	182	130	313	0	0	0
TUO0117	32	26	58	6	0	6	29	29	58	6	0	6
TUO0126	112	185	297	0	0	0	70	152	222	2	43	46
TUO0128	156	148	304	0	0	0	134	152	285	0	0	0
TUO0129	144	41	185	103	3	106	69	82	152	103	37	139
TUO0130	41	49	91	54	75	130	37	47	84	54	80	134
TUO0132	71	40	111	150	41	190	0	48	48	160	93	253
TUO0133	143	84	227	28	36	64	125	77	203	28	53	81
TUO0141	257	22	279	22	0	22	212	23	235	41	10	52
TUO0142	305	0	305	0	0	0	258	47	305	0	0	0
TUO0146	0	36	36	0	0	0	0	36	36	0	0	0
TUO0148	9	0	9	276	6	282	0	9	9	275	6	282
TUO0149	49	108	157	12	104	117	15	138	153	12	108	120
TUO0151	55	3	58	79	0	79	55	3	58	79	0	79
TUO0156	254	7	261	19	0	19	194	64	258	19	3	23
TUO0157	36	164	200	0	0	0	10	144	154	0	0	0
TUO0164	64	55	119	102	42	144	38	21	58	102	79	181
TUO0165	267	4	271	20	0	20	178	68	246	24	18	42
TUO0176	0	0	0	0	0	0	0	0	0	0	0	0

PAC ID	Pre-Treatment (No Action)						Post-Treatment (Proposed Action)					
	4D	4M	4D/4M	5D	5M	5D/5M	4D	4M	4D/4M	5D	5M	5D/5M
TUO0180	213	91	305	0	0	0	213	91	305	0	0	0
TUO0181	178	108	285	10	6	16	135	127	262	10	29	39
TUO0187	29	0	29	259	13	273	15	14	29	259	14	273
TUO0189	0	0	0	0	0	0	0	0	0	0	0	0
TUO0204	91	90	181	0	0	0	88	73	162	0	0	0
TUO0210	266	25	291	0	0	0	266	25	291	0	0	0
TUO0213	30	0	30	0	0	0	30	0	30	0	0	0
TUO0214	162	0	162	139	0	139	123	25	147	142	10	153
TUO0215	291	7	297	8	0	8	194	103	297	8	0	8
TUO0239	276	16	293	12	0	12	184	101	285	12	8	20
TUO0241	160	98	258	22	0	22	98	160	258	22	0	22
TUO0245	82	56	138	0	0	0	83	55	138	0	0	0
TUO0253	52	220	272	15	8	23	35	208	243	15	20	35
TUO0255	84	37	122	159	0	159	64	37	102	162	17	179
TUO0256	23	10	33	0	0	0	23	10	33	0	0	0
TUO0257	0	131	131	162	0	162	0	127	127	161	0	162
TUO0258	88	103	191	12	25	38	73	50	123	12	79	91
TUO0260	76	147	224	63	5	68	43	172	215	63	10	73
TUO0261	232	7	240	39	12	51	138	28	166	39	86	125

Table 20. Comparison between pre- and post-treatment acres of CSO highest-quality and best-available habitat within each individual territory (acres unless otherwise noted as %).

Territory ID	Pre-Treatment (No Action)										Post-Treatment (Proposed Action)									
	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?
CAL0045 - NF Stanislaus	0	0	0	0%	0	0	0	0%	0%	NA	0	0	0	0%	0	0	0	0%	0%	NA[9]
TUO0006 - Strawberry	32	173	205	70%	0	19	19	7%	77%	NA	3	18	21	7%	0	40	40	14%	21%	NA
TUO0007 - Sheering Creek	379	383	761	76%	0	0	0	0%	76%	Yes	343	187	530	53%	0	0	0	0%	53%	Yes
TUO0018 - Bumblebee	0	0	0	0%	13	1	14	100%	100%	NA	0	0	0	0%	0	14	14	100%	100%	NA
TUO0035 - Hull Crk	225	290	515	52%	205	37	242	24%	76%	Yes	103	182	284	28%	177	127	303	30%	59%	Yes
TUO0036 - Griswold Crk South	521	306	828	83%	0	0	0	0%	83%	Yes	509	319	828	83%	0	0	0	0%	83%	Yes
TUO0037 - Dry Meadows	104	0	104	82%	0	0	0	0%	82%	Yes	5	0	5	4%	0	99	99	78%	82%	Yes

[9] All "NA" are noted where there are too few territory acres in the project area to conduct a territory desired condition assessment

Territory ID	Pre-Treatment (No Action)										Post-Treatment (Proposed Action)									
	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?
TUO0053 - Brushy Crk	157	118	275	28%	398	233	631	63%	91%	Yes	82	116	199	20%	245	443	688	69%	89%	Yes
TUO0054 - Thompson Peak	331	125	456	59%	159	16	175	23%	82%	Yes	240	142	382	49%	152	81	233	30%	80%	Yes
TUO0057 - NF Tuolumne	575	266	842	84%	29	0	29	3%	87%	Yes	322	209	531	53%	45	145	190	19%	72%	Yes
TUO0059 - L 13 MIle Crk	151	237	388	39%	388	57	445	44%	83%	Yes	65	99	164	16%	246	264	510	51%	67%	Yes
TUO0061 - D51 Bear Spring Crk	**66**	**87**	**154**	**15%**	**6**	**0**	**6**	**1%**	**16%**	**No**	**66**	**87**	**154**	**15%**	**6**	**0**	**6**	**1%**	**16%**	**No[10]**
TUO0062 - Trout Crk	163	451	614	79%	0	63	63	8%	87%	Yes	107	305	413	53%	0	143	143	18%	71%	Yes
TUO0063 - Jonnie Gulch	610	44	654	85%	0	0	0	0%	85%	Yes	467	146	612	80%	13	19	31	4%	84%	Yes
TUO0068 - Mount Lewis	778	162	940	94%	11	0	11	1%	95%	Yes	458	304	762	76%	11	37	48	5%	81%	Yes
TUO0069 - D51 Basin Crk	701	104	804	80%	25	0	25	2%	83%	Yes	462	229	691	69%	25	79	104	10%	79%	Yes
TUO0070 - Herring Cr	193	185	378	38%	30	113	142	14%	52%	Yes	21	317	338	34%	15	156	172	17%	51%	Yes
TUO0101 - McKee Hill	458	291	749	75%	0	10	10	1%	76%	Yes	232	395	626	63%	0	26	26	3%	65%	Yes
TUO0117 - Strawberry North	49	60	109	93%	6	0	6	5%	98%	NA	29	73	102	87%	6	0	6	5%	92%	NA
TUO0121 - Sand Bar Flat	48	25	73	63%	19	0	19	16%	80%	Yes	48	25	73	63%	19	0	19	16%	80%	Yes
TUO0126 - Merrill Spring	297	492	789	79%	7	0	7	1%	80%	Yes	172	334	506	51%	3	85	88	9%	59%	Yes
TUO0128 - L Trout Crk	347	351	698	71%	32	83	115	12%	82%	Yes	145	384	529	54%	0	248	248	25%	79%	Yes
TUO0129 - U 2 Mile Crk	301	279	580	58%	99	53	151	15%	73%	Yes	56	252	308	31%	88	250	339	34%	65%	Yes
TUO0130 - Camp Clavey	38	89	127	34%	18	70	89	24%	58%	NA	27	79	106	28%	18	82	100	27%	55%	NA
TUO0132- Hull Crk Camp	143	308	451	45%	186	110	296	30%	75%	Yes	13	107	120	12%	166	159	324	32%	44%	Yes
TUO0133 - High Sierra N	244	434	678	68%	98	39	137	14%	82%	Yes	150	140	291	29%	48	145	193	19%	48%	Yes
TUO0141 - N Marble Mtn	687	155	842	84%	37	39	76	8%	92%	Yes	442	57	499	50%	41	178	220	22%	72%	Yes
TUO0142 - Marble Mtn S	613	87	700	70%	0	0	0	0%	70%	Yes	480	182	662	66%	0	0	0	0%	66%	Yes
TUO0146 - Hunter Crk	**10**	**91**	**101**	**10%**	**0**	**0**	**0**	**0%**	**10%**	**No**	**10**	**91**	**101**	**10%**	**0**	**0**	**0**	**0%**	**10%**	**No[10]**
TUO0148 - U 13 Mile Crk	106	95	201	20%	440	94	534	53%	74%	Yes	12	40	52	5%	360	247	606	61%	66%	Yes
TUO0149 - Cottonwood Crk	165	345	510	51%	52	155	207	21%	72%	Yes	24	167	190	19%	12	210	223	22%	41%	Yes
TUO0151 - L Cottonwood Creek	162	133	295	30%	144	30	174	17%	47%	Yes	159	115	274	28%	128	52	179	18%	46%	Yes
TUO0156 - High Sierra S	450	364	814	81%	77	21	98	10%	91%	Yes	221	188	409	41%	34	214	248	25%	66%	Yes
TUO0157 - South Bald Mtn	169	363	531	74%	0	53	53	7%	81%	Yes	129	339	468	65%	0	53	53	7%	73%	Yes
TUO0160 - Brushy Hollow	43	22	65	100%	0	0	0	0%	100%	NA	0	37	37	57%	0	0	0	0%	57%	NA
TUO0163 - Rushing Meadow	6	28	35	73%	4	0	4	8%	81%	NA	6	13	19	41%	4	0	4	8%	49%	NA
TUO0164 - Dodge Ridge	98	188	286	29%	362	185	547	55%	83%	Yes	38	69	107	11%	345	223	569	57%	68%	Yes

[10] No forest thinning – same pre- and post-treatment size and density class distribution.

Territory ID	Pre-Treatment (No Action)										Post-Treatment (Proposed Action)									
	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?	4D	4M	4D/4M	% 4D/4M	5D	5M	5D/5M	% 5D/5M	% 4D/4M 5D/5M	DC?
TUO0165 - Fahey Cabin	**421**	**343**	**763**	**76%**	**53**	**5**	**58**	**6%**	**82%**	**Yes**	**166**	**83**	**249**	**25%**	**26**	**114**	**140**	**14%**	**39%**	**No[11]**
TUO0172 - Fraser Flat	9	29	38	65%	0	0	0	0%	65%	NA	9	29	38	65%	0	0	0	0%	65%	NA
TUO0180 - Sheering West	462	363	825	82%	10	8	18	2%	84%	Yes	457	335	793	79%	10	0	10	1%	80%	Yes
TUO0181 - Lily Lake	222	348	570	58%	17	17	49	5%	63%	Yes	141	331	471	48%	14	66	80	8%	56%	Yes
TUO0187 - Thompson Meadow	110	269	380	38%	376	376	478	48%	86%	Yes	33	179	213	21%	285	258	543	54%	76%	Yes
TUO0189 - Stanislaus Tunnel	0	0	0	0%	0	0	0	0%	0%	NA	0	0	0	0%	0	0	0	0%	0%	NA
TUO0204 - McCormick Meadow	441	327	768	77%	0	0	0	0%	77%	Yes	375	308	683	68%	0	0	0	0%	68%	Yes
TUO0210 - Buchanan	477	159	635	64%	0	0	0	0%	64%	Yes	366	253	619	62%	0	0	0	0%	62%	Yes
TUO0213 - Griswold Cr N	568	272	840	84%	0	0	0	0%	84%	Yes	564	275	840	84%	0	0	0	0%	84%	Yes
TUO0214 - Camp Ida	328	187	515	52%	386	386	397	40%	91%	Yes	206	93	299	30%	328	152	480	48%	78%	Yes
TUO0215 - Upper Skull Cr	511	273	784	78%	8	8	8	1%	79%	Yes	279	372	651	65%	8	45	53	5%	70%	Yes
TUO0239 - Fisher Cr	556	57	613	93%	12	12	12	2%	95%	Yes	203	228	431	66%	12	115	127	19%	85%	Yes
TUO0241 – East Fisher	343	326	669	67%	22	22	22	2%	69%	Yes	328	341	669	67%	22	0	22	2%	69%	Yes
TUO0245 – S F Griswold	542	196	738	74%	0	0	0	0%	74%	Yes	514	201	716	72%	0	0	0	0%	72%	Yes
TUO0253 - Bell Meadow	100	374	474	52%	15	15	23	2%	55%	Yes	55	371	426	47%	15	23	38	4%	51%	Yes
TUO0255 - Box Spring	314	152	466	47%	204	204	229	23%	70%	Yes	226	120	346	35%	188	131	319	32%	67%	Yes
TUO0257 - Westside E	84	260	344	34%	338	338	467	47%	81%	Yes	47	201	248	25%	176	341	517	52%	76%	Yes
TUO0258 - Westside W	172	205	377	38%	159	159	218	22%	60%	Yes	92	72	163	16%	101	241	343	34%	51%	Yes
TUO0260 - Lily Creek	204	425	630	63%	66	66	114	11%	74%	Yes	65	247	311	31%	63	123	186	19%	50%	Yes
TUO0261 - U Camp 25	289	139	428	43%	177	177	287	29%	72%	Yes	141	126	268	27%	131	270	402	40%	67%	Yes
TUO0304 - Game Refuge	50	54	104	65%	0	0	0	0%	65%	Yes	0	83	83	51%	0	0	0	0%	51%	Yes

[11] Treatments are withing WUI and fuelbreaks – SPEC-CSO-STD-08 exception area.

Cumulative Effects

Will the proposed forest thinning treatments when added to other reasonably foreseeable future actions cumulatively impact the quality of CSO habitat or cumulatively contribute to the decline of the owl across the project area?

The results above demonstrate that the proposed action was designed in a way that ensures the habitat quality of the highest-quality habitat in CSO PACs is not reduced (the acres actually increase), additional acres of highest quality are created, and the shifts in CWHR classification in the best-available habitat are predominately 4D to 4M, a minor short-term reduction of habitat quality (Table 15).

Therefore, the proposed forest thinning within PACs, when added to other reasonably foreseeable future actions (Table F.01) would not cumulatively impact to the quality of CSO habitat.

Outside of CSO PACs, forest thinning actions proposed on private lands have the most potential to impact California spotted owl habitat because those actions may include clearcutting of private parcels of land adjacent to federal lands. Presently, timber harvest plans indicate plans to clear cut a very small proportion of lands located within the project area. In addition, when implementing forest thinning on private lands, the spotted owl is specially managed as per the California Forest Practice Rules (Title 14, California Code of Regulations chapters 4, 4.5, and 10) which govern the regulation of timber harvesting on state and private lands in California. If it is determined that a proposed plan has the potential to harm owls directly or significantly disturb occupied nesting habitat, California Department of Fish and Wildlife (CDFW) works with Cal Fire and the entity who submitted the timber harvest plan to find alternatives and mitigation measures to prevent significant impacts to the species. In the SERAL 2.0 project area, private lands account for very little highest-quality habitat. Therefore, actions on private lands are not likely to measurably impact the occurrence of highest-quality habitat across the landscape.

The other planned forest thinning on federal lands in the project area will be adhere to mitigation measures designed to prevent significant impacts as per direction for Regional Forester Sensitive species and the Stanislaus National Forest Forest Plan (USDA 2017). Assuming all policy and laws are followed negative cumulative effects are expected to be minimal.

In terms of wildfire risk reduction, the SERAL 2.0 proposed actions, when added to the other reasonably foreseeable future actions, will incrementally increase landscape resilience and reduce the risk of habitat loss due to high-severity wildfire, drought, or insect and disease infestations (Table 25 and Table 26 and Table 27. This is a beneficial cumulative effect.

Issue 1B. The proposed forest thinning and fuel reduction treatments may reduce marten habitat and impact their persistence.

Affected Environment

Pacific marten (*Martes caurina*) is a Region 5 Forest Service Sensitive species that occurs throughout much of its historic range in the Sierra Nevada Mountains (Slauson et al. 2007). Within the project area camera surveys confirmed marten presence 24 times between 1999 and 2012 with one suspected maternal rest site. Camera survey efforts since 2012 have not detected marten in the project area and no den sites have been discovered to date. Marten occur in the higher elevation red fir and mixed fir forests in the NE section of the Southern project polygon, west of Emigrant Wilderness and in the vicinity of three Inventory Roadless Areas; Bell Meadow, Waterhouse and Eagle. All observations were higher than 5,000 feet in elevation; approximately 49% of the project area is below this elevation.

For this analysis, we considered suitable habitat to be at elevations higher than 5,000 feet since numerous local surveys have been conducted and all local detections were at a higher elevation (NRIS). This elevational cutoff is also similar to what is described in Moriarty et al. (2016). USDA Forest Service

(2014b) also states that the marten is most common at higher elevations in true fir and subalpine zones, and USDA Forest Service (2004) says riparian corridors should be considered for assisting with habitat connectivity. We therefore defined suitable habitat as subalpine conifer, red fir, and lodgepole pine with elevation greater than 5,000 feet, size class greater than or equal to 4, and density of M or D. We also included river corridors. The Stanislaus National Forests has approximately 93,335 acres of suitable marten habitat. Suitable habitat in the project area totals 8,630 acres (~9% of the total available habitat on the Forest). The vast majority of suitable habitat is located at higher elevations of the larger project polygon adjacent to the Emigrant Wilderness (see Figure 17, in the Wildlife Biological Evaluation, 2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation).

USDA Forest Service (2004), largely based on Freel (1991), Slauson (2003), and Spencer et al. (1983) characterized marten habitat and habitat elements as follows:

- Highest quality habitat consists of CWHR types 6, 5D, 5M, 4D, and 4M in descending order of priority.
- Presence of large live conifer groups greater than 24 inches DBH.
- Upper elevation / subalpine forests, riparian corridors, and forest/meadow edges.
- Presence of large snags greater than 30 inches DBH.
- Coarse woody debris averaging 5-10 tons/acre in decay classes 1-2.

Indicators and Measures

Treatment Activities within Suitable Marten Habitat: Forest thinning, fuel reduction, prescribed fire, and salvage actions may all affect one or more important marten habitat elements. Each treatment type may impact marten habitat in different ways. Assessing the frequency of each proposed treatment type within suitable marten habitat helps to assess the magnitude of the potential impacts.

Changes to CWHR Classification: Forest thinning is able to cause a shift in CWHR classifications. However, the proposed action includes DBH limits and other constraints designed to minimize the loss of large, old, and structurally diverse trees while implementing restoration treatments designed to increase the landscape's resilience to natural disturbances. Reducing the proportion of CWHR 5D/5M and 4D/4M across the project area is an intentional objective of the SERAL 2.0 proposed action. However, CWHR types 6, 5D, 5M, 4D, 4M are recognized as important elements of a highest-quality marten habitat, in descending order of priority (similar to the CSO). Therefore, it is important to assess the degree to which CWHR 5D, 5M, 4D, and 4M will be retained by the proposed treatments in order to determine whether the proposed treatments may affect marten occupancy or cause a trend toward Federal listing or a loss of viability.

Snag and Down Log Retention:

Marten occupy forests with an abundance of large snags, logs and trees that present ample opportunities for foraging and resting. Forest management activities can reduce snag densities and the presence of large down logs, both preferred structures for resting and denning marten (Slauson and Zielinski, 2009, Tweedy 2018). Effects to these structures is important in understanding how project activities may affect marten in the project area. Large tree retention requirements in the treatment areas provides for future recruitment of large snags and large logs whereas snag and down log retention requirements helps protect existing structures. In addition, prescribed burning may create new snags but can reduce large logs and stumps.

SDI: The vegetation type of suitable marten habitat in the SERAL 2.0 project area is primarily fir-dominated and pine-dominated mixed conifer with fir-dominated mixed conifer being more prevalent. A fir-dominated mixed conifer stand with an SDI value greater than 330, and a pine-dominated mixed conifer stand with an SDI value greater than 270, are indicative of inter-tree competition and stress, making the trees more susceptible to mortality from drought, bark beetle attacks and disease. For the SDI metric here, post-treatment modeled estimates for a target SDI reduction were calculated as < 330 in fir-

dominated stands and < 270 in pine-dominated stands (according to the vegetation type from the F3 v16 dataset from ForSys modeled thinning treatments within suitable marten habitat). These thresholds represent targets for effective risk reduction to stand loss from insects, disease, and drought. However, lowering SDI values below the highest risk categories will reduce risk of stand and marten habitat loss to insects, disease, and drought.

Direct and Indirect Effects

Treatment Activities within Suitable Marten Habitat:

The probability of project activities influencing the persistence of the species on the Forest is unlikely due to the relatively small proportion of habitat in the project area, the staggered nature and timing of implementation activities as well as project design criteria protecting habitat features. Their persistence in the project area is largely dependent on the health and stability of the larger population on the Forest. Large scale disturbances such as high intensity wildfire and drought induced insect and disease mortality pose a greater risk to large scale habitat alterations threatening the persistence of the species on the Forest (Steel et al. 2022). Treatments in the project area may help reduce this risk, ideally improving habitat resilience to wildfire and providing opportunities for controlling wildfire.

Effects to individual marten in the project area and their daily activities (i.e. foraging, resting, breeding, and rearing young) is considered moderate. While no known den sites have been found in the project area, there is evidence of reproduction in the project area. One maternal rest site was documented when two juvenile marten were observed in 2012. Death or injury from project related activities would be unlikely given the mobility of this species and their large home ranges, a female marten's home range is between 548-988 acres (Moriarty et. al. 2017). Direct effects to individual marten are most likely to occur during treatment implementation. Management requirements establish a limited operating period (LOP) if any den sites are discovered which minimizes the probability that death, injury, or denning disturbance would occur in reproductive areas. Project activities would be most impactful if they occur near an undiscovered den or structure when mothers are present with kits too young to move on their own, making escaping project activities more challenging for the mother and her young. The 3 months, April to June, after birth is the most critical portion of the denning period when kits are not mobile and dependent on their mother. Delheimer et al. (2021) documented marten denning patterns on the Lassen National Forest and concluded that the duration of den use and daily time spent at the den decreased with increasing kit age. (Delheimer et al. 2021). Once kits are mobile, presumably sometime in July, their ability to move away from project activities increased, reducing the risk they would be injured or killed by project related activities. In addition, the presence of snow creates limited access at the elevations where marten occur making implementation less likely to occur in the spring when mothers and kits are most vulnerable because. Pile burning could overlap the critical time for marten. The effects of pile burning smoke accumulation into a den site pose a lower risk because of the limited spatial scale and the lower probability that a pile would be near a den site.

The project area overlaps approximately 8,630 acres of suitable habitat, approximately 9% of available habitat on the Forest. Many more thousands of acres of suitable habitat are adjacent and outside of the Project Area. Potential effects of forest thinning or post-disturbance salvage would be minimized by snag retention requirements, down wood retention, and retention of large trees within treatment units. While any habitat alteration may result in changing habitat suitability, variable density thinning and prescribed burning prescriptions for the SERAL 2.0 project promote or conserve many habitat elements important to marten such as forest complexity, large trees, hardwoods, snags, and downed logs. Moreover, long-term benefits of habitat resiliency are largely recognized (USDA Forest Service 2014b).

The proposed action may directly alter habitat features that serve as safe passage structures or safe foraging areas and may directly affect marten foraging strategies and predator avoidance capabilities. Actions that would reduce large down logs or course woody debris accumulations or even understory

shrubs have the potential to influence how marten move and forage within a stand. Moriarty et al. 2016 found that changes in forest structure had significant consequences for the energetic balance of martens. In this study martens moved more "deliberately, consistently and slowly" in structurally complex stands, indicating to the researchers that the animals were foraging in these areas. Martens typically avoided openings and simple stands but when they were found using these stand types their movements were "faster, more inconsistent, and more direct" indicating predator avoidance or less foraging opportunities (Moriarty et al. 2016).

The predominate treatments affecting suitable habitat in the project area are prescribed fire and fuels reduction treatments that maintain overstory canopy but reduce biomass sized trees (less than 10-inch dbh) and surface fuels. Fuels reduction and prescribed fire treatments would affect approximately 4% of the Forest's suitable habitat, between 4,360 and 5,218 acres (Table 21).

Changes to CWHR Classification:

Marten are positively associated with dense forest (Moriarty et al. 2015 and 2016, USDA Forest Service 2014b) thus any actions that alter forest density may have negative effect to habitat quality. The proposed action is expected to create a shift in average density and size class of trees resulting in a change in CWHR classification for some stands in the project area. It is important to note that the proposed action includes DBH limits (between 20–30-inch dbh) therefore many CWHR size class 4 stands shift to CWHR size class 5 because thinning smaller trees and retaining larger trees increases the QMD. Proposed treatments would change the CWHR classification on about 14% of the suitable habitat in the project area. Affecting 11% of suitable 4D/4M habitat where treatments are designed to reduce stand density resulting in a shift of averages in density and in many cases size class (Table 22). After treatment some acres would be classified as CWHR 5M, 4P, or 5P. Treatments affect a smaller proportion of CWHR 5M/5D where approximately 3% of the suitable marten habitat in the project area would change to another CWHR classification. Diameter limits and other constraints designed to minimize the loss of large, old, and structurally diverse trees help to preserve habitat features important to marten after treatment.

Forest thinning, ground based mechanical treatment and aerial treatments, would affect a smaller proportion, approximately 1,216 acres of habitat or an additional 1% of the available habitat on the Forest. Forest thinning and prescribed burning treatments may reduce or modify surface structures but are less likely to result in simplification of forest structure. While these treatments would affect more acres of habitat within the project area the design and intent of the treatments to restore or improve stand heterogeneity and to reintroduce fire on the landscape reduce the risk that stand simplification may occur. In addition, these restoration treatments include mitigation measures that would reduce the risk of creating simplified stand structure. The thinning prescription would thin in a variable manner leaving some areas dense and some areas more open where existing conditions provide these opportunities. The largest trees (>30 inch dbh) would be retained throughout treatment units reducing the risk of affecting viable rest or den trees. Variable density thinning also allows for denser patches where conifer crowns would be touching or interlaced, allowing for marten to escape a ground predator like a bobcat by moving through the canopy. These treatments retain a minimum of 4-6 standing dead trees and 4 down logs per acre making it possible for treatment areas to be used for reproduction in the future.

Treatments with a higher risk to marten habitat are the shaded fuel breaks, affecting 857 acres of suitable habitat (less than 1% of the habitat on the Forest). Fuel breaks are located along roads which present safe passage challenges for marten and are less likely to be areas desired for denning. However, fuelbreak treatments may create wider areas of perceived high predation risk as documented by Moriarity et al. (2016) because of the reduction in canopy continuity, limited shrub retention, some down log retention, and the removal of all snags. Removing snags reduces the recruitment potential for down logs for an extended period. Machine piling would greatly reduce surface logs, debris and shrubs. Fuel breaks are unlikely to be suitable habitat for resting or denning into the future and are most likely to result in forest

simplification after treatment, creating areas where predation risk increases if marten pass through. Fuel breaks do provide opportunities to control wildfire, therefore their proximity to marten habitat may reduce the risk of high severity wildfire impacting their habitat.

Salvage treatments would only occur in the event of a wildfire or insect and disease mortality. These events are likely to have more of an impact on marten habitat and movements than the salvage treatments however Volkmann and Hodges found marten avoided severely burned areas and excluded salvage-blocks from their home ranges (Volkmann and Hodges 2021). Salvage may further degrade habitat conditions and affect marten movement, breeding and foraging but the habitat structure and heterogeneity remaining after such an event is likely a greater influence on marten behavior.

In summary, thinning and prescribed burning may cause short-term negative effects to habitat by reducing canopy cover and stand density, but long-term forest resilience would increase by implementing the action alternative. Retention of snags, large down wood, and large trees would lessen the potential for negative impacts. Proposed treatment activities overlap a small portion, approximately 7.5%, of the suitable marten habitat on the Forest and the majority of treatments are designed to retain key habitat elements such as large trees, snags and large logs used for denning and resting. Fuelbreaks and salvage may result in greater alteration of habitat but are likely occurring where habitat quality is reduced to a degree do proximity to roads and after overstory mortality has occurred. The number of acres affected by treatments within the project are small relative to the number of acres of suitable habitat outside the project area. Therefore, negative effects from forest treatments are unlikely to have a measurable effect on the local marten population.

Table 21. Treatment activities within suitable marten habitat.

Proposed Treatment Within Suitable Marten Habitat	Proposed Action	No Action
Forest Thinning - Aerial	40	0
Forest Thinning -Ground	932	0
Forest Thinning - Fuelbreak	244	0
Fuel Reduction	3747	0
Fuel Reduction - Fuelbreak	613	0
Prescribed Fire	5,218	0
Salvage	3,471	0

Changes to CWHR Classification:

Marten are **positively** associated with dense forest (Moriarty et al. 2015 and 2016, USDA Forest Service 2014b) thus any actions that alter forest density may have negative effect to habitat quality. The proposed action is expected to create a shift in average density and size class of trees resulting in a change in CWHR classification for some stands in the project area. It is important to note that the proposed action includes DBH limits (between 20–30-inch dbh) therefore many CWHR size class 4 stands shift to CWHR size class 5 because thinning smaller trees and retaining larger trees increases the QMD. Proposed treatments would change the CWHR classification on about 14% of the suitable habitat in the project area. Affecting 11% of suitable 4D/4M habitat where treatments are designed to reduce stand density resulting in a shift of averages in density and in many cases size class (Table 22). After treatment some acres would be classified as CWHR 5M, 4P, or 5P. Treatments affect a smaller proportion of CWHR 5M/5D where approximately 3% of the suitable marten habitat in the project area would change to another CWHR classification. Diameter limits and other constraints designed to minimize the loss of large, old, and structurally diverse trees help to preserve habitat features important to marten after treatment.

Table 22: Summary of the effects of forest thinning on large tree retention within suitable marten habitat.

Land Allocation	Forest Type	Existing (No Action)			Proposed Action		
		Total Acres	CWHR 4D/4M	CWHR 5D/5M	Total Acres Forest Thinning	CWHR 4D/4M	CWHR 5D/5M
Suitable Marten Habitat	Pine	106	43	5	40	4	2
	Dry MC	119	62	7	25	39	0
	Moist MC	7,091	1,857	2,565	1,151	949	2,310
	Total	7,316	1,962	2,577	1,216	992	2,312
Other Areas Outside of Suitable Marten Habitat	Pine	25,795	17,470	734	10,021	9,496	1,020
	Dry MC	62,031	46,541	7,821	16,324	38,280	10,518
	Moist MC	27,857	19,536	2,363	6,440	15,998	3,157
	Total	115,683	83,547	10,918	32,785	63,774	14,695
Total		122,999	85,509	13,495	34,000	64,766	17,007

Snag and Down Log Retention:

To meet high energy requirements, marten must forage frequently. Rest sites are therefore an important attribute of marten survival, and secure resting and denning structures reduce energetic requirements making these structures a limiting habitat element (Slauson and Zielinski, 2009). Resting and denning structures are similar in their characteristics and are typically in large snags, logs, stumps and live trees (Tweedy 2018, Slauson and Zielinski 2009, Martin and Barrett, 1991). Treatment activities may reduce snag densities and the presence of large down logs, both preferred structures for resting and denning marten (Slauson and Zielinski, 2009, Tweedy 2018).

Snag retention and down log requirements apply to thinning and fuels reduction treatments areas across the project area. Large tree retention requirements in the treatment areas provides for future recruitment of large snags and large logs whereas snag and down log retention requirements helps protect existing structures. In addition, prescribed broadcast burning may create new snags but can reduce large logs and stumps if fire is allowed to consume these structures. Snag retention in mixed conifer stands is 4 snags per acre and in red fir stands it is 6 snags per acre. Snag retention is prioritized by the largest snags available which are most suitable for resting or denning. Larger snags may persist on the landscape longer and as demonstrated in Tweedy's study on the Lassen National Forest may serve multiple generations of marten (Tweedy 2018). Fuelbreaks would reduce snag densities well below current levels and are expected to have a longer-term effect to habitat quality that thinning and fuel reduction activities. Snags would be removed in the 857 acres of fuelbreaks within suitable marten habitat. Some down logs would be retained within fuelbreaks but it is unlikely these linear features along roads would serve as suitable marten habitat after treatment activities. These areas are likely to create some challenges for marten moving through the project area and re unlikely to be utilized for resting or denning. However, it is not expected to preclude marten from utilizing habitats in the project area post treatment.

SDI:

The vegetation type of suitable marten habitat in the SERAL 2.0 Project Area is primarily fir-dominated and pine-dominated mixed conifer with fir-dominated mixed conifer being more prevalent. A fir-dominated mixed conifer stand with an SDI value greater than 330, and a pine-dominated mixed conifer stand with an SDI value greater than 220, are indicative of inter-tree competition and stress, making the trees more susceptible to mortality from drought, bark beetle attacks and disease. For the SDI metric here, post-treatment modeled estimates for a target SDI reduction were calculated as < 330 in fir-dominated stands and < 220 in pine-dominated stands (according to the vegetation type from the F3 v16

dataset from ForSys modeled thinning treatments within suitable marten habitat (Table 23). These thresholds represent targets for effective risk reduction to stand loss from insects, disease, and drought. However, any progress made towards SDI targets will reduce risk of stand loss to insects, disease, and drought. The Proposed Action is anticipated to reduce SDI to target levels within suitable marten habitat.

Table 23. Estimated changes to SDI within suitable marten habitat as a result of mechanical treatments and mechanical and prescribed fire treatments combined.

Indicator		Pre-Treatment (No Action)	Post-Treatment Mechanical + Prescribed Fire
SDI Pines	Less than 130	0	25
	130 - 220	5	20
	Greater than 220	100	60
SDI Dry Mixed Conifer	Less than 160	20	41
	160 - 270	59	57
	Greater than 270	39	21
SDI Fir/Moist-mixed conifer	Less than 200	522	1,606
	200 to 330	4,290	4,274
	Greater than 330	2,278	1,211

Cumulative Effects

Pertinent projects to consider for cumulative effects to marten include reasonably foreseeable future actions, including those actions on private land, expected to modify suitable marten habitat. The Forest queried its databases, State databases, and others to determine present and reasonably foreseeable future actions as well as present and reasonably foreseeable future actions on other public (non-Forest Service) and private lands (SERAL 2.0 FEIS Appendix F). At this time there are no reasonably foreseeable actions, such as timber harvest plans on private lands within suitable marten habitat. There are three future projects planned on the Stanislaus National Forest, two projects propose thinning and prescribed burning affecting a small portion of suitable marten habitat in the project area (approximately 250 acres). The Forest's Hazard Tree Management Project would overlap about 2,000 acres of suitable marten habitat in the project area. The proposed fuelbreaks may contribute to a cumulative reduction of snag densities along roads in the project area when combined with the effects of hazard tree removal. Roads, like other openings, are generally avoided by marten except when crossing is essential making these areas less ideal for resting or denning (Moriarity et al. 2016). Reducing snag density along roads may affect resting and denning opportunities in these areas but is unlikely to change the species ability to persist in the project area.

While the SERAL 2.0 project overlaps approximately 10% of the suitable habitat on the Forest, project activities are not anticipated to contribute to a cumulative long-term reduction in habitat and may improve habitat resiliency to the effects of wildfire and drought. Approximately 35% of the suitable habitat on the Forest is in Wilderness meaning a large portion of suitable habitat would not be manipulated by forest management practices.

Issue 1C. The proposed DBH limits will leave stand densities too dense and structurally homogenous to effectively reduce the landscape's susceptibility to wildfire-, drought-, and insect and disease- related mortality or to achieve NRV-based objectives.

Affected Environment

The condition of the landscape across the project area is highly susceptible to wildfire, drought, insect attacks, and disease (Chapter 1.01). The SERAL 2.0 project proposes varying DBH limits within the action alternative (Table 2) designed to ensure compliance with the proposed amended and current Land and Resource Management Plan (USDA 2017) which includes ensuring critical habitat needs of sensitive species are maintained. The concern represented by Issue 1C is that the proposed DBH limits will impact the effectiveness of the proposed treatments in meeting the project's objectives, including the need to reduce stand densities (A.02) and increase forest heterogeneity (A.01).

Indicators and Measures

The landscape's resilience to disturbances such as insect outbreaks, disease, drought, and wildfire is correlated with low stand densities and high structural heterogeneity at both the stand and landscape scale. The SERAL 2.0 proposed actions were developed to reduce stand densities and to increase landscape structural heterogeneity, thus reducing susceptibility to largescale stand-replacing disturbances. Post-treatment modeled estimates of SDI, basal area, flame length probabilities, and annual burn probabilities enable a comparative assessment of the impacts of the proposed DBH limits on treatment effectiveness. Each metric provides a different insight into the effectiveness of the proposed treatments (and DBH limits) in reducing the landscape's susceptibility to disturbances. DBH limits vary between CSO PACs, CSO Territories, and outside of CSO PACs and Territories (Table 2). Therefore, each indicator and measure will look at four scales: (1) All Lands; (2) CSO PAC; (3) CSO Territory; (4) Outside of CSO PAC and Territory. Categories 2-4 are mutually exclusive, while category 1 is the sum of 2-4. Each category helps to assess the potential impacts of the DBH limits in different ways.

Stand Density Index (SDI): This indicator provides a measure to compare and contrast the action and no-action alternatives in relation to the risk factor of large-scale tree mortality related to drought, insects, and disease. SDI is a measure of stand density and competition, which is based on the number of trees per unit area (i.e., trees per acre) and the size of those trees (the quadratic mean diameter, or QMD, which is the diameter at breast height of the tree of mean basal area). SDI can be thought of as a measure of stem crowding: the higher the SDI, the more crowded the stand. As tree stands become more crowded, tree mortality tends to increase, especially during drought periods because trees are water-stressed. Lack of precipitation and resulting water stress increases susceptibility of a forest to insect colonization and attack. Any insect infestation or disease outbreak may be exacerbated by a lack of precipitation. During a drought, when conifers are moisture-stressed, they cannot produce sufficient resin flow to resist attack by native bark beetles. Any condition that results in excessive demand for moisture (such as tree crowding) or dense understory vegetation, can increase the tree's susceptibility to drought, insects, and disease. High stand densities are contributing toward a reduction in tree and stand health and decreased growth rates in the SERAL 2.0 project area. Increased growth rates are necessary to recruit large and very large trees and snags as described in the CSO Conservation Strategy (USDA Forest Service 2019). Strategically planned thinning will reduce the SDI and inter-tree competition for resources, allowing the tree's natural defenses to properly function and enhance growth and health of the residual trees.

SDI thresholds have been identified to indicate forested stands' susceptibly to mortality from drought, bark beetle attacks and disease (Table 24). For example, a pine stand with an SDI value greater than 220 would indicate significant inter-tree competition and stress, making the trees' susceptible to mortality from drought, bark beetle attacks and disease. SDIs greater than 220 for pine, 270 for dry mixed conifer forests, or 330 for fir- or moist-mixed conifer-dominant stands, enter the "zone of imminent mortality" where trees are likely to start dying due to stress from competition over limited resources (Oliver and Uzoh 1997). Assessing the proportion of conifer forests with SDIs above or below certain thresholds can help to quantify a landscape's susceptibility to mortality from drought, bark beetle attacks and disease. If the proposed treatments reduce the estimated SDIs to levels well below this "zone of imminent mortality" in treated stands, the landscape would be more resilient to drought and insect outbreaks. If post-treatment

modeled estimates of SDI remain at or above these thresholds, the proposed forest thinning treatments may not reduce the landscape's susceptibility to mortality from drought, bark beetle attacks and disease to ideal target levels. However, any progress made to reduce SDI also reduces susceptibility to overstory tree mortality.

Post-treatment modeled estimates of SDI (product of F3 – Huang et. al 2018) are presented as total acres by risk category (Table 24) at four scales: (1) All Lands; (2) CSO PAC; (3) CSO Territory; (4) Outside of CSO PAC and Territory. Acres within each risk category among the forest types are combined for the effects analysis.

Table 24. SDI threshold categories

Forest Type	Stand Density Index (SDI)	Risk of density-related mortality
Pine	Greater than 220	High
	130-220	Moderate
	Less than 130	Low
Dry Mixed Conifer-	Greater than 270	High
	160-270	Moderate
	Less than 160	Low
Fir- or Moist-mixed conifer	Greater than 330	High
	200-330	Moderate
	Less than 200	Low

Basal Area (BA): Basal area is another common measure of stand density and also an important indicator of forest health. It is determined from the sum of cross-sectional areas of all stems in a stand measured at breast height and expressed in unit of land area (square feet per acre, for example). Estimates of pre-European settlement basal areas are generally less than 150 ft²/acre in pine- and dry-mixed conifer forests and less than 200 ft²/acre in more fir- and moist-mixed conifer dominant stands, though was highly variable (Safford and Stevens 2017, Meyer and North 2019) (Table 3). Bark beetles and disease agents are often more damaging at high stand densities. Sartwell and Stevens (1975) found that infestations were likely to occur in ponderosa pine stands with densities ranging between 140 to 260 ft²/acre. Therefore, within pine dominated stands they recommended a target basal area of <150 ft²/acre. Research conducted in even-aged ponderosa pine stands in the Sierra Nevada suggested a thinning target of 100 ft²/acre (Oliver 1997). Landscapes with large, contiguous areas of high basal areas are generally more stressed (due to inter-tree competition for resources) and thus more susceptible to mortality. Tree mortality often increases during drought periods because trees are water-stressed leading to an inability to resist insect colonization during an attack or fight off disease due to poor resin production and flow. Any condition that results in excessive demand for moisture (such as tree crowding) or dense understory vegetation, can increase the tree's susceptibility to drought, insects, and disease. The proposed forest thinning, and understory fuel reduction treatments are expected to reduce stand basal areas.

To assess Issue 1C, we compare how well the proposed treatments reduce basal area. We assume that if too great an area has basal areas remaining above 150 ft^2/acre and 200 ft^2/acre respectively, that the forest thinning treatment may not be sufficient to reduce the landscape's susceptibility to mortality from drought, bark beetle attacks and disease, and that the proposed DBH limits would be one factor impacting effectiveness.

Post-treatment modeled estimates of basal area are presented by dominant forest type as total acres less than or greater than 150 ft^2/acre for pine and dry mixed conifer stands and less than or greater than 200 ft^2/acre within fir and moist-mixed conifer stands at four scales: (1) All Lands; (2) CSO PAC; (3) CSO Territory; (4) Outside of CSO PAC and Territory.

Conditional Flame Length Probabilities: Conditional flame length is an estimate of the probability distribution of flame length at a pixel, given the condition that a wildfire burns the pixel under different

simulated wildfire conditions (i.e., 10,000 simulations). A correlation exists between flame lengths and wildfire severity: high-severity (stand-replacing) fire is greatest when flame lengths exceed 8 feet, as these flame lengths are commonly associated with tree torching and crown fire initiation (Collins et al. 2013; Stephens et al. 2016). Assessing the landscape proportion expected to burn at varying flame lengths indicates the landscape's or vegetation's susceptibility to wildfire damage or effects. We expect the proposed forest thinning, fuel reduction, and prescribed fire treatments will collectively lower conditional flame lengths across the project area, including within CSO PACs and territories, which is critical to the project's effectiveness. However, due to the more restrictive DBH limits within CSO PACs and territories, it is possible treatments will be less effective at reducing conditional flame lengths within CSO PACs and territories than outside these areas.

To assess Issue 1C, we compare how well the proposed treatments lower the predicted conditional flame lengths (product of FSim, Finney et al. 2011, Scott et al. 2018). We assume that if the area expected to have flame lengths between 4-feet and 8-feet or greater than 8 feet are not measurably reduced, that the proposed treatments may not be sufficient to reduce the landscape's susceptibility to wildfire-, drought-, or insect- and disease-related mortality and that the proposed DBH limits would be one factor impacting effectiveness.

Post-treatment modeled estimates of conditional flame lengths are are presented as total acres with flame lengths of less than 4 feet, between 4 and 8 feet, and greater than 8 feet at four scales: (1) All Lands; (2) CSO PAC; (3) CSO Territory; (4) Outside of CSO PAC and Territory. Results also compare the effectiveness of mechanical treatments and mechanical treatments plus prescribed fire at each scale as well as the effectiveness only within areas treated by forest thinning within each scale. Looking specifically at the proposed forest thinning effectiveness at lowering conditional flame lengths among the different scales may provide the most insight into the potential affects of the DBH limits on project effectiveness. Values are reported as the number of acres within each scale with conditional flame lengths of less than 4-feet, 4-8 feet, and greater than 8-feet.

Annual Burn Probability: Annual burn probability provides an indicator of the landscape's susceptibility to wildfire based on the probability of burning. Annual burn probability is calculated by FSim. FSim calculates the annual burn probability for each pixel on the landscape as the number of iterations that resulted in the pixel burning divided by the total number of fire simulation iterations run (i.e., 10,000).

We expect the proposed forest thinning, fuel reduction, and prescribed fire will contribute to reducing the modeled estimates of annual burn probability, including within CSO PACs and territories, which is critical to the project's effectiveness at reducing the threat of habitat loss due to wildfire within CSO PACs and territories, across the project area, and nearby areas outside the project area. However, due to the more restrictive DBH limits in CSO PACs and territories, it is possible the treatments will be less effective at reducing annual burn probabilities within CSO PACs and territories than outside these areas.

Post-treatment modeled estimates of annual burn probability (product of FSim, Finney et al. 2011, Scott et al. 2018) are presented at four spatial scales: (1) project area (all lands); (2) CSO PACs, (3) CSO Territories, and (4) outside of CSO PACs and territories. Values are reported as the number of acres at each scale with annual burn probabilities of less than 1%; 1 to 2%; and greater than 2% to 5%.

Results also compare the effectiveness of the mechanical treatments and mechanical treatments plus prescribed fire at each scale as well as the effectiveness only within areas treated by forest thinning within each scale. Looking specifically at the proposed forest thinning effectiveness at reducing the annual burn probabilities across the project area, within CSO PACs and territories and outside of these areas, may provide the most insight into the potential effects of the DBH limits on project effectiveness.

Direct and Indirect Effects

Basal Area and SDI: The existing condition of conifer forests within the SERAL 2.0 project area can generally be characterized as much denser and more structurally homogenous as compared to the natural range of variation and, as such, highly susceptible to largescale mortality events from drought, insects, disease, and wildfire. Current basal area values average approximately 150 feet²/acre in pine-dominant stands and 184 feet²/acre in fir-dominant stands within the SERAL 2.0 project area, with more than 62,000 total acres of conifer forest stands having basal area values considered to be at high-risk to density-related mortality (>150 ft²/acre for pine-dominant stands or >200 ft²/acre for fir-dominant stands). The proposed action would reduce the amount of conifer forest acreage at high-risk to competition-related mortality via forest thinning (post-treatment), as measured by basal area and stand density index compared to the existing, pre-treatment condition (no action) (Table 25 and Table 26; Figure 13 and Figure 14) by shifting acres into lower risk densities.

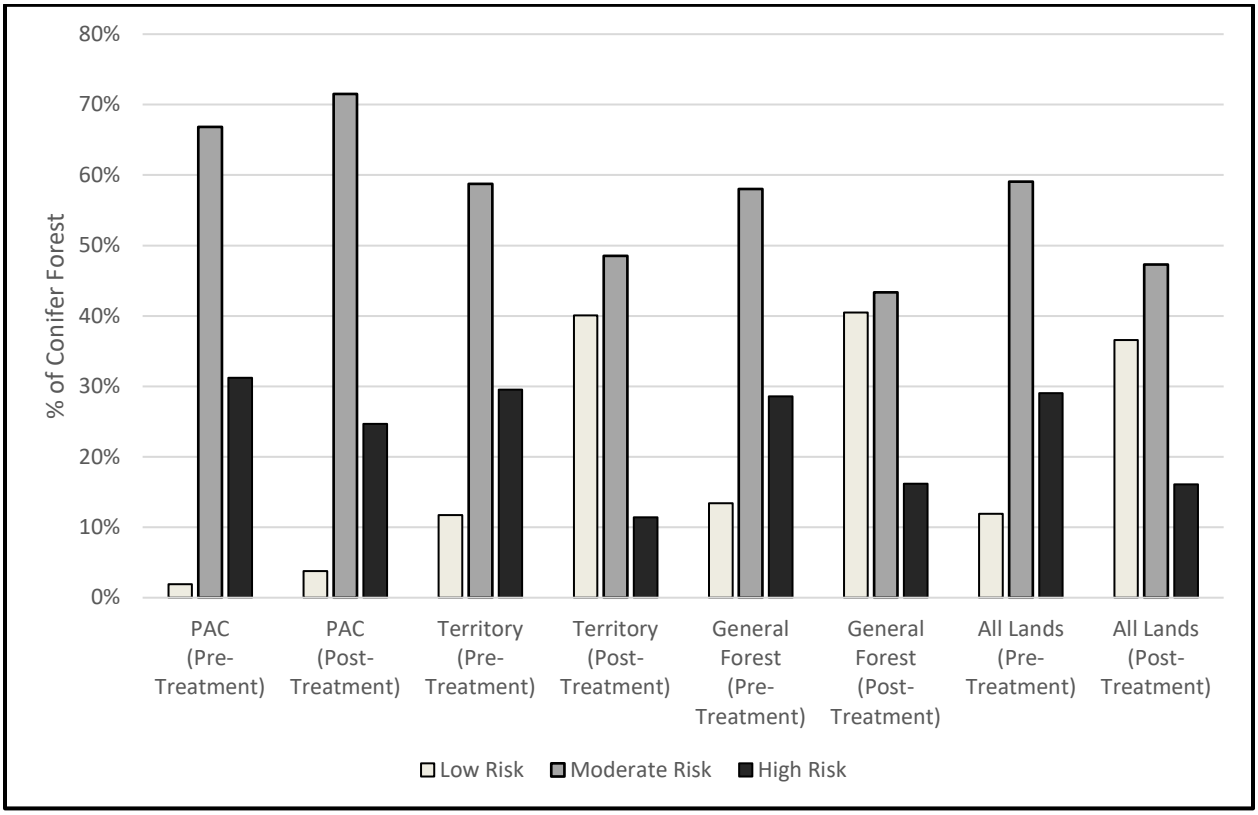

Figure 13: Pre- and post-treatment risk of density-related mortality due to insects, disease, and drought—as measured by SDI—in conifer forests in the SERAL 2.0 project area.

Table 25. Comparison of the acres (and percentages) within SDI risk of mortality categories pre- and post-treatment at different scales.

Land Allocation	Risk of Mortality	Pre-Treatment	Post-Treatment	Pre-Treatment Percent	Post-Treatment Percent	Pre-Treatment Only within Forest Thinning Acres	Post-Treatment Only within Forest Thinning Acres	Pre-Treatment Only within Forest Thinning Percent	Post-Treatment Only within Forest Thinning Percent
All Lands	Low	14,622	45,016	12%	37%	289	27,465	1%	81%
	Moderate	72,650	58,188	59%	47%	20,113	6,536	59%	19%
	High	35,723	19,792	29%	16%	13,599	0	40%	0%
CSO PACs	Low	246	483	2%	4%	42	272	2%	10%
	Moderate	8,501	9,094	67%	72%	1,953	2,524	70%	90%
	High	3,970	3,139	31%	25%	802	0	29%	0%
CSO Territories	Low	2,932	10,037	12%	40%	35	6,671	0%	72%
	Moderate	14,713	12,151	59%	49%	5,034	2,549	55%	28%
	High	7,395	2,852	30%	11%	4,149	0	45%	0%
Outside of CSO PACs and Territories	Low	11,445	34,495	13%	40%	212	20,522	1%	93%
	Moderate	49,435	36,942	58%	43%	13,126	1,464	60%	7%
	High	24,357	13,800	29%	16%	8,648	0	39%	0%

Table 26. Comparison of the acres (and percentages) above and below basal area risk thresholds pre- and post-treatment at different scales.

Land Allocation	Basal Area Threshold (Above or Below)	Pre-Treatment	Post-Treatment	Pre-Treatment Percent	Post-Treatment Percent	Pre-Treatment Only within Forest Thinning	Post-Treatment Only within Forest Thinning	Pre-Treatment Only within Forest Thinning Percent	Post-Treatment Only Forest Thinning Acres Percent
All Lands	Below	60,545	84,008	49%	68%	10,877	33,042	32%	97%
	Above	62,450	38,987	51%	32%	23,124	959	68%	3%
CSO PACs	Below	3,186	4,306	25%	34%	740	1,837	26%	66%
	Above	9,531	8,411	75%	66%	2,056	959	74%	34%
CSO Territories	Below	11,923	19,359	48%	77%	2,106	9,219	23%	100%
	Above	13,117	5,682	52%	23%	7,112	0	77%	0%
Outside of CSO PAC and Territories	Below	45,436	60,344	53%	71%	8,031	21,986	37%	100%
	Above	39,802	24,894	47%	29%	13,955	0	63%	0%

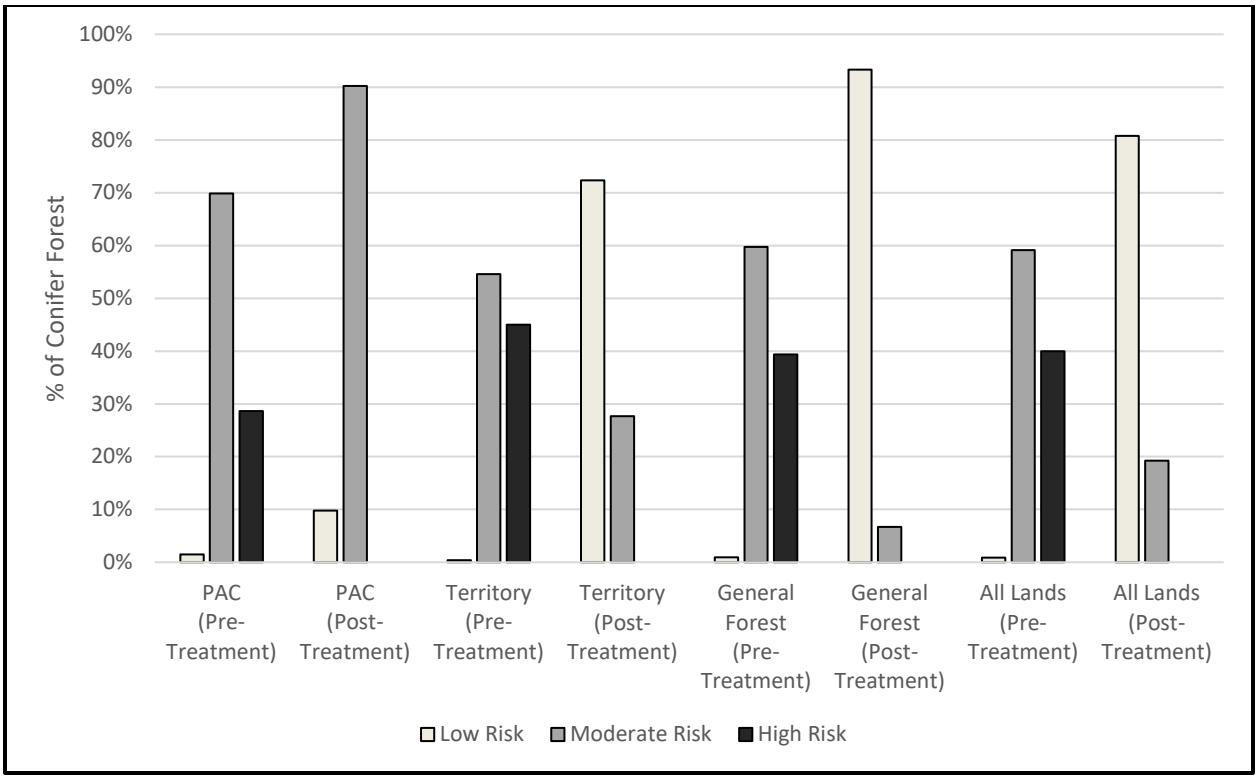

Figure 14 Pre- and post-treatment risk of density-related mortality due to insects, disease, and drought—as measured by SDI—in *treated acres of* conifer forests in the SERAL 2.0 project area.

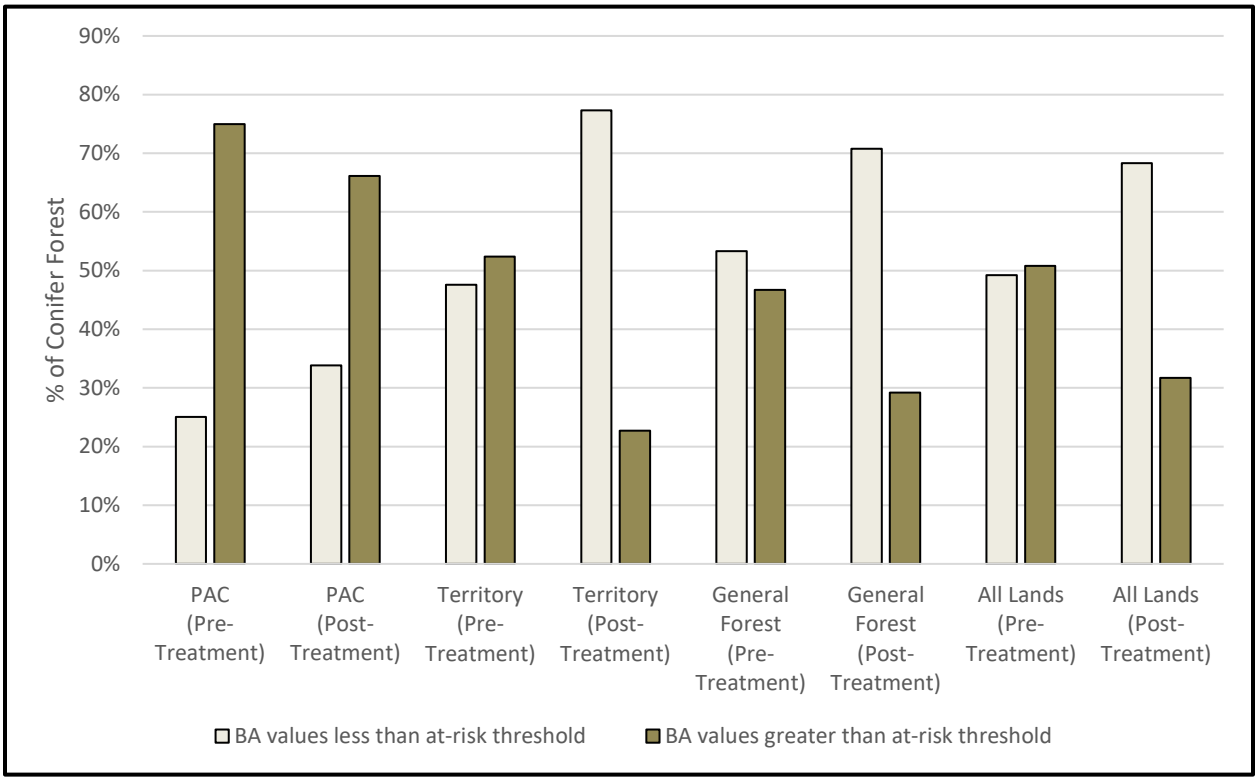

Figure 15. Pre- and post-treatment proportion of conifer forest in the SERAL 2.0 project area above and below basal area thresholds associated with density-related mortality.

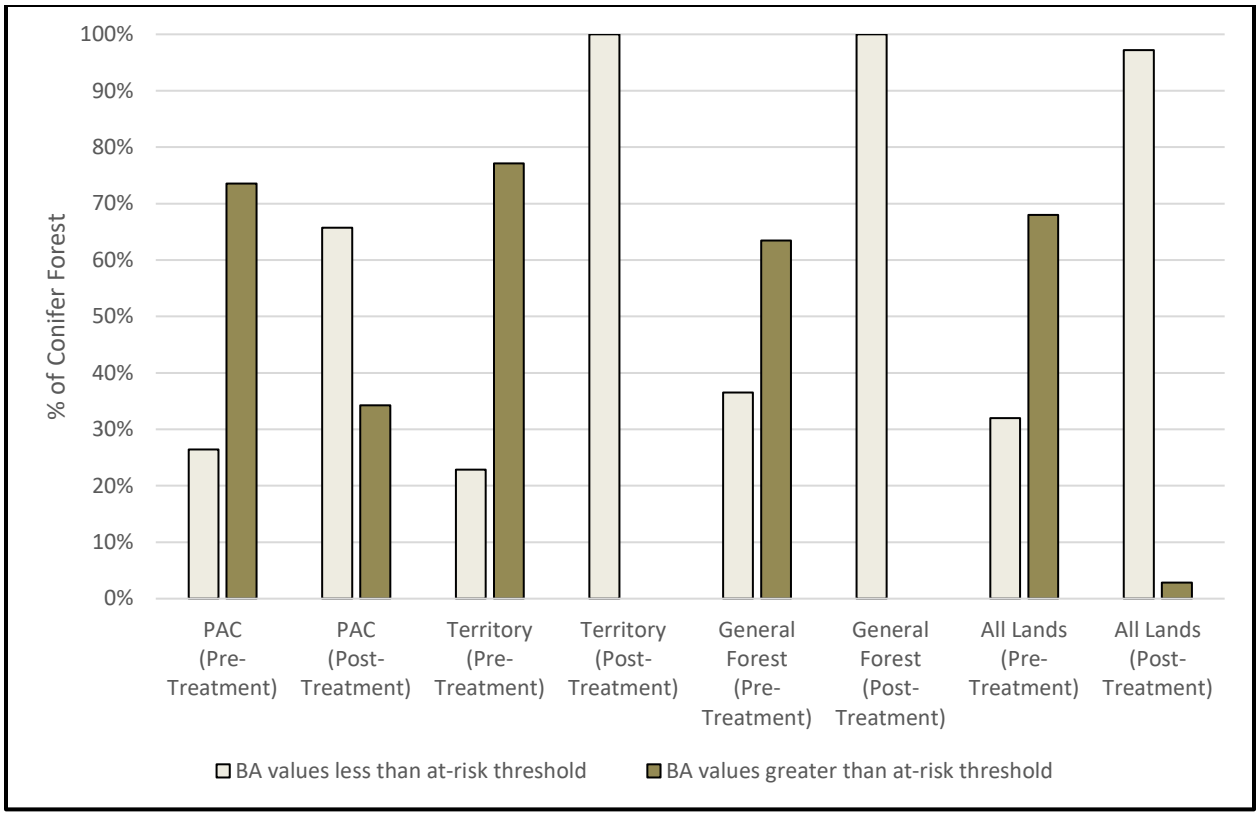

Figure 16. Pre- and post-treatment proportions of *proposed treatment acres* of conifer forest in the SERAL 2.0 project area above and below basal area thresholds associated with density-related mortality.

Of the nearly 123,000 acres of conifer forest in the project area, nearly 90% are considered to be at risk of density-related mortality—as measured by SDI (Table 24 and Table 25)—in their current condition, with more than 35,000 acres (nearly 30%) in the high-risk category. Just 12% (<15,000 acres) of those acres are currently classified as low-risk. In terms of density as measured by basal area, more than half (51%) of the total acreage of conifer forest in the project area (62,000 acres out of ~123,000 acres) currently have basal areas above the high-risk threshold prior to treatment (150 ft^2/acre for pine-dominant forest types and >200 ft^2/acre for more fir-dominant forest types), as described in the basal area indicator above (Table 26).

Approximately 34,000 acres of the 123,000 acres of conifer forest (~28%) are proposed for mechanical thinning. Of these 34,000 acres proposed for mechanical treatment, approximately 100% of them are at SDI levels that put them at risk to density-related mortality, with ~40% of them (~13,600 acres) classified as high risk. Following treatment, 81% of the treated stands are projected to be in the low-risk SDI category, and 0% are expected to remain in the high-risk category. Across the landscape—which includes all acres, both treated and untreated—the total acreage of conifer forest in the low risk of mortality category increases from 12% to 37%, as more than 30,000 acres are moved into the low-risk category. Just 16% (~19k acres) remain in the high-risk category, as measured by SDI (primarily due to inaccessible areas and wildlife habitat requirements). For basal area, the proportion of conifer forest with high basal areas for the given forest type is reduced from 51% pre-treatment to 32% post-treatment. The proportion of conifer forest acreage falling below this high-risk basal area threshold increases from 49% pre-treatment to 68% post-treatment. Of just the acres proposed for treatment, the proportion with high basal areas falls from 68% pre-treatment to 3% post-treatment, as more than 22,000 acres are modelled to have their basal areas reduced below these thresholds. Thus, 97% of the *treated* conifer forest acres are expected to be below these basal area thresholds post-treatment.

Spotted Owl PAC's: Approximately 98% of the ~12,700 acres of spotted owl PAC in the SERAL 2.0 project area are currently at moderate to high risk of density-related mortality, as measured by SDI. Roughly 4,000 of these acres are at high risk. Regarding basal area, 75% of the PAC acreage is above the high-density threshold for the given forest type.

Roughly 2,800 acres of PAC's are proposed for mechanical treatment. Following treatment, while the mortality risk is reduced in the treated acres, 98% of the PAC acres still remain at moderate risk of density related mortality as measured by SDI, as wildlife habitat requirements and diameter limits prevent more substantial density reductions into the low-risk SDI category. Very little of the PAC acreage (~230 acres; less than 2% of total PAC acres) is moved into the low-risk SDI category, showing that relatively high tree density is maintained even in the treated PAC's. None of the treated PAC acres are expected to remain at high risk of mortality, as these ~800 high risk acres are shifted into the moderate risk category. The fact that none of these high-risk PAC acres are projected to move into the low-risk category reflects the "light touch" of the proposed PAC treatment, intended to maintain all trees over 20 inches DBH and relatively high canopy cover. Following treatment, the proportion of total PAC acres above the high-density basal area threshold is reduced from 75% to 66%, showing that relatively high basal areas are maintained across PAC acres. Overall, proposed mechanical treatments in PAC's do not significantly reduce the risk of density-related mortality in PAC's, as proportions of overall PAC acreage in the different risk categories remain quite similar pre- and post-treatment.

Spotted Owl Territories: Roughly 88% of the ~25,000 acres of spotted owl territory in the SERAL 2.0 project area are currently at risk of density-related mortality, as measured by SDI. Approximately 7,400 of these acres (30%) are at high risk. In terms of basal area, more than 13,000 acres (or 52%) of the territory acreage are currently above the high-density threshold.

Following mechanical treatment, the proportion of Territory acreage in the moderate and high-risk SDI categories is reduced from 88% to 60%. The proportion of acres in the low-risk category increases from 12% to 40%, as stand density is significantly reduced across more than 7,100 territory acres. One hundred percent of the 4,150 territory acres at high risk of mortality that are proposed for mechanical treatment are projected to exit out of the high-risk category following treatment. The proportion of treatment acres in the low-risk category increases from <1% pre-treatment to 72% post-treatment as more than 6,500 territory acres are moved into the low-risk class. Post-treatment, the proportion of total territory acres above the high-density basal area threshold is reduced from 52% to 23%, while the proportion of acreage in the low-risk category increases from 48% to 77%, respectively.

General Forest: As measured by SDI, approximately 74,000 acres (or 87% of the ~85,000 acres) of conifer forest acreage outside of spotted owl PAC's and territories (e.g. "General Forest") are at risk of density-related mortality in their current condition. Roughly 24,000 (29%) of these acres are at high risk, and only 11,000 acres (13%) are currently at low risk to mortality from insects, disease, and drought. Of the nearly 22,000 General Forest acres proposed for mechanical treatment, ~99% of them are currently at SDI levels that put them at elevated risk for density-related mortality. For basal area, nearly 40,000 (~47%) acres are above the high-risk basal area threshold for the given forest type. Focusing just on the ~22,000 acres of proposed treatment in General Forest, 63% of them (~14,000 acres) are above these basal area thresholds.

Following mechanical treatments on approximately 22,000 acres of General Forest, the percentage of General Forest acres in the high-risk SDI category is reduced from 29% to 16%, as densities are reduced on ~10,500 of these acres. The proportion of acres in the low-risk category increase from 13% to 40%, as 23,000 additional acres are shifted into this low-risk class. Just looking at the proposed treatment acres, zero of the ~8,600 acres in the high-risk SDI category remain there post-treatment. For basal area, the percentage of total General Forest area above the high basal area threshold is reduced from 47% to 29%. Thus, post-treatment, 71% of General Forest acres are modelled to be at low risk stand densities. Focusing on just the treated acres, the proportion of high basal area acres is reduced from 63% pre-

treatment to 0% post-treatment, illustrating the effectiveness of proposed treatments at reducing the risk of density-related mortality in General Forest.

The proposed DBH limits certainly have an impact the proposed treatments' effectiveness at meeting certain project objectives, such as reducing stand density and creating stand heterogeneity, particularly in spotted owl PAC's where the DBH limits are most restrictive. However, even with the suite of DBH limits, the modelling of proposed treatments suggests they would be effective at reducing the susceptibility to wildfire-, drought-, and insect and disease- related mortality across tens of thousands of acres of conifer forest across the SERAL 2.0 landscape.

Fire Modeling Results (Conditional Flame Length): The proposed action increases the ratio of acreage in the lowest flame length category (less than 4 ft) compared to the highest flame length category (greater than 8 ft) (Table 27, Map 7) across each of the four scales. As expected, a larger proportion of acres in the greater than 8-feet category are reduced in areas outside of CSO PACs and territories compared to within CSO territories and PACs, with PACs showing the smallest change in acres with greater than 8-feet conditional flame lengths. Nonetheless, the treatments are effective at reducing the landscape's susceptibility to high severity wildfire as it is related to conditional flame lengths.

The greater the flame lengths the more likely forests are expected to experience active crown fires. When active crown fires occur in greater than 50% of a watershed, detrimental post-wildfire effects, such as debris flows, are expected. Landscapes with little to no active crown fire potential are expected to have less damaging post-wildfire effects.

Without management action (the no action alternative) the project area will remain more susceptible to greater flame lengths and to experience crown fire behavior during a wildfire. The proposed forest thinning demonstrates that it is effective at reducing the conditional flame length, and thereby, crown fire potential, even within CSO PACs which include the most restrictive DBH limits.

Increasing the proportion of the landscape expected to support conditional flame lengths less than 4-feet is another priority to create resilient conditions. The modeled post-treatment conditional flame lengths demonstrate that the proposed action at each scale will increase the proportion of the project area expected to burn with lower flame lengths and lower fire severity during an unplanned wildfire. The largest increase in acres with predicted conditional flame lengths less than 4-feet occurs outside of CSO PACs and territories, where the DBH limits are higher, canopy cover retention requirements are lower, allowing more shade-tolerant, fire-prone trees to be removed.

Annual Burn Probability

The proposed action is effective at reducing the annual burn probabilities across the project area to less than 2-percent. Post-treatment modeled estimates indicate that zero acres would remain above 2-percent post-treatment.

Similar to conditional flame lengths, the proposed action also increases the ratio of acreage in the lowest annual burn probability (less than 1 percent) across each of the four scales (Table 28, Map 8). As expected the proposed action increases the ratio most effectively in areas outside of PACs and territories, with PACs showing the smallest change in acres with a less than 1 percent annual burn probability. Although the effectiveness varies among the land allocations, collectively the proposed action reduces the landscapes susceptibility to natural disturbances.

Table 27. Comparison of the acres within categories of conditional flame length pre- and post-treatment at different scales.

Indicator / Measure		Pre-Treatment (No Action)	Post-Treatment Mechanical Only	Post-Treatment Mechanical + Prescribed Fire	Pre-treatment Only within Forest Thinning (Mech only)	Post-treatment Only within Forest Thinning (Mech only)
All Lands	< 4 feet	23,727	32,860	53,749	4,007	8,928
	4 – 8 feet	43,124	56,568	42,030	7,219	17,114
	> 8 feet	94,960	72,381	66,031	22,775	7,959
CSO PACs	< 4 feet	1,039	1,462	3,539	182	387
	4 – 8 feet	3,531	4,478	3,606	679	1,257
	> 8 feet	9,035	7,665	6,461	1,935	1,152
CSO Territories	< 4 feet	2,909	4,189	8,554	1,069	2,234
	4 – 8 feet	8,705	13,126	9,867	2,250	4,918
	> 8 feet	18,560	12,859	11,752	5,900	2,067
Outside of CSO PAC and Territories	< 4 feet	19,779	27,210	41,656	2,756	6,307
	4 – 8 feet	30,887	38,964	28,557	4,290	10,939
	> 8 feet	67,365	51,857	47,817	14,940	4,741

Table 28. Comparison of the acres within categories of annual burn probabilities pre- and post-treatment at different scales.

Indicator / Measure		Pre-Treatment (No Action)	Post-Treatment Mechanical Only	Post-Treatment Mechanical + Prescribed Fire	Pre-treatment Only within Forest Thinning (Mech only)	Post-treatment Only within Forest Thinning (Mech only)
All Lands	<1%	59,364	116,314	121,881	11,808	31,178
	1-2%	88,780	45,496	39,929	18,290	2,823
	> 2%	13,665	0	0	3,903	0
CSO PACs	<1%	5,886	11,678	12,118	1,083	2,607
	1-2%	7,002	1,927	1,487	1,567	189
	> 2%	717	0	0	146	0
CSO Territories	<1%	10,529	23,068	24,079	3,470	8,748
	1-2%	17,613	7,106	6,094	5,018	470
	> 2%	2,031	0	0	730	0
Outside of CSO PAC and Territories	<1%	42,949	81,568	85,684	7,254	19,823
	1-2%	64,165	36,463	32,347	11,705	2,163
	> 2%	10,918	0	0	3,027	0

Cumulative Effects

While the assessment of the proposed DBH limits impacts on stand densities demonstrated that the proposed action would reduce stand densities, large areas of the project area will be left at densities considered "high-risk" to density-related mortality. Although this is due to a number of factors, the proposed DBH limits are certainly one of them. Despite the acknowledgement that stand densities could be reduced further, the proposed action would be a massive step forward to making the SERAL 2.0 project area more resilient. Therefore, despite the inclusion of DBH limits in the proposed action, the proposed forest thinning when added to the other reasonably foreseeable future actions, will incrementally increase landscape resilience and reduce the landscape's susceptibility to high-severity wildfire, drought-, and insect- and disease-related mortality. This is a beneficial cumulative effect.

Issue 1D. The proposal to thin trees greater than 30-inch DBH is not necessary to increase landscape resilience.

Affected Environment

As presented in Chapter 1.01 and Appendix B.01, the current forest structure in the SERAL 2.0 project area is considerably departed from the reference conditions described in Safford and Stevens (2017) (Figure 2 and Figure 19). Restoring forest composition, structure, and processes based on NRV conditions has been linked to greater resilience to wildfire, climate change, and other stressors.

The concept of restoring the landscape into closer alignment with historic reference conditions is rooted in the assumption that the structural composition of forests occurring in pre-settlement times, were, and would still be, more resilient to disturbances such as insects, disease, drought, and climate change, and less susceptible to large, high severity burn areas from wildfires. Based on the NRV assessment of the SERAL 2.0 project area, restorative treatments, including the thinning and removal of trees greater than 30 inches DBH is necessary to rebalance the distribution and structural heterogeneity across the landscape. Therefore, the cutting and removal of trees greater than 30-inches DBH has the potential to affect the project areas susceptibility to disturbance.

On a 2019 field trip to the Stanislaus-Tuolumne Experimental Forest, Dr. Eric Knapp mentioned that trees in the 30- to 36-inch diameter class are over-represented in the Experimental Forest compared to historic conditions, while trees greater than 36-inches in diameter are significantly under-represented. Thus, he supported the ecological justification for occasionally removing trees greater than 30-inches DBH to sufficiently reduce densities and meet other objectives such as increasing forest health, restoring heterogeneity, and other NRV-based restoration needs (Appendix A).

Further justification for the need to cut and remove trees greater than 30-inches DBH is provided in USDA 2019(b). In this FAQ document it states "*Due to over a century of fire suppression and changing climate, removal of trees larger than 30-inches may be ecologically necessary in some locations to promote more fire resilient and shade intolerant pines and hardwood trees that are being outcompeted for resources by large trees of other less resilient species, to increase the resilience of existing larger trees, and/or to restore heterogeneity and resilience to the landscape. Given that larger trees are both disproportionally important to California spotted owl (CSO) and also disproportionately at risk due to stress and competition, there may be instances where trees above 30-inches must be removed to perpetuate the availability of large live trees on the landscape in the future. This may be particularly true in older plantations, or other stands lacking age-class diversity, where trees are both relatively large and crowded."*

Based on the NRV assessment, Dr. Knapp's experience within the local Experimental Forest, and the justification presented in USDA 2019(b), it is reasonable to assume the cutting and removal of trees

greater than 30-inches DBH has the potential to affect resilience or the susceptibility to disturbance of the entire project area.

Indicators and Measures

The same indicators presented for Issue 1C and Need 1 can be used to analyze Issue 1D. Issue 1D is assessed by comparing the current susceptibility of the landscape to disturbance related mortality with the estimated susceptibility post-treatment. The proposed action limits when trees greater than 30-inches DBH may be thinned to specific species or circumstances (Table 2).

The proposal to include *some* (emphasis added) removal of trees greater than 30-inch DBH is an important component included to specifically increase the abundance and distribution of fire-resilient, shade-intolerant species (pines and oaks) and decrease the abundance of shade-intolerant species (firs and cedars) (Chapter 1.01, Appendix A.01, A.04), and remove encroaching conifers within 66-feet of meadows and aspen stands. Many decades of fire suppression have led to a major shift from a dominance of fire-resilient species such as pines and oaks, to the dominance of shade-tolerant firs and cedars. The proposed action is designed to correct this imbalance by removing the fire-sensitive shade-tolerant tree species that should not have survived under a natural fire regime and which are outcompeting the other fire-resilient and resistant species. Collectively these objectives are equally important components to restore landscape resilience, forest health, and ecosystem diversity.

Post-treatment modeled estimates provide insight into how effectively the proposed treatments reduce the landscape's susceptibility to natural disturbances. Since trees greater than 30-inches DBH may only be thinned outside of CSO PACs and territories, the modeled post-treatment estimates of SDI, basal area, estimated conditional flame length probabilities, and annual burn probabilities are assessed at three scales: (1) PACs, (2) territories, and (3) outside of PACs and territories.

The modeled post-treatment estimates do not account for the potential removal of trees up to 40-inch DBH within 66-feet of meadows or aspen stands or within 66-feet of a proven rust resistant sugar pine. However, this does not measurably affect the analysis because there are only 42 mapped acres of meadows, 163-acres of aspen stands, and 6 proven rust resistant sugar pine within areas with proposed forest thinning in the project area. Although the effectiveness of removing trees under these special conditions cannot be modeled, it does not diminish the importance of the treatments.

Direct and Indirect Effects

The presentation of effects is supported by values presented in Table 25, Table 26, Table 27, and Table 28 and (Issue 1C).

The proposed action is effective at moving the landscape towards the desired condition, in terms of resilience to wildfire, drought, insects, and disease. Post-treatment modeled estimates also indicate that forest thinning is more effective outside of PACs and territories than within.

- The proposed action would reduce the proportion of conifer forest in the high-risk SDI categories and would increase the proportion within the low-risk in PACs, territories, Outside of territories, and across all lands (Table 25). Where thinning is applied in areas outside of CSO PACs and territories the treatments most effectively shift SDI values into the low risk of mortality category.
- The proposed action would reduce the acres of conifer forests above the high-risk basal area thresholds within PACs, territories, outside of territories and across all lands (Table 26). There is little difference between thinning effectiveness between treatments within CSO territories and outside of PACs and territories in shifting basal areas below the established risk thresholds. However, when compared to the effectiveness within PACs which have the most limited DBH

limit (i.e., 20-inch DBH), forest thinning is more effective both within and outside of territories which allow larger trees to be thinned.

- The proposed action is effective at reducing the potential wildfire severity as demonstrated by a measurable reduction in the acres where flame lengths are expected to exceed 8 feet and increasing the acres where flame lengths are expected to be less than 4 feet (Table 27). Arguably however, if the proposed action eliminated all DBH limitations, the proposed action would reduce the acres expected to exceed 8 feet flame lengths to a larger degree.
- The proposed action is effective at lowering the annual burn probability (Table 28).

Cumulative Effects

Does the cutting and removal of trees greater than 30-inches DBH, when added to other reasonably foreseeable future actions, cumulatively impact SERAL 2.0 ability to effectively treat the landscape?

Results have demonstrated that although stand densities are reduced by the proposed action, large areas of the project area will be left at densities considered "high-risk" to density-related mortality. Is it possible that if more trees greater than 30-inches DBH were thinned that stand densities would be more effectively reduced? Yes. Although, there are likely other ways to achieve a greater reduction in stand densities than cutting more large trees. Therefore, it is hard to measure whether cutting and removing trees greater than 30 inches when added to other reasonably foreseeable future actions (Table F.01-1) would cumulatively impact treatment effectiveness across the landscape.

Issue 2. Smoke emissions from prescribed fire may adversely affect air quality and human health.

As this is a still a relatively new issue, there is not yet an abundance of literature comparing the health impacts of smoke from wildfires and prescribed fires, particularly the long-term health impacts (Jones et al. 2022). "A better understanding of smoke impact over the landscape and related impacts is essential for properly assessing population exposure to smoke from different fire types" (Navarro et al. 2018). That said, there have been a of number studies that attempt to address this question, and there is a growing body of evidence supporting the commonly held view that "there is an implicit public health benefit–cost tradeoff of prescribed fire: more smoke today for less smoke tomorrow (Jones et al. 2022)." Kramer et al. (2023) found that wildfire contributes up to 20x more smoke particulate matter concentrations than prescribed fire. They conclude that: "Wildfire smoke is at least an order of magnitude higher than prescribed fire smoke...Overall, we found that air quality is impacted significantly more from wildfires than prescribed fires, past and proposed, for the majority of California." Navarro et al. (2018) states: "Destructive wildfires have higher rates of biomass consumption and have greater potential to expose more people to smoke than prescribed fires. Naturally ignited fires that are allowed to self-regulate can provide the best scenario for ecosystem health and long-term air quality. Generally, prescribed fire smoke is much more localized, and the smoke plumes tend to stay within the canopy, which absorbs some of the pollutants, reducing smoke exposure." Unfortunately, some smoke is inevitable in fire-prone (and fire-dependent) ecosystems. Clearly there are important tradeoffs related to prescribed fire and public health that warrant further study, though currently the best available science generally indicates that the pros of prescribed burning outweigh the cons.

The Clean Air Act of 1970 (amended in 1977 and 1990) requires the Unites States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment, and it was designed to "protect and enhance" the quality of the nation's air resources. The Clean Air Act identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of 'sensitive' populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops,

vegetation, and buildings. The EPA has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, which are called 'criteria' air pollutants and they include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter less than 10 microns in size (PM10), particulate matter less than 2.5 microns in size (PM2.5), and sulfur dioxide.

The EPA's General Conformity Rule, established under Section 176(c)(4) of the Clean Air Act, provides a specific process for ensuring that federal actions do not interfere with a state's plans to attain or maintain NAAQS. Compliance with the CAA by national forests in California, including prescribed fire authorizations, is achieved under state and local law (e.g., Tuolumne County Air Pollution Control District [APCD]). The California Air Resources Board (CARB) leads this effort under the process established by the California Smoke Management Program (Title 17). The legal basis of the program is found in the Smoke Management Guidelines for Agricultural and Prescribed Burning adopted by the CARB. The Guidelines provide the framework for state and local air district regulators to conduct the program. Elements of the program include registering and permitting of agricultural and prescribed burns; meteorological and smoke management forecasting; daily burn authorization; and enforcement.

Tree stand densities and surface fuels accumulations are far greater than the natural range of variation. These dense, largely contiguous fuel and vegetation conditions have direct, significant contributions to generate large amounts of smoke during proposed prescribed burns, or during potential natural- and human-caused wildfires. The amount of prescribed burning that may occur under the proposed action might cause short-term, sporadic diminished air quality, but they create long-term gains for subsequent reductions in size of wildfires and their associated smoke emissions for up to about 10 years (depending on amount of consumed material and meteorological conditions). The SERAL 2.0 proposed action will comply with the CAA, and burning on NFS lands would not occur unless prior approval is granted by Tuolumne County APCD in coordination with other regional and state agencies and fire events. Management requirements (Chapter 2.12) and best management practices are also included to minimize the impacts to air quality. By following the regulations and procedures outlined above, and by utilizing best available control measures and best smoke management practices, as described in Chapter 2.12, effects to air quality should be predicable and be more manageable than effects from large, unplanned wildfires.

If the proposed actions are not implemented (no action) the potential future wildfire behavior, timing, and amount/intensity of emissions would remain unmanaged. It is highly likely, that if no action is taken, another long-term multi-month, wildfire smoke event would occur, with the potential to impact multiple states.

The wildfire crisis is a public health crisis. As wildfires increases in size and severity, the related public health impacts, including from smoke exposure, will continue to grow. There are negative human health impacts from all forms of wildland fire smoke. At the same time, significantly increasing the application of all forms of wildland fire, including prescribed fire, in a strategic and coordinated manner is needed to mitigate the risk and adverse effects of high severity wildfire and future smoke exposure. USDA, DOI, EPA, and CDC are working together and investing in the mutually important objectives of protecting public health from the impacts of smoke and enabling land management practices that reduce the future risk of large, high severity wildfire events. The SERAL project is a key example of this partnership. USFS, EPA, CDC and the local Tuolumne County Health Department meet biweekly to advance public health preparedness and minimize smoke impacts on the public from the proposed prescribed fire.

Issue 3. The proposed DBH limits will impact the Forest's ability to provide timber (wood product) to local and regional communities and the likelihood of treatment implementation.

Affected Environment

Two sawmills in Tuolumne County are within the analysis area:

1. The Sierra Pacific Industries dimensional lumbermill just east of Sonora, and
2. The Sierra Pacific Industries fencing mill near Chinese Camp.

Two other sawmills are potentially able to haul logs from the project to their facilities economically:

1. The Sierra Pacific Industries mill in Lincoln, Placer County, 104 miles north of Sonora, and
2. The Sierra Forest Products mill in Terra Bella, Tulare County, 188 miles south of Sonora.

In addition, one other facility in Tuolumne County is within the region of impact that can process logs and/or byproducts:

1. The American Wood Fibers plant (formerly California Wood Shavings) just south of Jamestown off Highway 108.

Indicators and Measures

The objective of the SERAL 2.0 project is multi-faceted. Providing economic opportunities to local communities is one aspect of SERAL 2.0's purpose and need (Chapter 1.03) and treatments were proposed, in part, to meet this objective. Volume estimates were considered when selecting and locating treatment areas, however, they did not explicitly eliminate or select any particular area. Volume estimates rather helped to inform the likely treatment mechanism that would be employed to implement the forest thinning objectives. For example, average volume of sawtimber greater than 7 CCF per acre on slopes exceeding 45% best represents a common, real-world, minimum product volume needed in order to mobilize the specialized equipment and operators, to implement a traditional skyline yarding operation. Areas with slopes greater than 45% and an estimated volume of 7 CCF or greater per acre therefore represent, for this analysis, the areas on slopes greater than 45% that would provide wood products.

Mechanical forest thinning acres with wood product *and* DBH limits vary among different land allocations. Additionally, the proposed forest thinning includes variable ranges of density or canopy cover targets. These variations may impact the ability to directly measure the proposed DBH limit's impacts on wood product availability. To account for multiple variations among alternatives, analysis indicators to address Issue 3 are measured at two scales: (1) total; and (2) average per acre.

Post treatment modeled estimates of volume, cost, delivered market value, and net-value were calculated by Dr. John Hogland.

Estimated acres which will provide wood products (i.e., forest thinning): This acreage is presented as the total treatment acres with wood products (i.e., forest thinning).

Volume: Sawlogs and biomass both contribute to volume removed from the landscape, minus leakage. Volume is measured in hundred cubic feet (CCF). Volume estimates were broken down into sawlog and biomass components for the analysis because there are measurable differences between the two.

Post-treatment modeled estimates of volume are presented as total CCF and average CCF per acre for both biomass and sawlog product.

Cost: The cost, in dollars, of the proposed forest thinning to move material from the forest to the relevant sawmill or biomass processing facilities. It is a combination of multiple factors that include: (1) the travel time to move woody materials from a landing to a facility along a road network, 2) the travel time to move woody materials from the forest to landings for in forest processing, and 3) various machine rates and operation costs given harvesting, processing, and hauling systems. Road maintenance or

reconstruction needs were not considered in the modeling to estimate costs. Costs would be elevated proportionally with road reconstruction and maintenance needs.

Post treatment modeled estimates of cost are presented as total dollars and average dollars per acre to move both biomass and sawlogs to processing facilities. .

Delivered Market Value: Delivered market value is the market value of the product removed. In this context, the delivered market value refers to the total dollar amount paid for woody biomass and sawtimber products. It is derived by the amount of removed volume measured in CCF with the proposed forest thinning prescription applied and the market price. Market values vary by species of tree and are variable. Market values for this analysis were based on the estimated values as of August 14, 2020.

DMVs were calculated for each raster by silviculture prescription assigned to that particular raster across the project area.

Post-treatment modeled estimates of delivered market value are presented as total dollars and average dollars per acre for both biomass and sawlog product.

Net-Value: The net-value is the difference between the delivered market value and the cost to implement the proposed forest thinning.

Post-treatment modeled estimates of net-value are presented as total gains or losses in dollars and average gains or losses per acre to move and remove both biomass and sawlogs.

Direct and Indirect Effects

DBH limits are a common treatment constraint included to ensure critical habitat needs of sensitive species are met and are a universal way of complying with management direction aimed at habitat retention and conservation. DBH were included as a means of ensuring compliance with the forest plan as amended by the project-specific forest plan amendments (Table C.02-1). DBH limits also help to address concerns related to the conservation of the California spotted owl.

Although the use of DBH limits included are meaningful and purposeful, it is assuredly true that greater volumes of wood products would be available if the proposed treatments were free from DBH constraints. Similarly, if providing wood products was the project's sole objective, with no additional competing resource objectives or land and resource management plan requirements, then it is also assuredly true that greater volumes of wood products would be provided. However, as stated previously, the objective of the SERAL 2.0 project is multi-faceted and providing wood product to local communities is only one aspect of the purpose and need (Chapter 1.03). Despite the fact that greater volumes of wood products could be provided than will be produced by the SERAL 2.0 proposed actions – the results presented in (Table) demonstrate that wood product is provided.

There are significantly more acres of proposed forest thinning that produce wood products outside of CSO PACs and territories (Table 29). Outside of CSO PACs and territories there is more wood product volume removed for a few reasons; There are more NFS lands outside of CSO PACs and territories available for treatment to meet the restoration needs, these areas have less restrictive DBH limits, and the applied silviculture prescriptions target lower residual stand densities than within CSO PACs or territories.

The proposed forest thinning in CSO PACs provides the lowest mean volume of wood product removed per acre because CSO PACs have a static 20-inch DBH limit. A 20-inch DBH limit measurably reduces the estimated volume of material that may be removed, and subsequently, the net-value of product per acre. Within CSO PACs, the proposed action includes intentional prescription constraints to ensure important habitat characteristics for the California spotted owl are maintained and promoted while treatments to restore landscape resilience are implemented. The analysis presented for Issue 1C and Need 1 demonstrate that implementation of the proposed action does beneficially shift metrics associated with

landscape resilience. Increasing the landscape's resilience to natural disturbance to promote the long-term persistence of important resources while ensuring short term impacts are minimized is the primary objective of SERAL 2.0. Therefore, to meet this objective it is necessary and reasonable to accept that the proposed forest thinning in CSO PACs will result in a lower mean volume of wood product than in other areas across the project area. The proposed forest thinning within CSO PACs will still result in a positive net value and net value per acre from sawlog removal. Ensuring that wood product is provided and increasing the likelihood that treatments will be implemented.

Wood product is also provided in CSO territories and outside of CSO territories. Despite the more restrictive DBH limits in CSO territories compared to areas outside of territories, however, the mean volume of wood product removed per acre is similar among these two areas (Table 29). This similarity suggests that the DBH limits do not measurably impact the wood product available, nor do they make implementing the forest thinning within CSO territories any less likely than areas outside of territories. The similarity between the estimated wood product removed per acre within CSO territories and outside the territories can be explained because in general, territories have a slightly higher average SDI and basal area than areas outside of the territories (e.g., general forest). Therefore, there is potentially more standing volume within territories than outside.

Despite a higher DBH limit for shade tolerant species in areas outside of territories, the cost to remove volume outside of CSO territories is more expensive than within CSO territories. There is a much greater proportion of forest thinning which will require skyline or helicopter operations which are inherently more expensive. Nonetheless, similar to forest thinning within CSO PACs, forest thinning within CSO territories and outside of territories result in a positive net value and net value per acre from sawlog removal. Indicating that the proposed action, despite the DBH limits, is effective at providing wood product to the local community which helps to increase the likelihood of implementation.

Table 29: Assessment of potential wood product, volume, and revenue produced by the proposed forest thinning treatments.

Indicator / Measure		All Lands	CSO PACs	CSO Territories	Outside of CSO PACs and Territories
Acres of Forest Thinning with Wood Product	Biomass	31,476	2,793	8,703	19,979
	Sawlogs	34,001	2,796	9,218	21,986
Total Volume Removed (CCF)	Biomass	64,259	3,311	16,656	44,292
	Sawlogs	394,283	10,351	114,611	269,320
Mean Volume Removed per Acre (CCF / Acre)	Biomass	2.0	1.2	1.9	2.2
	Sawlogs	11.6	3.7	12.4	12.2
Total Cost to Remove Volume (Dollars)	Biomass	$8,647,591	$475,619	$2,122,093	$6,049,878
	Sawlogs	$57,085,315	$1,475,910	$14,862,060	$40,747,345
Mean Cost Per Acre to Remove Volume (Dollars / Acre)	Biomass	$275	$170	$243	$303
	Sawlogs	$1,679	$528	$1,612	$1,853
Total Delivered Market Value of Volume Removed (Dollars)	Biomass	$2,141,719	$110,369	$555,126	$1,476,223
	Sawlogs	$70,778,202	$1,874,521	$20,822,831	$48,080,850
Mean Delivered Market Value Per Acre of Volume Removed (Dollars / Acre)	Biomass	$68	$40	$64	$74
	Sawlogs	$2,081	$670	$2,259	$2,187
	Biomass	($6,505,872)	($365,250)	($1,566,967)	($4,573,655)

Indicator / Measure		All Lands	CSO PACs	CSO Territories	Outside of CSO PACs and Territories
Total Net Value (Dollars)	Sawlogs	$13,692,887	$398,611	$5,960,771	$7,333,505
Net Value per Acre (Dollars / Acre)	Biomass	($206.69)	($130.77)	($180.05)	($228.92)
	Sawlogs	$402.72	$142.56	$646.64	$333.55

Cumulative Effects

As always, sawmill and biomass processing facility capacity is limited locally and regionally due to their limited existence and distribution. Capacity issues have become more limiting due to the more frequent regularity of large-scale wildfires and the urgency of post-fire response needs across the Sierra Nevada. Hazard tree abatement in response to wildfires alone provides a steady stream of wood product to the local and regional facilities. Post-wildfire response to nearby wildfires often diverts all local and regional resources to focus on salvage actions for the first few years following a wildfire. When this occurs wood product removal in "green" project areas are often postponed. Nonetheless when wood products are removed they are complementary to any other wood product producing actions which keep the sawmills and biomass facilities operating with a steady flow of product and to meeting the Forest's volume targets. The wood product that would be provided as a result of the SERAL 2.0 forest thinning would never take priority over wildfire response actions in the region. The wood product that would be provided as a result of the SERAL 2.0 forest thinning is, however, a Forest priority and has been factored into the zones program of work over at least the next 10 years and SERAL 2.0 combined with the first SERAL project will be the two largest contributors of wood product from the Stanislaus National Forest during that time.

Issue 4A. The proposed action may impact Inventoried Roadless Area (IRA) characteristics and diminish their eligibility for future wilderness designation.

Affected Environment

There are 15,185 acres of inventoried roadless areas (IRAs) within the SERAL 2.0 project area. The Stanislaus National Forest Land and Resource Management Plan Record of Decision (USDA 1991) described that the IRAs identified in the RAREII effort were allocated to various management areas, including: Wild and Scenic River; Near Natural; Wildlife; SIA; RNA; Scenic Corridor; General Forest; and Winter Sports (USDA 1991, ROD). Further direction for IRAs was provided in the 2001 Roadless Area Conservation Rule (36 CFR 294). The intent of the 2001 Roadless Rule is to provide lasting protection for IRAs within the National Forest System in the context of multiple-use management. In particular, the direction is designed to maintain the roadless characteristics of the IRAs, which consist of: (1) high quality or undisturbed soil, water, and air; (2) sources of public drinking water; (3) diversity of plant and animal communities; (4) habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; (5) primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation; (6) reference landscapes; (7) natural appearing landscapes with high scenic quality; (8) traditional cultural properties and sacred sites; and (9) other locally identified unique characteristics (36 CFR 294). Vegetation management such as that included in the proposed action, is not specifically prohibited within IRAs within the 2001 Roadless Areas Rule and the Rule suggests that such uses are "best reviewed through local land management planning" (36 CFR 294, pp. 3244, 3245, and 3250).

Indicators and Measures

Acres of proposed treatments within IRAs: In order to assess the potential for the proposed treatments to impact the characteristics IRAs we assessed the type and quantity of treatments proposed designated

IRAs. The acres of proposed treatments are calculated for each treatment type: forest thinning, fuel reduction (mastication or machine piling); and prescribed fire.

For this analysis, the fuelbreak treatment acres are combined with the other like forest thinning, fuel reduction, and prescribed fire. The exception is the addition of the hand pile and burn treatment for areas of steep slopes on fuelbreaks, which is calculated and reported separately, as it is not proposed as part of the other treatment types.

Qualitative description of the potential for the proposed action to impact the roadless characteristics of IRAs: A qualitative assessment of treatments proposed within IRAs determines the potential impacts to the roadless area characteristics and whether the proposed actions would diminish eligibility for future wilderness designation.

Direct and Indirect Effects

No forest thinning or salvage of insect-, disease-, drought-, or fire-killed trees are proposed within IRAs (Table 30).

The proposed fuel reduction treatments and prescribed fire in general cause less ground disturbance and the proposal does not allow for newly constructed or temporary roads to be created to implement the treatments. Therefore, potential impacts to the IRA characteristics are expected to be minimal or beneficial (Table 31).

Table 30. Acres of proposed treatment within IRAs

Proposed Treatment Within IRAs	Proposed Action	No Action
Forest Thinning - Aerial	0	0
Forest Thinning -Ground	0	0
Fuel Reduction	3,344	0
Prescribed Fire	2,285	0
Salvage	0	0

Table 31. Qualitative assessment of the proposed actions potential impacts of the IRA's roadless characteristics.

Roadless Area Characteristic	Effect Determination
High quality or undisturbed soil	Fuel Reduction treatments such as mastication and machine piling and burning will have some short-term effects to soil surface layers, but they rarely negatively affect soil functions and quality. Woody fuel will be added to the soil surface in mastication or piled for burning. Mechanical equipment tracks can minimally depress or displace soil surface layers, but unlike forest thinning treatments, no concentrated skid trails (areas of severe soil disturbance) are created. Finally, no temporary road construction is proposed in IRA fuel reduction treatments. Prescribed fire treatments should have no effects to soil quality beyond those that would occur naturally with wildfire.
Sources of public drinking water	No effect. Project management requirements and BMPs related to equipment refueling and soil disturbance will ensure the treatments will not cause impacts to public drinking water sources.
Diversity of plant and animal communities	Mastication and machine piling and burning not impact the diversity of plant and animal communities in the Stanislaus National Forest.

Roadless Area Characteristic	Effect Determination
Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land	Since potential impacts to the IRA characteristics are expected to be minimal or beneficial, habitat for aquatic species would be maintained in roadless areas.
Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation	The proposed fuel reduction treatments will not permanently affect the availability of primitive or semi-primitive non-motorized or semi-primitive motorized recreation. A temporary disturbance to a non-motorized users experience may occur if and during the implementation of the proposed mastication and machine piling and burning. The disturbance may be associated with temporary disruption in access to or through the implementation area. The proposed fuel reduction will not cause a change to the recreation opportunity spectrum in the treatment area, nor will the proposed fuel reduction change the type of dispersed recreation available in the area.
Reference landscapes	The proposed fuel reduction will not impact reference landscapes. The proposed fuel reduction will leave behind short-lived, temporary 'signs' that fuel reduction treatments were implemented. Fuel reduction treatments often enhance the visual quality of an area and increasing visibility of interesting and unique landscape features which were not visible prior to the treatment.
Natural-appearing landscapes with high scenic quality	The proposed fuel reduction treatments may temporarily impact the natural appearance of the landscape. Mastication and machine piling are intended to treat the smallest-diameter trees, or other understory vegetation in a manner than mimics a natural wildfire. In forested settings, because only the smallest material is treated, neither mastication or machine piling and burning generally affect the overall canopy structure of forested areas.
Traditional cultural properties and sacred sites	The proposed treatments will not affect traditional cultural properties or sacred sites. Compliance with the National Historic Preservation Act was completed by using the Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Processes for Compliance with Section 106 of the National Historic Preservation Act For Management Of Historic Properties By The National Forests Of The Pacific Southwest Region" (Regional PA), signed February 2013, as amended 2018. In order to use the Regional PA, the project has to have a determination of no effect or no adverse effect. All eligible or unevaluated archaeological sites will be protected from project activities using Standard Protection Measures outlined in the Regional PA.

Cumulative Effects

Vegetation management within IRA areas is very limited. At present there is very little overlap with reasonably foreseeable future actions. We estimate that approximately 486 acres of the area of potential hazard tree management may occur within IRAs in the SERAL 2.0 project area, most of which occur within the Dodge Ridge Ski resort permit area. The decision for the hazard tree management project has not yet been signed, and the project still needs to go through the administrative review process. Further, at present we do not know to what degree, if any, hazard trees are present within the IRAs in the SERAL 2.0

project area. If hazard trees occur within the Dodge Ridge Ski Permit area, they will likely be mitigated to increase human safety in the recreation area.

The SERAL 2.0 proposed actions within IRAs are limited to fuel reduction treatments and prescribed fire, which cause minimal ground disturbance and no new or temp roads will be constructed. Therefore, the activities proposed in SERAL 2.0, in combination with the potential hazard tree removal within IRAs are not anticipated to impact the characteristics of IRAs or impact their eligibility for future wilderness designation.

Issue 4B. The proposed vegetation treatments may impact the characteristics of eligible and designated wild and scenic river segments.

Affected Environment

Three eligible (suitable) and one designated Wild and Scenic River run through the SERAL 2.0 project area. To be eligible for inclusion in the National Wild and Scenic Rivers System pursuant the Wild and Scenic Rivers Act, a river segment must be free-flowing and, in combination with its adjacent land area, possess one or more outstandingly remarkable values (ORVs). “Free-flowing” as applied to any river or section of a river means existing or flowing in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway. Categories of ORVs, as defined in the Act, include scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values (Wild and Scenic Rivers Act, Section 1(b)).

The eligible and designated Wild and Scenic River (WSRs) in the SERAL 2.0 project area are listed in Table 32. Section 2(b) of the Wild and Scenic Rivers Act specifies and defines three classification categories for Wild and Scenic rivers: Wild; Scenic; or Recreational (Table 32).

Table 32. WSR segments and ORVs potentially affected by the proposed actions.

Wild and Scenic Segment	Status	Classification	ORVs	Length (miles)	Project Area within 0.25-mile Buffer (acres)
Tuolumne River	Designated	Wild	Cultural, Fish/Wildlife, Geologic, Recreation, Scenery	9.5	1502
Clavey River	Suitable	Wild	Scenic; Cultural, Historic, Ecology; Fish; Wildlife	21.7	3371
Clavey River	Suitable	Scenic	Scenic; Cultural, Historic, Ecology; Fish; Wildlife; Recreational	14.8	2299
North Fork Stanislaus River	Suitable	Wild	Scenic, Recreation	<0.1	84
Stanislaus River	Suitable	Wild	Scenic, Recreation	1.2	217
Middle Fork Stanislaus	Suitable	Wild	Scenic, Recreation	0	5

Each of these river's segments are free-flowing and have one or more ORVs identified which make them unique among rivers of the United States (USDA 2017). The noticeable or distinctive ORVs identified for each of the segments vary (Table 32). Treatments are only proposed within the Clavey River WSR 0.25-mile buffer, therefore the remaining WSRs will not be addressed further in this analysis.

The Stanislaus National Forest Wild and Scenic River Study (USDA 1991) defines the ORVs listed in Table 32 for the Clavey River as follows:

Clavey River

Scenic: outstanding Variety Class A landscape includes a deep, V-shaped, river-cut canyon through metasedimentary rock. The river provides a variety of water forms including rapids, cascades and pools. Vegetation patterns are varied, including scattered ponderosa pine and oak/grass woodland. The scenic values of the lower Clavey are similar to the those of the lower Tuolumne Wild and Scenic River.

Ecologic: the largest stand of aspen on the Forest is located at Bell Meadow. It is the largest stand of aspen in the Sierra, south of the Eldorado National Forest. The meadow also has a rich variety of habitats including wet and dry meadow, meadow shrub and conifer forest.

Historic / Cultural: Jedediah Smith ascended the Clark Fork in 1826, traveling east out of California. The Bartleson-Bidwell party crossed the Sierra crest and descended into the river corridor, in 1841, traveling west. A relatively undisturbed section of the 1853 Emigrant Route, used by miners crossing the Sierra crest into California, is present.

Recreation: hiking and fishing are the popular dispersed activities. Access is limited and portions are remote and wild, resulting in a rare opportunity for solitude and non-motorized recreation experiences, below the snow and available all year. This portion of the Clavey has been traversed by expert kayakers. It is a native trout fishery, and a State designated Wild Trout Stream which is significant to anglers. Hiking and swimming are the popular activities near the Clavey's confluence with the Tuolumne Wild and Scenic River.

Fish: one of the first streams in California to be designated as a Wild Trout Stream, representing a mid to low elevation trout stream in a remote location. Due to extensive planting of non-native trout species and the illegal introductions of nonnative warm water fish species, few other streams in the Sierra contain only the original assemblage of fish species. The Clavey River may be the only "rainbow trout" river left, in the Sierra Nevada, with its original fish assemblage still intact and relatively unaffected by introduced species.

Wildlife: A large tract of late seral stage forest habitat is centered on the Clavey River between Reed Creek and Road 3N01. Five SOHAs and two fisher reproductive units are located on or adjacent to the river, within 8,000 acres of older mature forest habitat. It is unusual to have this much older mature forest habitat at this elevation in the Sierra.

Indicators and Measures

Acres of Proposed Treatment within ¼ miles buffer of WSR Corridor: In order to assess the potential for the proposed treatments to impact the characteristics of the Clavey wild and scenic river segments located within the SERAL 2.0 project area we assessed the type and quantity of treatments proposed within a quarter-mile buffer of the WSR corridor. Doing so enabled a qualitative assessment of the proposed treatments on the ORVs associated with each segment.

The acres of proposed treatments within ¼ mile of the WSR corridors were calculated for each treatment type: forest thinning, understory and surface fuel reduction (mastication or machine piling); and prescribed fire. For this analysis, the fuelbreak treatment acres are combined with the other like forest thinning, fuel reduction, and prescribed fire.

No salvage of insect-, disease-, or drought-killed trees or fire salvage would occur within the ¼-mile WSR buffer.

Water Quality Assessment: A qualitative assessment of water quality is needed to determine if water quality in the eligible Wild and Scenic River segments can be maintained under the action alternatives.

Qualitative Assessment of the Impacts of the ORVs of each WSR Segment: A qualitative assessment of treatments proposed within each Clavey river segment determines the potential impacts of the proposed actions to the ORVs and whether the proposed actions would diminish the eligibility of the suitable WSR segments to be designated in the future.

Free-Flowing Condition Assessment: A qualitative assessment of the free-flowing condition is needed to determine if the proposed action would impact the free-flowing condition of the river segments.

Direct and Indirect Effects

Table 33. Summary of proposed treatments within Wild and Scenic River corridor.

Proposed Treatment Within WSR		Proposed Action (acres)	No Action (acres)
Tuolumne River	Forest Thinning	0	0
	Fuel Reduction	0	0
	Prescribed Fire	0	0
	Salvage	0	0
Clavey River	Forest Thinning	0	0
	Fuel Reduction	824	0
	Prescribed Fire	4	0
	Salvage	0	0
North Fork Stanislaus River	Forest Thinning	0	0
	Fuel Reduction	0	0
	Prescribed Fire	0	0
	Salvage	0	0
Stanislaus River	Forest Thinning	0	0
	Fuel Reduction	0	0
	Prescribed Fire	0	0
	Salvage	0	0
Middle Fork Stanislaus	Forest Thinning	0	0
	Fuel Reduction	0	0
	Prescribed Fire	0	0
	Salvage	0	0

Water Quality

Maintaining high water quality is needed to maintain the WSR values. As seen in Table 33, proposed treatments within the ¼ mile buffer of the Clavey River's eligible wild and scenic river segments are dominated by fuel reduction which is accomplished via mastication or machine piling and burning. While these methodologies do create some ground disturbance which could cause some erosion and sedimentation there are many management requirements and BMPs which are followed to mitigate water quality impacts to the river. One of the objectives of implementing these treatments is to reduce fuels, and subsequently reduce the likelihood of future stand-replacing wildfire. Stand-replacing wildfire would have much larger water quality impacts than the fuel reduction treatments, because mastication does not consume extensive areas of organic matter. Mastication rearranges the fuels and leaves them on the landscape as ground cover until future prescribed or wildfire occur. Therefore, while some sedimentation could occur as a result of the proposed action, it is anticipated to be minimal and of short duration and is not expected to affect the long-term beneficial uses and purposes for which these river segments were made eligible.

ORV: Scenic

The proposed fuel reduction and prescribed burning will not alter the broad, deep and rugged, V-shaped river or the variety of water forms such as rapids, cascades, and pools. One of the goals of fuel reduction and prescribed fire is to reduce fuel loading, which could help prevent large stand-replacing wildfire. Future stand-replacing wildfire could impact the vegetations patterns for which the WSR segments were

made eligible – scattered ponderosa pine and oak woodland. The proposed fuel reduction and prescribed fire treatments are therefore anticipated to protect scenic values.

ORV: Ecologic

The proposed fuel reduction and prescribed fire treatments will not impact the aspen stand at Bell Meadow or the meadow itself.

ORV: Recreation

The proposed fuel reduction and prescribed burning will not affect hunting and fishing opportunities within the Clavey River WSR corridor. No temporary road construction within the WSR corridor is included as part of the proposed action within WSR corridors, so the opportunity for solitude and non-motorized recreation experiences would not be impacted.

Free-Flowing Condition

Maintaining the free-flowing condition of the WSR segments is necessary to maintain their WSR values. The fuel reduction and prescribed burning treatments proposed would not affect the existing flow regimes of these rivers, as these actions would not impound, divert, straighten, riprap, or in any way modify the waterway. Constriction of flow is not anticipated as a result of stream crossings, as no temporary roads or stream crossings are proposed within the ¼ mile buffers.

Cumulative Effects

Past activities within the WSR ¼-mile buffers are limited. Outside of those proposed in SERAL 2.0, future proposed activities are limited to those needed to maintain the FERC facilities in the area. This could include treatments such as thinning, biomass removal, pile burning, mastication, salvage, hazard tree removal, and treatment of noxious weeds on up to 22 acres.

Maintaining the free-flowing condition of the eligible WSR segments is necessary to maintain the WSR values. The past activities described above have not affected the free-flowing condition of the WSR segments. The treatments proposed, as well as other future activities (FERC), would not affect the free-flowing condition of the rivers. Naturally occurring events, such as landslides or trees falling into the river could affect the free-flowing condition, but these natural events would not affect the eligibility of the WSR segments.

Maintaining high water quality is also needed to maintain WSR values. Management requirements have been designed to minimize water quality impacts. This includes requirements such as retaining ground cover during prescribed fires and restoring fire lines following prescribed fires. While some sedimentation could occur as a result of the action alternatives and other future activities (FERC), it is anticipated to be minimal and of short duration and is not expected to affect the long-term beneficial uses and purposes for which the river was made eligible.

The activities proposed in SERAL 2.0, in combination with past activities and other future activities (FERC) are not anticipated to impact the ORVs of the eligible and designated WSR segments.

Issue 5. The proposed forest thinning may affect the amount and distribution of mature and old growth forests.

Affected Environment

The SERAL 2.0 project proposes 790-acres of forest thinning and 1,383-acres of mastication or machine pile and burning within the existing 3,345-acres in old-growth forest conditions (Table 34).

Old growth forests are defined by forest type, trees per acre by diameter class, site soil productivity class and stand age (FS-1215a with unpublished edits from Mature and Old Growth Working Group). Existing

old growth forest in SERAL 2.0 was modelled using estimates of trees per acre by diameter class derived from F3 modeling (Huang et al. 2018) and site productivity and forest type from Region 5 Existing Vegetation and Strata datasets. Stand age was not used as data was not available across the project area. This may lead to some overestimation of the frequency of old growth in the project area.

Table 34. Acres of existing, and proposed treatments within old growth forested conditions.

Forest Type	Existing Old Growth	Forest Thinning	Fuel Reduction
Red Fir	24	0	19
White Fir	14	3	3
Lodgepole Pine	355	81	192
Conifer Mixed Forests	236	139	11
Ponderosa Pine	104	7	0
Jeffrey Pine	2,040	542	705
Mixed Subalpine	573	17	452
Grand Total	3,345	790	1,383

Forest thinning and fuel reduction treatments have been strategically located in areas most at risk of high severity wildfire and most departed from the natural historic range of variation to increase the landscapes resilience to natural disturbances and future conditions such as insects and disease infestations, drought, wildfire, and climate change. The proposed mastication and machine piling and burning are not able to remove trees above the diameter thresholds associated with old-growth forest conditions and therefore will not impact the amount and distribution of old-growth forest conditions in the project area.

In general forest thinning *could* potentially impact the amount and distribution of old-growth forest conditions, but SERAL 2.0's proposed action includes a suite of diameter limits and other constraints designed to maintain and promote the habitat needs and persistence of sensitive species who rely on large trees or patches of dense stands composed of large trees and maintain and improve old-growth forest conditions.

For example, the proposed action allows shade-intolerant trees (firs, cedars) up to 34-inches DBH to be removed, in some areas, where there is at least one 30-inch (or greater) shade-intolerant tree (pines, oaks) left within one tree length of the shade-intolerant tree being removed. This is to more effectively promote forest resilience by increasing the abundance and distribution of fire-resilient and resistant shade-tolerant species (pines, oaks). Many decades of fire suppression have led to a major shift from a dominance of fire-resilient species such as pines and oaks, to the dominance of shade-tolerant firs and cedars. The proposed action is designed to correct this imbalance by removing the fire-sensitive shade-tolerant tree species that should not have survived under a natural fire regime and which are outcompeting the other fire-resilient and resistant species.

The proposed action also allows trees up to 40-inch DBH to be removed within a meadow within 66-feet of an aspen stand or within 66-feet of a proven rust resistant sugar pine. There are only 42 mapped acres of meadows, 163-acres of aspen stands, and 6 proven rust resistant sugar pine in the project area. There are no proven rust resistant sugar pine within old-growth conditions and only 1.3-acres of mapped meadows and 14-acres of aspen stands within old-growth forest conditions. The preservation of meadows and aspen stands are important to the overall landscape diversity and their health and persistence are equally important. Neither meadows or aspen stands themselves meet the characteristics of old-growth forest conditions therefore maintaining their integrity does not impact the amount or distribution of old-growth forests.

Indicators and Measures

Change in Total Acres of Old-Growth Forest Conditions: A reduction in the amount and distribution of old-growth forest conditions might indicate the proposed action conflicts with EO 14072 and the Forest

Service's national policy direction to maintain and improve mature and old growth forest conditions. To assess the potential change in acres of old-growth forest conditions we calculated the pre- and post-treatment acres of old-growth forest conditions by dominant forest type as well as the modelled change.

Adjusted Expected Change in Acres of Old-Growth Forest Conditions: Since these calculations are based on modeled post-treatment estimates we also provide the adjusted expected change based on the tree species-specific DBH limits included in the proposed action.

Direct and Indirect Effects

The definition of old-growth conditions vary by forest type and thus the potential impacts of the proposed forest thinning within old-growth forest conditions varies among the forest types (Table 35).

The SERAL 2.0 proposed action will not impact the amount or distribution of old-growth forest conditions in most forest types (Table 35). Where soil productivity is classified as "low" the minimum diameters and trees per acre (tpa) thresholds for classifying areas as old-growth are fairly low: e.g., >=29-inches and 5 tpa for conifer mixed forests; >=29-inches and 8 tpa for white fir; and >30-inches and 1 tpa for Jeffrey pine.

Table 35. A comparison of the modelled pre- and expected post-treatment acres of old growth forest conditions.

Forest Type	Pre-Treatment (No Action)	Post-Treatment (Proposed Action)	Modelled Change	Adjusted Expected Change
Red Fir	24	24	0	0
White Fir	14	13	-1	-1
Lodgepole Pine	355	355	0	0
Conifer Mixed Forests	236	196	-40	< 40
Ponderosa Pine	104	104	0	0
Jeffrey Pine	2,040	1,984	-56	0
Mixed Subalpine	573	573	0	0
Grand Total	3,346	3,248	-98	-< 41

The modelled post-treatment estimates indicate that the proposed forest thinning may reduce the amount of old-growth forest conditions in the white fir, conifer mixed forest, and Jeffrey pine forest types. These potential reductions can be explained and supported. Conifer mixed forests are composed of shade-intolerant pines and shade-tolerant firs and cedars. The proposed action allows shade-intolerant trees (firs, cedars) up to 34-inches DBH to be removed, in some areas, where there is at least one 30-inch (or greater) shade-intolerant tree (pines, oaks) left within one tree length of the shade-intolerant tree being removed.

Therefore, in conifer mixed forests with low soil productivity the proposed action could reduce the tpa of trees above the diameter threshold of 29-inches to below 5 tpa in limited instances. Since the proposed action includes the requirement to leave at least one shade-intolerant tree greater than 30-inch DBH within one tree length of a shade-tolerant tree being removed, we expect the frequency of greater than 30-inch shade-tolerant trees being removed will be low and the tpa of trees greater than 29-inches will only drop below 5 tpa where the tpa is at or very near 5 prior to treatment. Suggesting that the conditions of the area are just barely old-growth conditions.

Similarly, old-growth forest conditions composed of white fir may also be reduced in instances where there is at least one 30-inch (or greater) shade-intolerant tree (pines, oaks) left within one tree length of the white fir potentially being removed. Modelled estimates indicate that this would only occur on one acre in the project area.

In Jeffrey pine forest types with low soil productivity the minimum trees per acre to meet old-growth forest conditions is only one tree greater than 30-inches DBH per acre. This is a very low threshold to

represent old-growth forest conditions. As stated above, the proposed action does not allow any Jeffrey pine over 30-inch DBH to be thinned, therefore, in a truly pure Jeffrey pine stand, all trees greater than 30-inches would be retained and the acres of old-growth forest conditions retained as well. However, in situations where Jeffrey pine is the dominant forest type but large white fir or cedars are contributing to the one tree per acre (or greater) threshold for old-growth conditions, the acres meeting old-growth conditions may be reduced by the proposed forest thinning. This reduction is not contradictory to EO 14072 or the Forest Service's national policy direction to maintain and improve mature and old-growth forest conditions, because the trees being thinned are specifically being selected to decrease shade-tolerant, more fire prone trees in order to promote the health, vigor, and persistence of more shade-intolerant, fire resistant trees (pines). The thinning of fir or cedars greater than 30-inch DBH and up to 34-inches DBH will help to release the smaller Jeffrey Pine and promote the growth, health, and resilience of the Jeffrey pine in the stand. Once any of the Jeffrey pine present in the area exceed 30-inch DBH the temporary reduction in total acres of Jeffrey pine old-growth forest conditions will be restored and the conditions will be more resilient to future disturbances because the abundance of shade-tolerant species has been reduced.

The proposed action includes the allowance to cut shade-tolerant trees up to 34-inches, intentionally, to more effectively promote forest resilience by increasing the abundance and distribution of fire-resilient and resistant shade-tolerant species (pines, oaks). Many decades of fire suppression have led to a major shift from a dominance of fire-resilient species such as pines and oaks, to the dominance of shade-tolerant firs and cedars. The proposed action is designed to correct this imbalance by removing the fire-sensitive shade-tolerant tree species that would not have survived under a natural fire regime and which are outcompeting other fire-resilient and resistant species. Doing so will improve the health, vigor, and resiliency of the residual trees and promote conditions that will support future old-growth forests.

Cumulative Effects

Does the proposed forest thinning within old-growth forest conditions, when added to other reasonably foreseeable future actions, cumulatively impact the amount and distribution of old-growth forests across the SERAL 2.0 project area?

The analysis of direct and indirect effects demonstrates that the SERAL 2.0 proposed actions will benefit the overall health and resilience of the existing old-growth conditions across the project area and promote conditions that will support future old-growth forests in other areas as well. The other reasonably foreseeable future actions planned on national forest system lands within the project area were also designed to increase forest health and increase the landscapes resilience to natural disturbances such as insect-, disease-, drought-, and wildfire. Each of these other projects limit forest thinning from removing trees greater than 30-inches DBH and authorized forest thinning on a limited number of acres (Table F.01-1) Therefore, these other projects on federal lands do not individually affect the amount or distribution of old-growth forest conditions in the project area. Cumulatively, SERAL 2.0 and the other reasonably foreseeable future actions incrementally help to maintain the existing amount and distribution of old-growth forest conditions as well as promote conditions that will support future old-growth forest conditions. Private timber harvest lands do not contain old-growth forest conditions.

Issue 6. Delineating a circular territory could result in an insufficient quantity and quality of habitat conserved and protected for CSO as compared to home range core areas (HRCA).

Affected Environment

The existing Stanislaus National Forest Land and Resource Management Plan (Forest Plan) directs that HRCAs are to be delineated within 1.5 miles of a CSO activity center encompassing 1,000 acres

(including the 300-acre PAC acres) of the best available CSO habitat in as compact arrangement as possible in closest proximity to the owl activity center in descending order of priority. Additional standards and guidelines are included in the existing Forest Plan to retain large trees (S&G 6) and closed-canopy cover (S&G 7) while implementing fuel reduction and other mechanical thinning treatments (USDA Forest Service 2017).

Like the first SERAL, SERAL 2.0 includes project-specific forest plan amendments which shift management direction to delineate 1,000 acre-circle territories centered on document CSO nest sites or roosts sites if nest locations are unknown, rather than HRCA delineations (LAND-SERAL-WILDLIFE-02) (Appendix C, Table C.02-1). The proposed action also proposes to adopt standards and guidelines (SPEC-CSO-STD-01, SPEC-CSO-STD-05, SPEC-CSO-STD-06) intended to maintain and promote sustainable and resilient owl territories and to foster the development of highest-quality habitat and habitat connectivity (Appendix C, Table C.02-1)).

Indicators and Measures

This issue focuses solely on the proposal to shift from HRCA delineation to circular territory delineations.

Change in Total Acres Delineated: Assessing the change in total acres delineated as a result of shifting from HRCA to territory provides context to the magnitude of the change, if any. Those concerned about the shift and delineation believe that HRCAs cover more acres than territories and therefore "protect" more acres. This indicator assesses that assertion.

The change in total acres delineated will be calculated as territory acres minus HRCA acres (current). Positive values indicate that territories represent a larger area than HRCAs and negative values indicate that HRCAs cover a larger area than territories.

Change in Acres of Highest-Quality Habitat Delineated: Assessing the change in highest-quality habitat *delineated* (emphasis added) requires the assumption that highest-quality habitat is only *protected* (emphasis added) when the highest-quality habitat is located within a HRCA or territory.

The change in total acres of highest-quality habitat *protected* (emphasis added) is calculated as acres of highest-quality habitat located within territories delineated as 1,000-acre circles around activity centers minus the acres of highest-quality habitat located within HRCAs (current). Positive values indicate a greater quantity of highest-quality habitat is *protected* (emphasis added) within territories and negative values indicate that a greater quantity of highest-quality habitat is *protected* (emphasis added) within HRCAs.

Change in Acres of Best-Available Habitat Delineated: Assessing the change in best-available habitat *delineated* (emphasis added) requires the assumption that best-available habitat is only *protected* (emphasis added) when the best-available habitat is located within a HRCA or territory.

The change in total acres of best-available habitat *delineated* (emphasis added) is calculated as acres of best-available habitat located within territories minus the acres of best-available habitat located within HRCAs (current). Positive values indicate a greater quantity of best-available habitat is *delineated* (emphasis added) within territories and negative values indicate that a greater quantity of best-available habitat is *delineated* (emphasis added) within HRCAs.

Direct and Indirect Effects

Owls benefit from mature forests with a mosaic of vegetation types and seral stages. A mosaic condition of small open areas or gaps and edges interspersed with highest-quality nesting/roosting habitat is considered an important predictor for owl occupancy and reproduction. Circular territories rather than Home Range Core Areas (HRCA) better recognize the need to manage toward NRV and fine scale habitat heterogeneity that recent research shows owls prefer for nesting, roosting, and foraging. In contrast, HRCA focus mainly on canopy cover over a large area which may result in homogenization,

densification, and continuous fuel profiles that increase the risk of sustained crown fire. Circular territories also better recognize how owls are central place foragers (i.e., tend to focus activities in a circular pattern). In contrast, HRCA delineation in practice, often result in more "amoeba" like or long linear features that may not actually be defended by owls (an owl territory is the area defended by a resident pair).

The quantity and quality of the CSO habitat currently encompassed by existing HRCAs and the quantity and quality of CSO habitat encompassed by the proposed shift to 1,000-acre territory circles are presented in Table 36. The acres reported, are inclusive of the PAC acres which occur within both territories and HRCAs. Where acres overlapped within a single category (territory or HRCA) those acres were not counted twice. For example, it is common, particularly in HRCAs, for multiple individual HRCAs to share many of the same acres. Overlap occurs among individual territories when delineating 1,000 acres territories as well, but not to the same degree.

Table 36. Comparison of habitat quality within delineated territories and HRCAs (acres).

Indicator	Territory	HRCA	Change	Shared
Total Acres Delineated	36,135	28,543	7,592	19,371
Highest-Quality Habitat (5D/5M)	5,011	5,275	-264	4,171
Best-Available Habitat (4D/4M)	22,529	19,372	3,157	12,485
Private Property	4,208	109[1]	4,099	68

[1] In practice HRCAs are only delineated to include NFS lands and do not include private property. The 109 acres reported here are a result of inaccurate delineations and slight shifts in ownership lines over time.

HRCAs have not been delineated for 11 CSO PACs, therefore the territories associated with those 11 PACs are not included for this Issue 6 analysis. The total acres of delineated territories presented in Table 36 do not reflect the total acres of CSO territories across the project area. There are more acres of territories than reported here.

Delineating 1,000-acre territory circles around activity centers results in more unique acres delineated than HRCAs based on existing delineations and approximately 68% of the existing HRCAs would become part of the new territories (Table 36). Comparatively, territories contain slightly less highest-quality habitat than HRCAs, but both HRCAs and territories contain significantly more best-available habitat than highest-quality because this is what is available on the landscape.

Territory delineations do include acres on private land, which has been identified as a point of concern in public feedback because the Forest Service has no control over the management of the private lands. Nonetheless, there are more unique territory acres delineated than HRCAs even if the acres on private property are not included. Further, the overlap with private property was considered during the CSO territory desired condition assessment and development of the proposed action. Considerations of the potential for private lands to be clear-cut were factored into the design of the proposed action and documented in Appendix B (Table B.02-5).

This assessment demonstrates broadly that shifting to territories from HRCAs does not fundamentally result in an insufficient quantity or quality of California spotted owl habitat managed for the California spotted owl.

Cumulative Effects

In light of the conclusion drawn above, that shifting to territories from HRCAs would not fundamentally result in an insufficient quantity or quality of California spotted owl habitat protected, but rather lead to an increase in the quantity of lands managed specifically for the California spotted owl habitat, including quality habitat. This shift has the potential to contribute, cumulatively to California spotted owl preservation across the landscape. Conversely, because the analysis demonstrated that territory

delineations would not result in an insufficient quantity of California spotted owl habitat protected, included quality habitat, the shift to territories would not cause any detrimental or negative cumulative effects when added to other current or reasonably foreseeable future actions. The more acres of California spotted owl habitat that are maintained and protected on NFS lands in the SERAL 2.0 project area, the more likely spotted owl persistence, reproduction, and population growth may occur, including onto neighboring non-federal lands and into areas outside of the project area.

Issue 7. The proposed use of herbicides to treat non-native invasive plants and to maintain fuelbreaks may adversely affect human health and the health and diversity of other native species, including local and migratory bird species.

Affected Environment

Humans – Humans can be inadvertently exposed to herbicides during application from spray drift and a risk of exposure from accidental spills, leaks from equipment failure, and concerns with storage, transport, and disposal. There is also a risk of exposure when coming into contact immediately following the application of herbicide on wetted vegetation.

Aquatic Wildlife – Aquatic species in the project area could potentially be exposed to herbicides from the treatments proposed for non-native invasive weeds and fuelbreak maintenance. Fish, aquatic invertebrates, amphibians, macrophytes and algae are present in the project area.

Terrestrial Wildlife – Terrestrial species in the project area could potentially be exposed to herbicides from the treatments proposed for non-native invasive weeds and fuelbreak maintenance. Birds and mammals are present across all proposed treatment acres.

Botany –Twenty seven (27 species of non-native and invasive plants have been found within the project area. Population sizes vary among the species and the use of herbicides to control or eradicate their occurrences is proposed to occur within these known populations. As such the proposed use of herbicides is limited to approximately 770 acres (Map 2) — and an additional 20% over the currently mapped acreage to account for population spread prior to treatment. Potential risks of herbicides to Federally listed and sensitive plant species include overspray and wind drift of herbicide. Buffers around known Federally listed and sensitive plants are included in management requirements for the SERAL 2 project and will minimize impacts to known Federally listed and sensitive species.

Indicators and Measures

A Human Health and Ecological Risk Assessment was completed by the Syracuse Environmental Research Associates (SERA) for each herbicide proposed for use (USDA 2021(b)). The information in these assessments is the basis for worksheets which estimate concentrations of herbicide in water for a range of potential scenarios (USDA 2021(b)). Analysis indicators and measures from these risk assessments vary among the proposed herbicides: those used to assess the effects of glyphosate and those used to assess the effects of all other proposed herbicides.

Water Quality – Glyphosate:

Is the Maximum Contaminant Level (MCL) exceeded? Yes or No. Both the State of California and the Environmental Protection Agency has set a Maximum Contaminant Level (MCL) for glyphosate. The MCL is the highest level of a contaminant that is allowed in drinking water. MCL is measured in milligrams per liter (mg/L) and will be compared to the expected environmental concentration (EEC) values generated in the SERA worksheets. These values represent concentrations of the herbicide in surface water that are or could be expected with normal use and are also measured in mg/L. The MCL for glyphosate modeled by the EPA is .7 mg/L. The assumption is if the MCL is not exceeded then water

quality standards would be met, and beneficial uses of water would be protected. If levels exceed the MCL, then further analysis is needed to determine the likelihood of the modeled scenario, the risk to water quality and beneficial uses, and what management requirements are needed to prevent standards from being exceeded. Each of the following SERA EECs will be compared to the MCL:

Peak Expected Environmental Concentration (PEEC): The risk assessment estimates a peak EEC - a short-term peak concentration of glyphosate in water (acute exposure). The SERA worksheet generated an upper value of .332 mg/L of glyphosate in surface water for PEEC.

Chronic Expected Environmental Concentration (CEEC): The risk assessment estimates a chronic EEC – a long-term peak concentration of glyphosate in water (chronic exposure). The SERA worksheet generated an upper value of .0232 mg/L of glyphosate in surface water for CEEC.

Accidental Spill into a Pond: The risk assessment estimates the concentration of glyphosate in water under the scenarios of an accidental spill of 20, 100, and 200 gallons into a pond. The SERA worksheet generated an upper value of .1514 mg/L of glyphosate in pond water after an accidental spill.

Water Quality – All Other Herbicides:

Is the hazard quotient (HQ) greater than 1 for sensitive aquatic invertebrates? Yes or No. Neither the State of California nor the Environmental Protection Agency (EPA) have developed MCLs for the other four proposed herbicides (aminopyralid, chlorsulfuron, clopyralid, and triclopyr). Since MCLs are not established, the no observed adverse effect concentration (NOAEC) for sensitive aquatic organisms is used as a proxy. The NOAEC corresponds to where there are no anticipated adverse effects to sensitive aquatic invertebrates. Modeled concentrations of herbicides in water are divided by the NOAEC to get a hazard quotient (HQ). If the HQ is less than one, then it is assumed that water quality objectives are met, and beneficial uses of water are protected. If the HQ is greater than 1, then further analysis is needed to determine the likelihood of the modeled scenario, the risk to water quality and beneficial uses of water, and any management requirements that could mitigate that risk.

Aquatic Wildlife

Are hazard quotients (HQs) greater than 1 for aquatic species?

Hazard quotients greater than 1.0 indicate a potential for observable adverse effects. Observable adverse effects typically begin at far lower dosages than a lethal dose which means hazard quotients of just over 1.0 usually indicate much milder symptoms. Where risk assessment indicate the HQ is greater than 1.0, we conducted a further assessment to determine the likelihood of the modeled risk scenario, the potential impacts to aquatic species, and the effectiveness of best management practices at minimizing that risk.

Terrestrial Wildlife

Are hazard quotients (HQs) greater than 1 for birds?

Hazard quotients greater than 1.0 indicate a potential for observable adverse effects. Observable adverse effects typically begin at far lower dosages than a lethal dose which means hazard quotients of just over 1.0 usually indicate much milder symptoms. Where risk assessment indicate the HQ is greater than 1.0, we conducted a further assessment to determine the likelihood of the modeled risk scenario, the potential impacts to birds, and the effectiveness of BMPs at minimizing that risk.

Are hazard quotients (HQs) greater than 1 for mammals?

Same measures as for birds.

Human Health – All Herbicides:

Is the hazard quotient (HQ) greater than 1 for human health? Yes or No. The risk assessment estimates a dose for exposure to each herbicide. A hazard quotient (HQ) was calculated by dividing this dose by the

human reference dose (RfD) established by the EPA. In general, if the HQ is less than or equal to 1, then the dose is at or below the RfD and the risk of human health effects is considered acceptable. Whether a particular dose is at or below the RfD will be assessed for the following circumstances:

Workers with General Occupational Exposure (Chronic)

Workers with Accidental Exposure (Acute)

General Public with Longer-term Exposure (Chronic)

General Public with Shorter-term Exposure (Acute)

Surfactants and Colorants:

Surfactants improve the activity and penetration of herbicides by reducing surface tension, allowing the herbicide mixture to spread evenly over the surface of vegetation. A colorant is added so that the actual treated area can be readily determined, which eliminates the probability of over-application of herbicides and avoids skips, overlaps and human exposures to recently treated vegetation. A qualitative assessment of their potential water quality impacts will be discussed.

Qualitative Assessment of the Effectiveness of Best Management Practices (BMPs):

Implementation and effectiveness of BMPs in protecting water quality following herbicide application is monitored annually on the Stanislaus National Forest. Results of past monitoring can be used as an indicator of future BMP effectiveness for the SERAL 2.0 project.

Direct and Indirect Effects

Table 37. Issue 7 direct and indirect effects.

Indicator / Measure		Proposed Action
Does Peak Expected Environmental Concentration (EEC) Exceed the Maximum Contaminant Level (MCL)	Glyphosate	No
Is the Hazard Quotient >1 for Aquatic Invertebrates (sensitive) when Exposed to the Peak Expected Environmental Concentration (Acute)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Triclopyr	No
Does Chronic Expected Environmental Concentration (EEC) Exceed the Maximum Contaminant Level (MCL)	Glyphosate	No
Is the Hazard Quotient > 1 for Aquatic Invertebrates (sensitive) when Exposed to the Longer-term Expected Environmental Concentration (Chronic)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Triclopyr	No
Does Accidental Spill into a Pond Exceed the Maximum Contaminant Level (MCL)	Glyphosate	No
Is the Hazard Quotient >1 for Aquatic Invertebrates (sensitive) when Exposed to an Accidental Spill in a Pond (Acute)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Triclopyr	No
Are Some Hazard Quotients >1 for Birds	Aminopyralid	Yes
	Chlorsulfuron	No
	Clopyralid	Yes
	Glyphosate	Yes
	Triclopyr	Yes
Are Some Hazard Quotients >1 for Aquatic Species	Aminopyralid	No

Indicator / Measure		Proposed Action
	Chlorsulfuron	Yes
	Clopyralid	Yes
	Glyphosate	Yes
	Triclopyr	Yes
Are Some Hazard Quotients >1 for Mammals	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Glyphosate	Yes
	Triclopyr	Yes
Is the Hazard Quotient >1 for Workers with General Occupational Exposure (Chronic)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Glyphosate	No
	Triclopyr	Yes
Is the Hazard Quotient >1 for Workers with Accidental Exposure (Acute)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Glyphosate	No
	Triclopyr	No
Is the Hazard Quotient >1 for the General Public with Longer-term Exposure (Chronic)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	Yes
	Glyphosate	No
	Triclopyr	Yes
Is the Hazard Quotient >1 for the General Public with Shorter-term Accidental Exposure (Acute)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Glyphosate	No
	Triclopyr	No
Is the Hazard Quotient >1 for the General Public with Shorter-term Non-Accidental Exposure (Acute)	Aminopyralid	No
	Chlorsulfuron	No
	Clopyralid	No
	Glyphosate	Yes
	Triclopyr	Yes

The discussion on water quality, terrestrial wildlife (birds and mammals), and human health, below, addresses all "yes" answers above in Table 37. Further analysis is needed on all "yes" answers to determine the likelihood of the modeled scenario, the risk to water quality and beneficial uses of water, the risk to human health for workers and the general public, and any management requirements that could mitigate that risk.

Water Quality

Glyphosate: The MCL was not exceeded under any of the water quality scenarios evaluated for glyphosate. It is, therefore, unlikely that water quality standards would be exceeded under the proposed use of glyphosate.

Aminopyralid: The HQ was not greater than 1 under any of the water quality scenarios evaluated for aminopyralid. It is, therefore, unlikely that water quality standards would be exceeded under the proposed use of aminopyralid.

Chlorsulfuron: HQs for aquatic species were used as a proxy for the EPAs MCL to determine the effects on water quality from the application of chlorsulfuron. HQs were not greater than 1 under any of the water quality scenarios modeled for fish or aquatic invertebrates and toxicity data was not available for amphibians. However, macrophytes and algae are the most sensitive and 14 HQs exceeded 1 and ranged from 1.3 to 1,183. Three of those HQs above 1 were generated for tolerant species while eleven HQs were generated for sensitive species . The wide range of HQs reflects the wide range of conditions used in the modeling to estimate runoff and chlorsulfuron concentrations in surface water under the most extreme scenarios which are unlikely. The product label for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of chlorsulfuron in ground and surface water and includes direction for site specific applications to mitigate the effects. With implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that water quality standards would be exceeded under the proposed use of chlorsulfuron.

Clopyralid: HQs for aquatic species were used as a proxy for the EPAs MCL to determine the effects on water quality from the application of clopyralid. HQs were not greater than 1 under any of the water quality scenarios modeled for fish or tolerant aquatic invertebrates. Toxicity data was not available for amphibians or sensitive aquatic invertebrates or macrophytes. However, the HQs for tolerant macrophytes exceeded a level of 1 and ranged from 2 to 6 (6 being the upper bounds). With implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that water quality standards would be exceeded under the proposed use of chlorsulfuron.

Triclopyr: HQs for aquatic species were used as a proxy for the EPAs MCL to determine the effects on water quality from the application of triclopyr. HQs were not greater than 1 under any of the water quality scenarios modeled for fish, aquatic invertebrates, amphibians, or algae. However, macrophytes are the most sensitive and 10 HQs exceeded 1 and ranged from 2 to 4,542. All HQs were generated for sensitive macrophyte species. The wide range of HQs reflects the wide range of conditions used in the modeling to estimate triclopyr concentrations in surface water under the most extreme scenarios which are unlikely. The product label for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of triclopyr in ground and surface water and includes direction for site specific applications to mitigate the effects. With implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that water quality standards would be exceeded under the proposed use of triclopyr.

Terrestrial Wildlife

Glyphosate: Birds: 24 central hazard quotients for birds are below 1.0, but three are over (HQ's of 1.7, 2.0, and 4.0). Applications of glyphosate at rates of up to 3 lb. a.e./acre do not appear to present any apparent risks to terrestrial animals, based on upper bound estimates of exposures (SERA 2011a). At application rates above about 3.3 lb a.e./acre, the HQs for birds modestly exceed the level of concern, but there is no basis for asserting that overt toxic effects in birds are likely. The label directions for some formulations of glyphosate state that a surfactant should be added to the formulations prior to application. Some surfactants are virtually nontoxic and are not likely to impact the toxicity of glyphosate. The use of a nontoxic surfactant would have no substantial impact on the risk characterization. Some studies using formulations from South America suggest adverse effects on reproduction in birds, amphibians, and terrestrial invertebrates. The types of studies conducted on the South American formulations have not been conducted on formulations that will be used in Forest Service programs. Consequently, the applicability of the data on South American formulations to the current Forest Service risk assessment is difficult to assess because of the proprietary nature of the data on the surfactants used in different formulations of glyphosate (SERA 2011a).

Mammals: 46 central hazard quotients for mammals are below 1.0, and one is just over (HQ of 1.2). No significant risks are apparent based on central estimates of exposure. The less toxic formulations of glyphosate do not appear to present any risks to terrestrial mammals (SERA 2011a). Chronic/long-term consumption is unlikely because this project proposes targeted, infrequent applications for fuelbreak maintenance and non-native weed control.

Aminopyralid: Birds: 24 central hazard quotients for birds are below 1.0 (threshold of concern), and three are just over (HQ's of 1.2, 1.5, and 3.0). Although three hazard quotients are just over 1.0, a study on quail and mallards observed no adverse effects at any dietary concentration, including high concentrations (Gallagher et al. 2004a and 2004b). In another mallard study (SERA 2007), no significant adverse effects to reproduction were observed in adults or offspring at dietary concentrations of up to 2700 ppm. Another study on quail found no signs of toxicity or effects on reproduction (Temple et al. 2007).

Mammals: All 47 central hazard quotients are below 1.0. The mammalian toxicity of aminopyralid is relatively well-characterized in experimental mammals in a series of toxicity studies that are required for pesticide registration. In standard experimental toxicity studies in rats, mice, rabbits, and dogs, aminopyralid has low acute and chronic oral toxicity. The most common effects noted in these studies involve changes in the gastrointestinal tract and decreased body weight. Incoordination has been noted in gavage studies with rabbits. Other than these effects, aminopyralid does not appear to cause specific target organ toxicity in mammals (SERA 2007).

Chlorsulfuron: Birds and Mammals: All central hazard quotients for birds and mammals are below 1.0. This means chlorsulfuron is below the No Observable Adverse Effects Level when applied directly to vegetation at the rates proposed for this project.

Clopyralid: Birds: 24 central hazard quotients for birds are below 1.0. Three exceed 1.0, but only when chronic ingestion occurs (HQ's of 1.0, 1.3, and 2.0). Chronic/long-term consumption is unlikely because this project proposes targeted, infrequent applications for fuelbreak maintenance and non-native weed control. This contrasts with something like largescale agriculture which may utilize the chemical several times per year on a recurring annual basis. The toxicity of clopyralid is relatively well characterized in experimental mammals but few wildlife species have been assayed relative to the large number of non-target species that might be potentially affected by the use of clopyralid. Within this admittedly substantial reservation, clopyralid appears to be relatively non-toxic to terrestrial or aquatic animals, is highly selective in its toxicity to terrestrial plants, and is relatively non-toxic to aquatic plants. Thus, the potential for substantial effects on non-target species appears to be remote (SERA 2004).

Mammals: all 47 central hazard quotients are at or below 1.0. A substantial number of toxicity studies are available in experimental mammals, specifically rats, mice, rabbits, and dogs exposed to clopyralid. The acute toxicity of clopyralid is relatively low: LD50 values of about 3000 mg/kg for clopyralid produced by electrochemical process and >5000 mg/kg for clopyralid produced by the penta process. For terrestrial mammals, the dose-response assessment is based on the same data as the human health risk assessment (i.e., an acute No Observable Adverse Effect Level (NOAEL) of 75 mg/kg/day and a chronic NOAEL of 15 mg/kg/day). None of the exposure scenarios, acute or longer term, result in exposure estimates that exceed this NOAEL (SERA 2004).

Triclopyr: Birds: 20 central hazard quotients for birds are below 1.0, but seven hazard quotients are over (exceeding HQ's range from 1.2 to 5). The U.S. EPA/OPP (1998) classifies triclopyr as being slightly toxic to birds. There are two field studies, Boren et al. (1993) and Schulz et al. (1992a), which involve triclopyr applications in the range of application rates that may be used in Forest Service programs. Neither study indicates that the triclopyr applications caused adverse effects in birds; what is more, the study by Schulz et al. (1992b) suggests that some bird species benefited from the applications due to changes in vegetation. These types of observations of population effects secondary to changes in habitat are common in field studies involving herbicide applications (SERA 2011b).

Mammals: 41 central hazard quotients for mammals are below 1.0 while six are over (exceeding HQ's range from 1.2 to 5). Hazard quotients exceed the level of concern for exposures involving the consumption of contaminated vegetation by mammals. HQs are greatest for large mammals. As with the human health risk assessment, the high HQs suggest the potential for adverse effects, but not overt toxic effects, in large mammals. Based on a very cursory probabilistic assessment, exposures of mammalian wildlife that would be associated with upper bound HQs are probably rare occurrences (SERA 2011b).

Summary for Terrestrial Wildlife: Herbicides are typically applied to non-native invasive plants prior to flowering which reduces some impacts to terrestrial birds and mammals. For fuel break maintenance, application would occur on recently treated areas (e.g., masticated) that are less likely to have an abundance of flowering plants which also reduces impacts to terrestrial birds and mammals. The herbicides proposed for this project degrade quickly once they enter the environment or bind tightly to soil particles, limiting their ability to bioaccumulate (SERA 2004, 2007, 2010, 2011a-b, 2014, and 2016a-b; Tatum 2004). This limits the potential for repeat exposure and makes the chronic exposure scenarios in the Risk Assessments very unlikely. Chronic exposure is even less likely because this project proposes targeted, infrequent applications. This contrasts with something like largescale agriculture which may utilize the chemical several times per year on a recurring annual basis. Studies have also shown that the proposed surfactants pose a low toxicity risk to non-target terrestrial organisms (Bakke 2003).

This project requires that only direct foliar application may be used (no aerial or other broadcast methods); herbicides can only be applied when heat, wind speed, wind direction, humidity, and precipitation are suitable (as defined on the label); a Pesticide Use Spill Plan must be in place; all best management practices for water quality must be followed (USDA 2011b).

Risk assessments show the majority of hazard quotients are below the threshold of concern for birds and mammals. The hazard quotients that exceed the threshold of concern do not exceed by a large amount, and the likelihood of toxic effects occurring are low because the project proposes targeted applications at an infrequent return interval. Risk of harm is reduced even further by BMPs that reduce the probability of drift or spraying non-target plants or animals.

Aquatic Species

Glyphosate: HQs were not greater than 1 under any of scenarios modeled for fish, amphibians, or aquatic invertebrates. However, macrophytes and algae are the most sensitive and 7 HQs exceeded 1 and ranged from 1.4 to 2. Five of those HQs above 1 were generated for sensitive macrophytes and sensitive algae species under an accidental exposure while two HQs were generated for sensitive macrophyte and algae species under a non-accidental exposure . The range of HQs reflects the range of conditions used in the modeling to estimate runoff and glyphosate concentrations in surface water under the most extreme scenarios which are unlikely. The product label for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of glyphosate in surface water and includes direction for site specific applications to mitigate the effects. The hazard quotients that exceed the threshold of concern do not exceed by a large amount and with implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that toxic effects would occur under the proposed use of glyphosate.

Aminopyralid: The HQ was not greater than 1 under any of the scenarios evaluated for aminopyralid. It is, therefore, unlikely that toxic effects would occur under the proposed use of aminopyralid.

Chlorsulfuron: HQs were not greater than 1 under any of the scenarios modeled for fish or aquatic invertebrates and toxicity data was not available for amphibians. However, macrophytes and algae are the most sensitive and 14 HQs exceeded 1 and ranged from 1.3 to 1,183. Three of those HQs above 1 were generated for tolerant species while eleven HQs were generated for sensitive species . The range of HQs reflects the range of conditions used in the modeling to estimate runoff and chlorsulfuron concentrations in surface water under the most extreme scenarios which are unlikely. The product label

for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of chlorsulfuron in ground and surface water and includes direction for site specific applications to mitigate the effects. With implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that toxic effects would occur under the proposed use of chlorsulfuron.

Clopyralid: HQs were not greater than 1 under any of the scenarios modeled for fish or tolerant aquatic invertebrates. Toxicity data was not available for amphibians or sensitive aquatic invertebrates or sensitive macrophytes. However, the HQs for tolerant macrophytes exceeded a level of 1 and ranged from 2 to 6 (6 being the upper bounds) under an accidental acute exposure. The range of HQs reflects the range of conditions used in the modeling to estimate clopyralid concentrations in surface water under the most extreme scenarios which are unlikely. The product label for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of clopyralid in ground and surface water and includes direction for site specific applications to mitigate the effects. The hazard quotients that exceed the threshold of concern do not exceed by a large amount and with implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that toxic effects would occur under the proposed use of clopyralid.

Triclopyr: HQs were not greater than 1 under any of the scenarios modeled for fish, aquatic invertebrates, amphibians, or algae. However, macrophytes are the most sensitive and 10 HQs exceeded 1 and ranged from 2 to 4,542. All HQs generated were for sensitive macrophyte species. The wide range of HQs reflects the wide range of conditions used in the modeling to estimate triclopyr concentrations in surface water under the most extreme scenarios which are unlikely. The product label for the representative formulation considered explicitly notes the potential environmental hazards associated with the contamination of triclopyr in ground and surface water and includes direction for site specific applications to mitigate the effects. With implementation of the directions for application in the product label, management requirements, and best management practices, it is unlikely that water quality standards would be exceeded under the proposed use of triclopyr.

Human Health

Glyphosate: The HQ was greater than 1 under the scenario of shorter-term acute non-accidental exposure of glyphosate to the general public. The exceedance was specifically for an adult female consuming contaminated vegetation shortly following noxious weed treatment. The likelihood of an adult female consuming contaminated vegetation shortly following noxious weed treatment in SERAL 2.0 is unlikely. This scenario is more applicable to use of glyphosate in agricultural settings than treatment of small populations of noxious weeds. In addition, sites that are treated with herbicides have signs posted to warn the general public that spraying has recently occurred. It is, therefore, unlikely that human health standards for workers or the general public would be exceeded under the proposed use of glyphosate.

Aminopyralid: The HQ was not greater than 1 under any of the human health assessments for aminopyralid. It is, therefore, unlikely that human health standards for workers or the general public would be exceeded under the proposed use of aminopyralid.

Chlorsulfuron: The HQ was not greater than 1 under any of the human health assessments for chlorsulfuron. It is, therefore, unlikely that human health standards for workers or the general public would be exceeded under the proposed use of chlorsulfuron.

Clopyralid: The HQ was slightly greater than 1 (1.2) for the general public under the scenario of an adult female consuming contaminated vegetation (chronic). The likelihood of an adult female repeatedly consuming contaminated vegetation following noxious weed treatment in SERAL 2.0 is unlikely. This scenario is more applicable to the use of clopyralid in agricultural settings than treatment of small populations of noxious weeds. In addition, sites that are treated with herbicides have signs posted to warn

the general public that spraying has recently occurred. It is, therefore, unlikely that human health standards for workers or the general public would be exceeded under the proposed use of clopyralid.

Triclopyr: The HQ for workers with general occupational exposure (chronic) was greater than 1 (3 at the upper bounds) when applying triclopyr with ground broadcast application. Eye irritation is probably the most likely effect that workers will experience during the application of triclopyr formulations; furthermore, eye irritation is the only adverse effect associated with triclopyr exposure in humans (SERA 2011). As with all pesticide applications, potential ocular and dermal effects can and should be minimized or avoided by prudent industrial hygiene practices during and after the application of triclopyr formulations.

The HQ was greater than 1 for the general public under the scenarios of an adult female consuming contaminated vegetation or contaminated fruit (both acute and chronic). The likelihood of an adult female consuming contaminated vegetation or fruit following noxious weed treatment in SERAL 2.0 is unlikely. This scenario is more applicable to use of triclopyr in agricultural settings than treatment of small populations of noxious weeds. In addition, sites that are treated with herbicides have signs posted to warn the general public that spraying has recently occurred. It is, therefore, unlikely that human health standards for workers or the general public would be exceeded under the proposed use of triclopyr.

Surfactants and Colorants

SYL-TAC-EA™: SYL-TAC-EA™ is a surfactant likely to be used as an additive during herbicide application unless site specific mitigations require the use of herbicides without a surfactant. SYL-TAC-EA™ is a proprietary blend of modified vegetable oil concentrate and a silicone surfactant. Principal functioning agents are Ethylated seed oil, Polyether-Polymethylsiloxane-Copolymer, and Polyoxyalklene fatty acid. The safety data sheet (SDS) indicates that the chemical mixture does not meet the classification for a hazard or precautionary statement. There are no occupational exposure limits or biological limit values noted for this chemical. Toxicological information contained in the SDS indicate no adverse effects are expected due to inhalation or skin contact; however, direct contact with eyes may cause temporary irritation. SYL-TAC-EA™ is expected to be a low ingestion hazard. Specific information regarding studies on the toxicity relative to mammals or aquatic organisms are not readily available

Hi-Light™ Blue: Hi-Light™ Blue is a water-soluble dye that contains no toxic chemicals (USDA 2021b). It is mildly irritating to the skin and eyes. It is considered to be virtually non-toxic to humans. Its effect on non-target terrestrial and aquatic species is unknown, however its use has not resulted in any known problems (Bakke 2007). The dye used in Hi-Light™ Blue is commonly used in toilet bowl cleaners and as a colorant for lakes and ponds (USDA 2021b).

Colorfast™ Purple: ColorfastTM Purple is a water-soluble dye that contains no toxic chemicals (USDA 2021b). It is mildly irritating to the skin, but, because of the acetic acid content, can be severely irritating to the eyes and can cause permanent damage. Acetic acid is the ingredient in household vinegar, although household vinegars are typically 4-10 percent acetic acid and ColorfastTM Purple contains 23.4 percent by weight. ColorfastTM Purple contains gentian violet, which is a common laboratory reagent and stain. This dye is commonly used as an antifungal or antibacterial medication for dermal or mucous membrane infections (USDA 2021b).

BMP Effectiveness

The Stanislaus National Forest has utilized herbicides for treatment of noxious weeds as well as for reforestation purposes. Reforestation activities utilize much larger quantities of herbicides than those proposed for noxious weeds, as noxious weed populations are often much smaller and isolated populations, compared to large-scale site prep or release with herbicides in reforestation. Therefore, effectiveness of BMPs during reforestation activities can indicate the likelihood of success of BMPs for smaller noxious weed projects.

Monitoring has been conducted by the Stanislaus National Forest on reforestation herbicide treatments. The most recent monitoring was completed for BMP implementation and effectiveness for Rim Reforestation following the National Core BMP Evaluation Protocol in 2018, 2019, and 2021. Monitoring indicated that BMPs were fully implemented and were effective at all three sites, resulting in composite scores of excellent. In addition, all Rim Reforestation units that were treated with herbicides have a BMP checklist that is filled out by the project lead, documenting whether BMPs were implemented as planned in the Rim Reforestation NEPA. Between 2018 and 2020, BMP checklists were completed for 82 units, and all applicable BMPs were implemented as planned. Based on this track record of implementing BMPs on the ground and monitoring results showing that implemented BMPs were effective at protecting water quality, it is assumed that BMPs proposed for SERAL 2.0 will be implemented and effective at protecting water quality and human health and safety.

Cumulative Effects

Past noxious weed treatments within the SERAL 2.0 project watersheds are limited. The Rim Fire Reforestation project authorized the use of herbicides in natural regeneration areas spanning 667-acres which occur within the SERAL 2.0 project area, however when or whether those treatments will occur is uncertain. The same decision also authorized the use of herbicides to treat noxious weed sites. There is also a potential for herbicides to be used on private land (noxious weeds and/or reforestation) or within FERC boundaries (powerline maintenance noxious weeds). It is common 2-3 herbicide treatments to occur for each SPI clearcut (approximately 850 acres over next two years). Powerline maintenance likely occurs every 5 years.

The proposed use of herbicides in SERAL 2.0, when added to these other potential future uses of herbicides, is unlikely to cause cumulative impacts to human health or the health and diversity of other sensitive species. Risk assessment modeling indicated low risk to human health and water quality as well as aquatic and terrestrial wildlife, including birds. In addition, evaluations of implementation and effectiveness of BMPs on much larger herbicide treatments for reforestation projects indicate that BMPs for herbicide treatments are typically implemented as planned and effective. Therefore, cumulative effects of herbicide treatments on water quality, human health, and wildlife are not anticipated.

Issue 8. Due to the conditional nature of the proposed salvage the site-specific environmental impacts of those actions are not clear.

The rapid response salvage proposed in SERAL 2.0 is in line with standard practice in planning and project implementation. In nearly every USFS NEPA decision for vegetation management, provisions are made on what to do if a tree dies. For example, a tree that was “supposed” to be retained in a decision suddenly dies post-decision and becomes a hazard, that tree may be removed post-decision provided the action was identified and analyzed in the NEPA document. Thus, whether or not a tree is retained or removed post-decision depends on its condition. Likewise in SERAL 2.0, rapid response salvage is designed to deal with post-decision condition of trees and groups of trees to address safety hazards and fuel load hazards. Although scaling up from the usual single tree condition, the salvage provisions in SERAL 2.0 still require well-defined thresholds of scope and scale. As we learned in the southern Sierra Forests and elsewhere, groups of beetle-killed drought-stricken trees exceeding NRV subsequently helped fuel megafires that devasted communities and wildlife habitat. This scaling up is critical to public safety, community safety, and forest management. Although it cannot be predicted where exactly a tree may die, we know that trees and groups of trees will die and that there will be needs to rapidly respond to manage the associated risks. The site-specific requirements for resource protections, e.g., archaeological surveys, rare plant surveys, wildlife surveys, etc., and subsequent management requirements remain the same and the scale and scope of the action and associated effects analysis applicability is well-defined by management requirements and thresholds described in the SERAL 2.0 proposed action.

The Watershed Management Report details the environmental impacts of the proposed salvage activities on sediment and temperature (see Environmental Consequences, Effect Discussion for Resource Indicator and Measure 1 – Water Quality related to sediment and stream temperature). Salvage of insect-, disease-, or drought-killed trees is very similar to harvesting of live green trees. The insects, disease, and drought do not affect the ground cover and duff layer, so there is intact ground cover to filter any offsite movement of sediment that occurs post-harvest. The risk of offsite soil movement is greater with the salvage of wildfire-killed trees. This is because, depending on the severity of the fire, there is a reduction, or even complete loss, of ground cover to filter out sediment movement. Because of this elevated risk, additional monitoring is required by the Central Valley Regional Water Quality Control Board (Water Board) under Category 5A (post-fire activities) of the Timber General Order (GO). This monitoring is intended to ensure that BMPs are implemented and effective and that any BMP failures are quickly rectified.

All condition-based salvage activities would be subject to the GO coverage requirements of the Water Board, as described in the Watershed Management Report (see Monitoring Requirements / Timber General Order). Implementation of BMPs and GO monitoring is required for these salvage treatments, regardless of where they fall within the SERAL 2.0 project area footprint. Site specificity would be provided to the Water Board in the form of maps prior to receiving GO coverage for these activities. The monitoring and reporting requirements of the GO reduce the likelihood of BMP failures being unnoticed and causing water quality impairment.

The Watershed Management Report also details the risk of salvage activities on cumulative watershed effects (CWE). (See Resource Indicator and Measure 5 – Watershed Function (ERA Model Results) under the Environmental Consequences Section of the Watershed Management Report).

Salvage of insect-, disease-, or drought-killed trees is proposed within 1/4 mile of roads as long as the TOC is not exceeded. If the need to implement these salvage activities arise in the SERAL 2.0 project area in the future, the equivalent roaded acreage (ERA) calculations described in the Watershed Management Report will be updated to ensure the TOC is not exceeded and the updated CWE analysis will be provided to the Water Board as part of the GO submittal. ERA coefficients and recovery timeframes outlined in the ERA analysis worksheets will be used. These activities will not be authorized under SERAL 2.0 in any watershed where the TOC is exceeded. Amount of salvage may be scaled down in order to remain under the TOC. Because the location and extent of this potential future activity is unknown, and because the potential future activity would not be authorized if a TOC is exceeded, this activity is not currently in the ERA calculation spreadsheet. However, the constraints placed on the project, namely following BMPs, not allowing the TOC to be exceeded, providing site-specific maps to the Water Board as part of the GO submittal, and monitoring and reporting to the Water Board, ensures that cumulative watershed effects would not occur as a result of salvage of insect-disease-, or drought-killed trees.

Salvage of up to 500-acres of fire-killed trees could also occur in each watershed as long as the TOC is not exceeded. If the need to implement fire salvage activities arise in the SERAL 2.0 project area in the future, the ERA calculations, including the effects of the fire itself, will be updated to ensure the TOC is not exceeded. The updated CWE analysis will be submitted to the Water Board as part of the GO submittal. ERA coefficients and recovery timeframes outlined in the ERA analysis worksheets will be used. These activities will not be authorized under SERAL 2.0 in any watershed where the TOC is exceeded. Amount of salvage may be scaled down in order to remain under the TOC. Because the location and extent of this potential future activity is unknown, and because the potential future activity would not be authorized if a TOC is exceeded, this activity is not currently in the ERA calculation spreadsheet. However, the constraints placed on the project, namely following BMPs, not allowing the TOC to be exceeded, providing site-specific maps to the Water Board as part of the GO submittal, and monitoring and reporting to the Water Board, ensures that cumulative watershed effects would not occur as a result of salvage of wildfire-killed trees.

Issue 9. The construction of temporary roads that are not properly decommissioned lead to erosion, unauthorized cross-country travel by wheeled motor vehicles, and introduction of noxious weeds.

Temporary or "temp" road needs are best identified during the layout stage of project implementation. This is because needs are identified as unit boundaries are refined, flag & avoid protection measures are identified (e.g., archaeological sites), available equipment, and other factors. Although the precise location of where those needs will occur won't be identified until layout, we know from past projects the typical scale and scope of those needs. The SERAL 2.0 DEIS identifies sideboards, management requirements, and BMPs that remain the same regardless of location such that the scale and scope of temp road needs and resource protection parameters are known to allow for analysis of potential effects.

The Watershed Management Report, Erosion and Sedimentation (Road Treatments) section under Environmental Consequences, Effect Discussion for Resource Indicator and Measure 1 – Water Quality related to sediment and stream temperature details the environmental impacts of the proposed temporary road construction on erosion and sedimentation (see - Similarly, the Soils Report (Section 2.03; Other Action Categories) also assesses the potential impacts of the temporary road construction and use on erosion, soil cover and infiltration.

Temporary road construction includes both temporary road needs for forest thinning activities, and temporary roads of up to 500 feet in length for condition-based salvage activities. These temporary roads would be decommissioned following use, further reducing the potential for erosion and sedimentation. Monitoring of temporary roads would be completed as part of the Significant Existing and Potential Erosion Sites (SEPES) data collection/monitoring required by the Central Valley Regional Water Quality Control Board (Water Board) under the Timber General Order (GO). Although exact locations of forest thinning temporary roads and condition-based salvage temporary roads are not known at this time, the monitoring and reporting requirements outlined in the Timber GO will be utilized to ensure that temporary roads do not become sources of sedimentation and cause water quality impairments.

The potential disturbance caused by the estimated temporary roads needed to implement the proposed forest thinning (i.e., 1 mile per 1,000-acres of forest thinning) were considered in the CWE analysis. ERA Model results indicate that the total disturbance of proposed temporary road construction equates to less than 0.1 % of any one of the project area watersheds.

Construction of temporary road segments less than 500 feet in length needed for salvage could occur. When temporary road construction is needed, the cumulative watershed effects (CWE) analysis will be updated to account for this disturbance. The updated CWE analysis will be submitted to the Water Board as part of the GO submittal. ERA coefficients and recovery timeframes outlined in the ERA analysis worksheets will be used. Temporary road construction will not be authorized in any watershed where the TOC is exceeded. Amount of temporary road construction may be scaled down in order to remain under the TOC. Because the location and extent of this potential future activity is unknown, and because the potential future activity would not be authorized if a TOC is exceeded, temporary road construction for potential salvage actions is not currently included in the ERA calculation spreadsheet. However, the constraints placed on the project, namely following BMPs, not allowing the TOC to be exceeded, providing site-specific maps to the Water Board as part of the GO submittal, and monitoring and reporting to the Water Board, ensures that cumulative watershed effects would not occur as a result of construction of temporary road segments needed for salvage activities.

3.02 Ability of the Alternatives to Meet the Purpose and Need

The purpose and need analysis informs the decisionmaker and the public of the relative effectiveness of the alternatives at meeting the project objectives.

Need 1. Increase Landscape Resilience to Natural Disturbances (drought, insects, disease, wildfire) by Restoring Resilient Forest Conditions

Affected Environment

The narrative in Chapter 1, The Purpose and Need for Action, establishes why the proposed vegetation management is needed in order to increase landscape resilience to natural disturbances and establishes how those proposed treatments contribute to resilient forest conditions. This section focuses on how effective the proposed treatments are at increasing landscape resilience. To do so, this analysis adopts the assumption that if, collectively, the proposed treatments (A) increase forest heterogeneity; (B) reduce stand densities; (C) retain large, old, structurally diverse trees and snags; (D) increasing the relative abundance of fire-tolerant and shade-intolerant trees; (E) reduce surface and ladder fuels; (F) increase management by fire; (G) construct and maintain a network of fuelbreaks; and (H) salvage disturbed areas, then the SERAL 2.0 project will effectively increase the resilience of the landscape to natural disturbances.

Indicators and Measures

Departure from NRV by Seral Stage: Proportions of seral stages across the landscape can be an indicator of resilience in Sierra Nevada mixed conifer forests to fire, insects, disease, drought and climate change. For this indicator, desired conditions are based on the descriptions in GTR-256: Natural range of variation for yellow pine and mixed-conifer forests in the Sierra Nevada (Safford and Stevens, 2017). Existing conditions were summarized using ForSys/F3-generated modelled outputs of WHR size and density classifications which were used to bin the data into the different seral stages.

The NRV-assessment of conifer forest types was divided into two forest type groupings: (1) Dry Mixed Conifer; and (2) Moist Mixed Conifer. This NRV-assessment identified a need to increase the amount of open canopy conditions and reduce the proportion of mid-seral closed canopy conditions (Figure 2) to get a patchy distribution of diverse stand types across the landscape. To assess the effectiveness of the proposed treatments in moving the landscape into closer alignment with NRV, a comparative assessment of the difference between historic landscape structure and the existing and post-treatment estimates of landscape structure are calculated.

Evaluation of landscape restoration needs requires a perspective larger than individual stands. The rationale for using this metric was to systematically assess the landscape-scale forest structure restoration needs within the SERAL 2.0 project area, with the assumption that forest structure is an appropriate indicator of overall ecosystem health, and that restoring forest structure towards its NRV will increase the landscape's resilience and adaptive capacity. As Haugo et al. (2015) notes… "…a fundamental principle of landscape ecology is the linkage between ecological patterns and processes. Restoration of pattern in forested landscapes, from local to regional scales, facilitates the restoration of ecological processes." The primary intent of this metric was to compare the existing landscape forest structure to NRV, communicate the magnitude of departure from NRV within the project area, and provide a landscape-scale context that could help inform finer-scale (i.e., stand-level) treatments. Conducting the same post-treatment modeled estimates of the departure from NRV then allows a comparative assessment of the effectiveness of the proposed treatments at restoring forest structure towards NRV.

The proportion of acreage in each successional class, or seral stage, is displayed in Table 38 for both pre- and post-treatment. These numbers can be compared with the approximate NRV value in the same table, which represents the desired landscape condition.

Stand Density Index (SDI): see description of SDI under Issue 1C.

Basal Area: see description of basal area under Issue 1C.

Large Tree Retention: Large trees, which are often older and have more structural complexities, provide critical wildlife habitat, such as owl and roosting habitat. Large trees are commonly defined as those equal or greater than 30 inches DBH, and very large trees are those equal or greater than 36 inches DBH. There are few trees of this stature across the landscape, so retaining those that do exist and promoting their health is an important component of the proposed actions. The proposed treatments were located and designed to avoid areas composed of large trees and / or to retain them where treatments occur. To assess how effectively the proposed treatments avoid and retain large trees, a comparative assessment of the difference between the existing proportion of large trees and the modeled estimate of the proportional composition of large trees on the landscape remaining post-treatment is presented as total acres of CWHR classes 5 S, P, M, or D across the project area. Because the proposed treatments were located to avoid forested areas containing large trees coupled with included DBH limitations, the reduction of large trees post-treatment should be minimal. Using CWHR for this assessment may overestimate the proportion of the project area containing the "large" and "very large" trees, but similarly may also overestimate increases or losses of large and very large trees. To supplement the assessment of large tree retention we also present the mean trees per acre greater than 30-inches DBH pre- and post-treatment.

Surface and Ladder Fuel Reduction: Spatial fire modeling, such as Nexus and FSim, utilize these fuel models at $1/8^{th}$ of their inputs, but this fuel model input fills a dominant modeling role in determining fire type, flame lengths, and burn probabilities due to describing the surface and ladder fuel amounts (e.g., vertical and horizontal fuel or vegetation continuity) which often drive fire behavior and spread. The fuel model changes used for each spatial pixel during modeling was determined by treatment type, intensity, and location. In sum, where intensive treatments were proposed based on current conditions, and especially at locations where multiple treatments were applied (e.g., tree thinning and prescribed burns), surface and ladder fuels as represented by these fuel models were reduced in parallel correlation to the amount of understory and overstory vegetation cut and removed. Fuel models with reduced fuel loading are a landscape indicator of improved conditions moving towards increased landscape resiliency. The assessment of the effectiveness of the proposed actions at reducing surface and ladder fuels are addressed in the discussion pertaining to conditional flame lengths.

Annual Burn Probability: see description of Burn Probability under Issue 1C. Annual burn probabilities percentage reductions across the project area are the most desirable (e.g., closer to less than 1% is best scenario), and reducing the percentage of burn probability is expected from the treatment activities.

Conditional Flame Lengths: see description of conditional flame lengths under Issue 1C. The goal of the proposed action is to reduce the ratio of higher flame lengths (greater than 8 ft) acreage and increase the lowest flame lengths (less than 4 ft) acreage in order to increase the landscape's resilience to wildfire hazards and subsequent fire effects or mortality/damage to dominant vegetation and human infrastructure and safety. Changes in the middle category flame lengths (4 to 8 ft) are also desirable to reduce fire behavior and effects.

Prescribed Fire: The percent of the landscape with prescribed fire proposed among the action alternatives is nearly the same but has key differences on where it is coupled with other treatment methods, and this demonstrates a commitment to larger, watershed scale prescribed fire efforts. Secondarily, the post-treatment modeled estimates of predicted fire type, flame lengths, and reduced fire severities (see above and Issue 3A) help to assess the effectiveness of the proposed prescribed fire activities, especially in conjunction with the other vegetation management actions in increasing landscape resilience.

Salvage for NRV-based restoration and conservation benefits: The intent for including salvage as part of the proposed action, prior to a mortality event occurring, is to rapidly, effectively and efficiently eliminate accumulated fuels and reduce further increasing wildfire risk on the landscape. The proposal confines the area of potential salvage and includes additional conditions that must be met which ensure the potential impacts of the action remains minimal while enabling conservation and economic benefits

are achieved. It is impossible to quantitatively measure the effectiveness of potential future salvage at restoring NRV or meeting conservation objectives other than relying on literature or recent past salvage operations which supports the need for such actions and citing the project-imposed limitations required in order to salvage. Therefore, the proposed salvage actions contribute to increasing landscape resilience to natural disturbance but the assessment of that effectiveness relies solely on what is presented in Section A.08 and is not addressed further in the analysis for Need 1.

Direct and Indirect Effects

Table 38. Need 1 effectiveness.

Indicator / Measure		Pre-Treatment (No Action)	Post-Treatment
Landscape Structure NRV Departure –Dry Mixed Conifer	Early Seral (NRV: 20%)	0%	0%
	Mid-Seral Open (NRV: 25%)	10%	14%
	Mid-Seral Closed (NRV: 10%)	77%	63%
	Late-Seral Open (NRV: 40%)	1%	5%
	Late-Seral Closed (NRV: 5%)	13%	17%
Landscape Structure NRV Departure – Fir / Moist Mixed Conifer	Early Seral (NRV: 20%)	0%	0%
	Mid-Seral Open (NRV: 20%)	18%	25%
	Mid-Seral Closed (NRV: 15%)	61%	49%
	Late-Seral Open (NRV: 25%)	6%	11%
	Late-Seral Closed (NRV: 20%)	14%	16%
CWHR Classification	WHR 5 S & P	3,257	11,335
	WHR 5 M & D	13,597	17,112
Mean Trees per Acre	Trees greater than 30-inches DBH	3.70	3.63
Annual Burn Probability:	Less than 1%	45,037	121,838
	1% to 2%	68,299	39,883
	2% to 5%	48,385	0
Conditional flame lengths	< 4 feet	19,532	53,717
	4 – 8 feet	41,863	42,014
	> 8 feet	100,325	65,990

Increase Forest Heterogeneity: In both the dry mixed conifer and the moist mixed conifer forest types, current departure is most pronounced in the mid-seral closed and late-seral open developmental stages, with the current landscape containing much more of the mid-closed condition and much less of the late-open stage. This finding is consistent with GTR-256 (Safford and Stevens 2017) which states: "*Modern mean canopy cover is above presettlement...Current lack of old-forest successional stages*."

The proposed action moves the conifer forest structure at the landscape scale towards NRV (as described in Section 1.01), by decreasing the amount of mid-seral closed canopy and creating more mid- and late-seral open forest (Figure 17 and Figure 18).

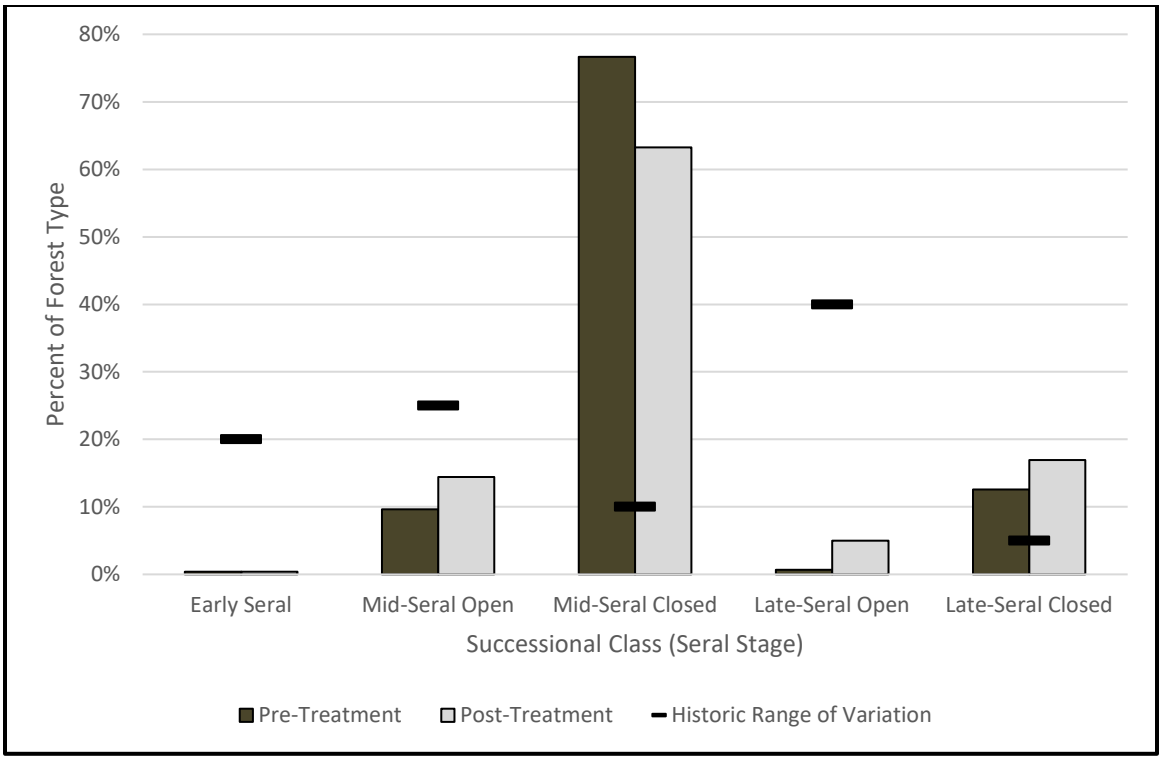

Figure 17. A comparison of pre- and post-treatment landscape structure of the dry mixed conifer forest type compared to historic conditions.

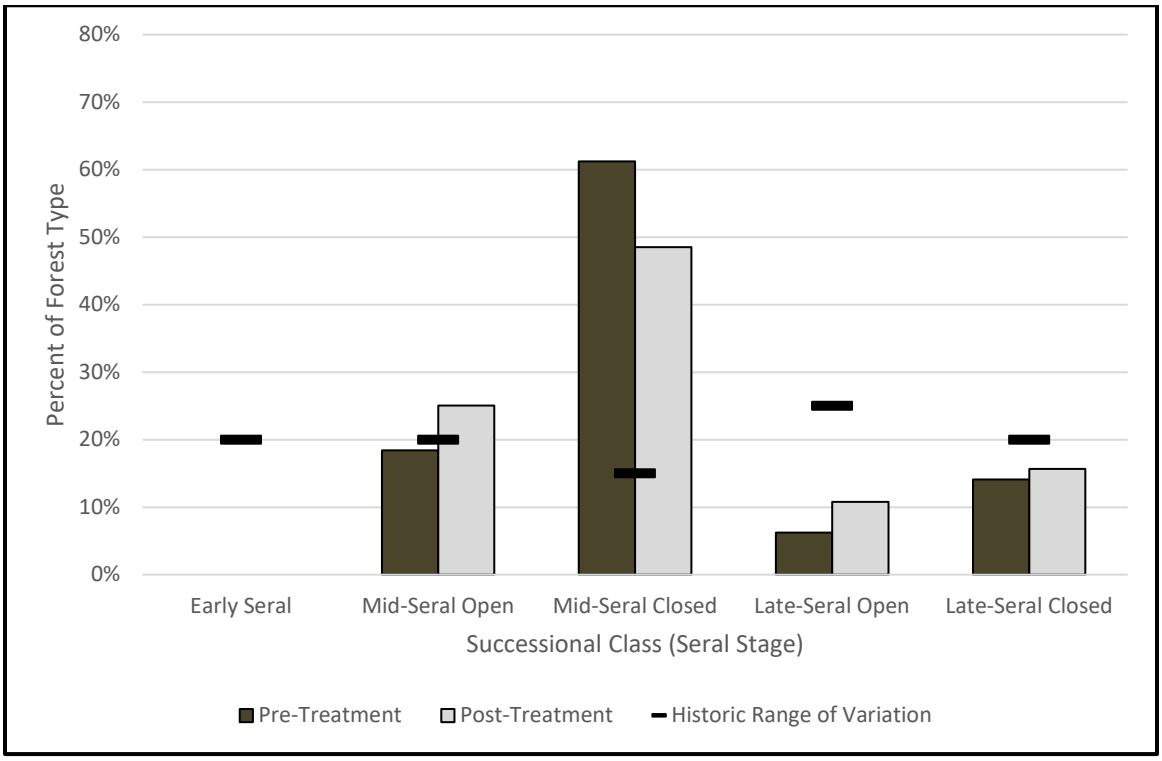

Figure 18. A comparison of pre- and post-treatment landscape structure of the moist mixed conifer forest type compared to historic conditions.

The "no-action" would maintain a relatively homogeneous landscape forest structure, due to an overabundance of acreage in both the mid- and late-seral closed canopy conditions and a conspicuous lack of more open-canopy conditions (Figure 17 and Figure 18). If no action is taken, forested stands will remain at high risk to many disturbances, such as large-scale, high-severity fire; insects; disease; drought; and climate change. Significant acreage of late-seral, open canopy conditions—which historically would have been the most abundant condition on the landscape—would be unlikely to develop under the no-action alternative. Due to the existing abundance of dense, closed canopy stands, eventual disturbances are likely to be stand-replacing in nature, thus moving large, contiguous areas into the 'Early Seral' successional class or even result in permanent conversion of the vegetation to a more shrub- or oak-dominated condition.

The proposed action is modestly effective at moving landscape forest structure towards NRV. The proportion of dense, mid-seral closed canopy conifer stands decreases and the amount of open canopy conditions increases. A large excess of mid-seral closed canopy remains, however, as does a large deficit of late-seral open forest. This is partly to be expected, as full attainment of landscape forest structure targets is not possible immediately after just one treatment, nor with mechanical treatments alone. In much of the project area, a lack of access for equipment (due to steep slopes, lack of roads, or both) or an insufficient volume of material in a stand can hinder the viability of potential mechanical treatments. Wildlife habitat requirements and other protections on sensitive resources also play a role in limiting what can be done with mechanical treatments. One important note about this metric is that the post-treatment values represent post-mechanical treatment. Follow-up prescribed burning, while proposed, was not simulated in the development of these post-treatment values of seral stages. Broadcast burning after mechanical treatments, along with forest succession over time, would be expected to further move these proportions toward the desired conditions, as represented by the average NRV values.

Reduce Stand Densities: Stand density and resilience to natural disturbances is addressed more in-depth under Issue 1C. The proposed action would shift tens of thousands of acres of conifer forest—currently at high-risk to drought-, insect-, and disease-related mortality—to densities considered to be at lower risk to largescale mortality and encourage the development of larger trees (Table 24 and Table 25). Without treatment however, tree density and competition for growing space would continue to increase and stand vigor would decrease. Growth rates of individual trees would slow and delay the development of larger trees. Competition-related mortality would increase over time, as stands increasingly exceed at-risk density thresholds and "self-thinning" occurs.

Retain large, old, structurally diverse trees and snags: Prior to "applying" (modeling) the proposed treatments, the project area lacked any forest structure classified as CWHR 5 S & P (Table 38). The proposed action increases the occurrence of CWHR 5 S & P which contain trees greater than 24 inches DBH with open canopies (10-39% canopy cover). Even if these forested areas are composed primarily of trees at the lower end in this size category, with succession, these areas are expected to grow more rapidly than prior to treatment. After applying the proposed treatments, the estimated proportion of the landscape containing forest structure classified as CWHR 5 M & D will be reduced. A portion of the CWHR 5 M & D acres reduced are converted to CWHR S & P so the change is most an artifact of a reduction in canopy cover rather than loss of large trees. Relaying on CWHR to assess the effectiveness of the proposed treatments at retaining large, old, structurally diverse trees likely overestimates the proportion of large trees on the landscape and the post-treatment increases and losses in proportion. Nonetheless, using the CWHR classification to assess large tree retention across the landscape post-treatment demonstrates that the proposed action promotes more large trees on the landscape than the existing condition (Alt. 2).

To further assess large tree retention among the alternatives we present the average trees per acre of trees greater than 30-inches DBH (Table 38). The estimated trees per acre of trees greater than 30-inches DBH reflect the 30-inch DBH restriction. The proposed action which includes the selective cutting of larger trees reduces the estimated large trees per acre just slightly from 3.7 to 3.63 trees per acre. Therefore,

although the proposed action allows some, limited, larger trees to be cut, in general the proposals effort to retain large trees is effective.

Reduce surface and ladder fuels and increase management by fire: Fuel model inputs fill a dominant role in determining fire type, flame lengths, and burn probabilities due to describing the surface and ladder fuel amounts (e.g., vertical and horizontal fuel or vegetation continuity). The fuel model changes used for each spatial pixel during modeling was determined by treatment type, intensity, and location. In sum, where intensive treatments were proposed based on current conditions, and especially at locations where multiple treatments were applied (e.g., tree thinning and prescribed burns), surface and ladder fuels as represented by these fuel models were reduced in parallel correlation to the amount of overstory vegetation cut and removed. The assessment of the effectiveness of the proposed action at reducing surface and ladder fuels are inferred through the assessment of conditional flame lengths and burn probabilities as presented next.

Conditional Flame Lengths: The proposed action increases the ratio of acreage in the lowest flame length category (less than 4 ft) compared to the highest flame length category (greater than 8 ft) (Table 27, Map 7) across each of the four scales. As expected, a larger proportion of acres in the greater than 8-feet category are reduced in areas outside of CSO PACs and territories compared to within CSO territories and PACs, with PACs showing the smallest change in acres with greater than 8-feet conditional flame lengths. Nonetheless, the treatments are effective at reducing the landscape's susceptibility to high severity wildfire as it is related to conditional flame lengths.

The greater the flame lengths the more likely forests are expected to experience active crown fires. When active crown fires occur in greater than 50% of a watershed, detrimental post-wildfire effects, such as debris flows, are expected. Landscapes with little to no active crown fire potential are expected to have less damaging post-wildfire effects.

Without management action (the no action alternative) the project area will remain more susceptible to greater flame lengths and to experience crown fire behavior during a wildfire. The proposed forest thinning demonstrates that it is effective at reducing the conditional flame length, and thereby, crown fire potential.

Increasing the proportion of the landscape expected to support conditional flame lengths less than 4-feet is another priority to create resilient conditions. The modeled post-treatment conditional flame lengths demonstrate that the proposed action at each scale will increase the proportion of the project area expected to burn with lower flame lengths and lower fire severity during an unplanned wildfire. The largest increase in acres with predicted conditional flame lengths less than 4-feet occurs outside of CSO PACs and territories, where the DBH limits are higher, canopy cover retention requirements are lower, allowing more shade-tolerant, fire-prone trees to be removed.

Annual Burn Probabilities: The proposed action is effective at reducing the annual burn probabilities across the project area to less than 2-percent. Post-treatment modeled estimates indicate that zero acres would remain above 2-percent post-treatment.

Similar to conditional flame lengths, the proposed action also increases the ratio of acreage in the lowest annual burn probability (less than 1 percent) across each of the four scales (Table 28, Map 8). As expected the proposed action increases the ratio most effectively in areas outside of PACs and territories, with PACs showing the smallest change in acres with a less than 1 percent annual burn probability. Although the effectiveness varies among the land allocations, collectively the proposed action reduces the landscapes susceptibility to natural disturbances.

Prescribed Fire: Prescribed fire is a key tool or treatment method that cannot be easily replaced by a fire-surrogate type treatment in terms of creating the full range of burn effects and nutrient recycling. The proposed action is successful at returning fire processes back to the landscape to improve the balance of the fire return interval departure (see Chapter A.06) to improve landscape resiliency (Knapp et al. 2017,

Knapp et al. 2020). All NFS lands are proposed to receive prescribed fire treatments as initial or "burn only" treatments or follow up treatments, and then subsequent maintenance treatments. This combination of returning multiple fire cycles back to the landscape's fire regime process is the best way to create and maintain resilient landscape conditions and understory biodiversity (Goodwin et al. 2018). One way to improve the often-slow pace and scale of prescribed burning is to conduct forest thinning or other mechanical fuel reduction or rearrangement treatments first and in order to reach increased resiliency outcomes (North et al. 2015, Knapp et al. 2020). This is especially important if a long time has passed since the last wildfire or vegetation/fuel treatment has occurred, which is the situation for most NFS land in the project area.

Prescribed fire implementation only occurs after a range of preparation activities, such as those listed in Section Appendix A, A.06. Preparation needs impact implementation efficiencies. For example, the more temporary control line construction or pre-burn hazard tree mitigation is needed, then the pace (and scale) of prescribed fire is slowed. The need for temporary control lines and hazard tree mitigation is often higher in areas that have (1) had no recent disturbances (e.g., high fuel loading and dense vegetation are present), or (2) had recent near-past disturbances but are located where no post-disturbance treatment has been applied. After a disturbance a large number of dead trees are still standing or recently fallen trees are stacked on top of the existing high fuel loading. Large accumulations of surface and ladder fuels in these areas are likely and often need to be managed in at least temporary control line locations prior to initiating a prescribed fire treatment. Where mechanical treatments have been applied to remove or divide up surface and ladder fuels, less prescribed fire preparation activities are needed. As more mechanical treatments are completed, prescribed fire will be efficient at larger scales, at a faster rate, and with better effects (Kane et al. 2019, Odland et al 2021). Until mechanical treatments are completed however, prescribed fire will be applied in smaller, more discrete and manageable burn unit sizes to ensure safe ignition conditions are in place and to mitigate unwanted fire behavior, and/or higher severity effects. To best meet these objectives, burn piles, rather than understory or broadcast burning ignition techniques, will be most likely used as the initial prescribed fire treatment approach until the landscape has been prepared sufficiently to safely and efficiently apply understory or broadcast burning techniques more regularly.

Burn piling is laborious requiring multiple steps — cut trees and understory vegetation, build piles, then burn piles. The results are small, but important differences in fire effects. For example, although burn piles reduce accumulated fuels, the burn pile patterns lack the more desired natural mosaic of an understory burn pattern that is partially determined by natural and treatment-generated spatial surface fuel distributions. A second example is our constraints on machine piling methods due to slope limitations and access, which are efficient compared to the pace of hand piling work.

Cumulative Effects

The SERAL 2.0 proposed actions are designed and located to increase landscape resilience to natural disturbances by increasing and restoring resilient conditions on only NFS lands. The past and reasonably foreseeable future actions identified in Table F.01-1 are planned on both private and NFS lands. The reasonably foreseeable future actions under Forest Service control (Tuolumne Main Canal, Cedar Ridge, Cold Springs, and the prescribed burning) were planned and analyzed in compliance with the Stanislaus National Forest current forest plan which includes specific constraints and standards and guidelines which limit where and when forest thinning may occur, as well as limit the size of the trees (DBH limit) and require canopy cover retention thresholds. We expect the previously planned treatments or actions will collectively contribute to reducing the landscape's susceptibility to disturbances. Therefore, when the SERAL 2.0 proposed actions are added to these other actions, we expect cumulatively beneficial effects across the project area.

Need 2. Provide social and -economic opportunities to local communities.

The analysis presented in Issue 3 (Section 3.01) above, provides the most direct comparison of economic opportunities that would occur under each alternative. Table 29 shows that the total anticipated volume removed and delivered market value of the products removed by the proposed forest thinning. The delivered market value is a relative measure of economic benefits workers in the timber and biomass industries (truckers, mill workers, equipment operators, etc.), but also businesses and staff supporting the industry (seasonal crews, and to some extent service industries) could receive if all SERAL 2.0 actions are implemented. Of course, the net values in Table 29 show that biomass treatments come at a cost (negative values), but this is simply the difference between cost of treatments and the delivered market value, it does not take into consideration grant funding or other sources of money that may be used (brought in) to pay for biomass treatments. While negative values potentially reduce the amount of biomass removal feasible, there has been an increase in grant opportunities for fuels reduction work to improve forest health, protect water sources and reduce carbon emission. These grants opportunities to fund fuels reduction work including biomass removal could result in an infusion of millions of dollars; however, the amount of grant funding any individual forest might receive is unknown. Although not all of this funding will go to local contractors, the duration of the contracts will result in indirect revenue to the local area as contractors purchase fuel, stay in hotels or rent housing and frequent grocery stores, restaurants and stores.

Additionally, at least 2 new pellet facilities are scheduled to come online in the next couple years capable of utilizing up to 344,000 bone-dry tons, or roughly 287,000 ccf per year, this additional demand has the potential to increase the feasibility of biomass removal. If the proposed forest thinning treatments are not authorized there would be no forest product removal and associated revenue generation. The SERAL 2.0 project is a substantial part of the Forests planned program of work, and not implementing this project would result in greatly reduced offering of sawlogs, biomass and other forest products due to the time it takes between project conception and implementation. Replacement of sawlogs and biomass from National Forest System lands with other sources would likely impact current and planned facilities that rely on this supply to at least some extent and may result in reduction the number of employees or hours offered.

The proposed forest thinning and fuel reduction treatments will support job creation, or at least, job retention in local communities.

Other economic indicators, besides market value of wood products are more difficult to quantify directly, but they are no less important to the overall economy for this region. In fact, the recreation and tourism economy is a larger total economic contributor to Tuolumne County than the forest products industry, and more jobs are available in recreation, arts and entertainment in Tuolumne County, than there are in forestry, and agricultural services (U.S. Department of Commerce, 2021(a)). Rural communities located along access routes to national forests benefit from the economic contributions that recreation visitors provide. This includes the spending that supports jobs, but also contributions to local tax revenues through sales and lodging taxes collected. These local tax revenues support important public services that improve the quality of life in these communities. Thus, disruptions to the recreation economy can have a wider impact to local communities. Economic data show in Tuolumne County, after large, local fire events in 2013 (Rim Fire), and 2018 (Ferguson and Donnell Fires), there was an employment decline for at least 1 year in industries that include travel and tourism (U.S. Department of Commerce, 2021(b)). These temporary declines could be tied to closures of popular NFS lands destinations, severe smoke, or (in the case of Rim and Ferguson fires) temporary closures of neighboring Yosemite National Park. SERAL 2.0 proposed treatments are designed to change vegetation and fuel conditions on NFS lands to limit large wildfire disturbance or high severity events, and to support ongoing, long-term, safe recreation and forest products industries and economies. While the performance of the regional and state economies overall likely fills a bigger role in these employment trends, the effects are certainly felt at the local level.

Another way the SERAL 2.0 proposed action would affect the local economy, indirectly, is through maintaining access to public lands. The proposed action would authorize road reconstruction and maintenance where needed to improve the road conditions to provide access to treatment units, provide for safe and efficient haul of forest products, and maintain or improve safe access to public lands.

Need 3. Reduce the Spread of Invasive Non-Native Weeds

Affected Environment

Forest Service Manual 2903(4) requires the Forest to "determine the risk of introducing, establishing, or spreading invasive species associated with any proposed action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk prior to project approval." The Stanislaus National Forest Land and Resource Management Plan (Forest Plan) as amended, and the Pacific Southwest Region Noxious Weed Management Strategy require that a noxious weed risk assessment be conducted to "determine risks for weed spread … associated with different types of proposed management activities" (USDA 2004)).

There are 770 acres of known infestations of invasive plants within the SERAL 2.0 project area, and a likely risk of the establishment of new infestations if left uncontrolled. Yellow star-thistle, Maltese star-thistle (tocalote), Italian plumeless thistle,bull thistle, and Medusahead account for approximately 730 acres of the known, mapped occurrences. Occurrences are found across the project area and 80 percent are less than one acre in size. Annual rates of spread vary from 10 to 24 percent for many invasive plant species in the western United States (Asher and Dewy 2005). Since non-native species have proliferate seeding rates that quickly colonize disturbed settings, potential influx along major travel routes poses risk for high rates of weed spread into areas where vegetation is being treated to reduce the risk of wildfire or to provide conditions supporting more natural fire regimes. Timely treatment of known infestations as well as small, newly discovered infestations before they have a chance to spread, is critical to maintaining an effective invasive species control program. Once in the natural setting, the costs and potential damages increase because weeds affect the natural successional response to disturbance and create large, infested areas too difficult to eradicate with existing control measures.

Indicators and Measures

The SERAL 2.0 proposed actions include treatments designed to control and eradicate invasive non-native weed and include management requirements designed to reduce the spread of or additional introductions of new infestations during project implementation.

Direct and Indirect Effects

Although invasive plant seed could be vectored through the activities proposed depending on the type of equipment and associated personnel, where they were prior entering the project area, how clean the equipment entering and operating in the project area is, and each treatments proximity to existing populations. Standard management requirements, mitigation measures, and monitoring practices reduce the likelihood of introducing new noxious weed infestations and reduce the risk of spreading existing noxious weeds in the project area (see 2023_DRAFT_SERAL_InvasiveWeedRiskAssessment).

The proposed invasive plant control and eradication will further reduce the spread of invasive non-native weeds and those already existing in the project area. However, treatment methods will take multiple years to take effect, therefore some risk of spread will remain. Some established weeds will only be controlled not eradicated. If early detection rapid response is employed and successful, new infestations should be fully mitigated. The ability to use herbicides as is proposed will enable a more effective response for certain invasive weeds than not allowing the use of herbicides.

Cumulative Effects

Reducing and avoiding the spread of invasive non-native weeds is considered in every reasonably foreseeable future action planned on private and federal lands within the SERAL 2.0 project area (Table F.01-1). Some projects include herbicide weed treatments in the suite of actions planned. Collectively the SERAL 2.0 proposed actions and management requirements added to the other past invasive weed treatments and the reasonably foreseeable future actions identified in Table F.01-1 are expected to mitigate the spread of invasive non-native weeds, and potentially lead to a cumulative reduction of the existing non-native weeds already present in the project area.

4. List of Preparers

4.01 Interdisciplinary Team

Name	Title/Discipline	Relevant Experience	Education
Jacob Baker	Silviculturist	Forester, Stanislaus National Forest, 9 years; Forestry Technician, US Forest Service, 2 seasons	BS, Forestry MF, Forestry
Kellin Brown	Fire and Fuels	Stanislaus National Forest District Fire Management Officer	
Matthew Bushman	Botanist	Botanist/Ecologist, USFS Enterprise Program, 1 year; Forest Silviculturist, Chequamegon-Nicolet NF, 3 years; Zone Botanist, National Forests in North Carolina, 4 years; District Botanist, Chequamegon-Nicolet NF, 10 years	BS, Forestry; BS, Biology; MS, Natural Resources – Plant Ecology
William Downing	Fire and Fuels	Fire Risk Analyst, USFS Enterprise Program, 3 years; Research Fire Ecologist, Oregon State University, 3 years; Wildland Firefighter, USFS, 17 years	
Marcie Easter	Wildfire Crisis Strategy Implementation Coordinator – Resource Management Staff Officer	WCS Project Manager & Implementation Coordinator, Stanislaus National Forest, 2 years; Resource Management Staff Officer, Stanislaus National Forest, 3 years; Wildlife Biologist, Stanislaus National Forest, 13 years	BS, Wildlife Management and Conservation
Hailey Gleason	Natural Resource Specialist	Natural Resource Specialist, Stanislaus National Forest, 1.5 years; Forest Health Specialist, AmeriCorps, 1 year; Aquatic Research Assistant, UCSD and UC Davis, 3 years	BS, Environmental Science and Management – Ecology, Biodiversity, and Conservation emphasis
Chad Hermandorfer	Hydrologist	Hydrologist, Uinta National Forest, 3 years; Hydrologist, Forest Service Enterprise Program, 20 years	BS, Environmental Science, MS Candidate, Watershed Management
Steve Holdeman	Aquatic Biologist	Forest Aquatic Biologist, Stanislaus National Forest 21 years; Aquatic Biologist, Private Consulting 12 years	BS, Wildlife and Fisheries Science MS, Fisheries Science
Crispin Holland	USFWS Consultation Lead	Forest Range Wildlife Aquatic and Botany Program Manager 13 years; Region 5 Range	BS, Rangeland Resource Science - Soils and Botany Minor

Name	Title/Discipline	Relevant Experience	Education
		Program Manager 3 years; Rangeland Specialist Plumas and Stanislaus National Forests 10 years	
Michael Jow	Resource Management Staff Officer	Forest Resource Mgt. Staff Officer, Stanislaus National Forest ,4 years; District Resource Mgmt. Program Area Leader, Stanislaus NF, 6 years; Forester/Sale Prep/ID Team leader, Idaho Panhandle NF, 4 years; Forester/Silviculture/IDT Leader, Stanislaus NF, 5 years	BS, Environmental Horticulture and Urban Forestry - Restoration Ecology emphasis; MF Forestry
Ryan Kalinowski	Wildlife Biologist	Wildlife Biologist, Stanislaus National Forest, 11 years; Student Career Experience Program (Wildlife), Stanislaus National Forest 3 years; Wildlife Technician 4 seasons	BS, Wildlife Management and Conservation MS, Natural Resources – Wildlife Emphasis
Renee Kehler	Range Specialist	Rangeland Specialist, Sawtooth National Forest, 8.5 years; Rangeland Specialist, Boise National Forest 3 years; Range Technician, Boise National Forest, 1 year; Range Technician, Sawtooth National Forest, 6 months	BS, Rangeland Ecology and Watershed Management
Curtis Kvamme	Soil Scientist	Soil Scientist, Stanislaus National Forest 13 years; Soil Scientist, Shoshone NF Student Career Experience Program 2 years	BS, Ecology & Conservation Biology MS, Forest Ecology & Management
Brian McCrory	Wildfire Crisis Strategy Coordinator	WCS Project Coordinator, Stanislaus National Forest, 1 year; Timber Management, Stanislaus National Forest, 8 years; Timber Sale Administration, Mendocino National Forest, 5 years; Timber Sale Prep, Gifford Pinchot National Forest, 3 years	BS, Recreation and Park Administration
Kelsey Retich	Wildlife Biologist	Wildlife Biologist, Stanislaus National Forest, 1 year; Wildlife Biologist, Colville National Forest, 5 years; Wildlife Biologist Detail, Umatilla National Forest, less than 1 year; Wildlife Biologist, Bureau of Land Management Southern Nevada, 1.5 years; Biological Science Technician, various locations and agencies, 4 years.	BS, Biology Emphasis Wildlife and Natural Resource Management
Ramon Rivera	Aquatic Biologist	District Fisheries Biologist, Siskiyou National Forest, 10 years; District Fisheries Biologist, Willamette National Forest, 21 years; Fisheries Biologist Forest Service Enterprise Program, Washington Office, 5 years.	BS in Agriculture Double Major in Fish and Wildlife Sciences Minor in Biology
Kathy Strain	Heritage and Archeology	Forest Archaeologist and Tribal Relations Program Manager; National Forest 33 years; District Archaeologist, Sequoia National Forest 4 years; Ecosystem Archaeologist, Humboldt-Toiyabe National Forest 4 years; Forest Archaeologist, Stanislaus National Forest 25 years	BA, Anthropology MA, Behavioral Science emphasis Anthropology
Katie Wilkinson	Forest Environmental Coordinator,	Environmental Coordinator, Stanislaus National Forest, 7 years; Ecologist, Stanislaus National	BS, Environmental Biology / Zoology

Name	Title/Discipline	Relevant Experience	Education
	SERAL 2.0 Team Leader	Forest, 4 years; Biological Science Technician, Stanislaus National Forest 8 years.	MS, Biology — Aquatic Wildlife Emphasis
Lucas Wilkinson	GIS specialist, ForSys Technician, Resource Model Support	GIS Coordinator, Stanislaus National Forest, 2.5 years; Aquatic Biologist, Stanislaus National Forest, 6 Years; Ecologist, Stanislaus National Forest, 4 Years; Biological Science Technician, Stanislaus National Forest 7 Years.	BA, Environmental Sciences (Double Major); MS, Ecology

4.02 Additional Technical Advisors and Contributors

Technical advisors were instrumental during the planning and development of SERAL 1.0 and SERAL 2.0. Information and expertise provided for SERAL 1.0 was brought forward and directly incorporated into the development of SERAL 2.0.

Name	Title/Discipline
Becky Estes	Central Sierra Province Ecologist, USFS Pacific Southwest Region
Eric Knapp	Research Ecologist, USFS Pacific Southwest Research Station
Peter Stine	USFS Pacific Southwest Research Station
Alan Agar	Research Forester, USFS Rocky Mountain Research Station
Chris Dunn	Research Associate, Oregon State University
Jessica Haas	Fire and Fuels Ecologist, USFS Enterprise Program
Stacy Drury	Research Fire Ecologist – USFS Pacific Southwest Research Station
Kirk Evans	GIS / RS Analyst, Region 5 USFS Contractor– Remote Sensing Lab
John Hogland	Research Forester, USFS Rocky Mountain Research Station
Sarah Sawyer	National Wildlife Ecologist, USFS WO Biological & Physical Resources Staff
Joe Sherlock	Regional Silviculturist, USFS- Pacific Southwest Region
Ramiro Rojas	Assistant Regional Silviculturist, USFS - Pacific Southwest Region
Jens Stevens	National Program Lead -Wildland Fire and Fuels Research, US Forest Service
Rachel McIntosh-Kastrinsky	Acting Policy Advisor, US EPA - Office of Air and Radiation
Kayla McCauley	Physical Scientist, U.S. EPA - Office of Air Quality Planning & Standards
Scott Damon	Health Communication Lead, CDC – Asthma and Air Quality Branch
Gabrielle Ceja	Communications Coordinator, Tuolumne County Public Health

4.03 Yosemite Stanislaus Solutions Collaborators

Name	YSS Leadership Role	Affiliation
Brian Wayland	YSS Leadership Team	Wayland Professional Forestry
John Buckley	YSS Leadership Team	Central Sierra Environmental Resource Center
Hannah Grabowski	YSS Leadership Team	Sierra Pacific Industries
Mike Albrecht	YSS Leadership Team	Sierra Resource Management, Inc.
Chris Trott	YSS Leadership Team	CT Bioenergy Consulting
Patrick Koepele	YSS Leadership Team	Tuolumne River Trust, Executive Director
John Amodio	YSS Leadership Team	Tuolumne River Trust
Carolyn Lott	YSS Member	Facilitator
Liz Peterson	YSS Leadership Team Chair	Tuolumne County

5. List of Agencies, Organizations, and Persons to Whom Copies of the Statement are Sent

5.01 Federal, State and Local Agencies

Advisory Council on Historic Preservation, Director, Planning and Review
U. S. Army Corp of Engineers, South Pacific Division
Environmental Protection Agency, Region 9, EIS Review Coordinator
Federal Aviation Administration, Regional Administrator, Western-Pacific Region
NOAA Fisheries Service, SW Region, Habitat Conservationist Division
Natural Resources Conservation Service, National Environmental Coordinator
APHIS PPD/EAD, Deputy Director
National Agricultural Library, Acquisitions and Serials Branch
US Coast Guard, Office of Environmental Management
US Department of Energy, Director, Office of NEPA Policy and Compliance
USDI Fish and Wildlife Service

5.02 California State Agencies

California Department of Fish and Wildlife
California Department of Parks and Recreation OHMVR
Central Valley Regional Water Quality Control Board

5.03 Local Elected Officials

Alpine County Board of Supervisors
Tuolumne County Board of Supervisors
Calaveras County Board of Supervisors
Mariposa County Board of Supervisors

5.04 Tribes

Tuolumne Band of Me-Wuk Indians
Washoe Tribe of Nevada and California
Chicken Ranch Tribal Council

5.05 Individuals and Organizations

The Forest Service has distributed this draft environmental impact statement or made it electronically available to over 500 individuals and groups. Each specifically subscribed to the project mailing address or Forestwide mailing address, requested a copy of the document or commented during scoping.

Electronic correspondence was distributed via GovDelivery (USDA Forest Service forestservice@public.govdelivery.com).

We have omitted a complete mailing listing from this DEIS, but it is available on request.

6. Regulatory Review of Other (than NEPA) Law, Regulation, and Policy Compliance

6.01 National Forest Management Act (NFMA) — Land Management Plan Consistency and Compliance

This project is consistent with the forest plan as documented in the Forest Plan Consistency checklist. The consistency of the proposed actions are compared to the forest plan as amended by the proposed project-specific forest plan amendments (Appendix C, Table C.01-1).

Supporting Project Documentation

Documentation Title	File Name
Forest Plan Compliance Checklist	2024_SERAL 2.0_ForestPlanCompliance.docx
Project-specific Forest Plan Amendment Compliance	2024_SERAL_2.0_ProjectSpecifcForestPlanAmendments_Compliance.docx

6.02 Endangered Species Act

Stanislaus National Forest specialists reviewed the proposal and made effects determinations for threatened, endangered, and proposed species and critical habitat that occur or have the potential to occur within the project area (Table 40) and ensured compliance with the Endangered Species Act.

Table 39: Effect Determination for Endangered Species Act species and habitat.

Species/Habitat	Status	In Project Area?	ESA Determination	Supporting File Name
Northwestern Pond Turtle	Proposed Threatened	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Foothill Yellow-Legged Frog	Endangered	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Yosemite Toad	Threatened	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Yosemite Toad Critical Habitat	Designated	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Sierra Nevada Yellow-Legged Frog	Endangered	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Sierra Nevada Yellow-Legged Frog Critical Habitat	Designated	Yes	MALAA	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
California Red-legged Frog	Threatened	No	No Effect	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
California Tiger Salamander	Threatened	No	No Effect	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Delta Smelt	Threatened	No	No Effect	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Monarch Butterfly	Candidate	Yes	MANL-FL	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
North American Wolverine	Threatened	No	No Effect	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Pacific Fisher	Threatened	No	No Effect	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation

Species/Habitat	Status	In Project Area?	ESA Determination	Supporting File Name
Pacific Fisher Critical Habitat	Proposed	No	No Effect	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Sierra Nevada Red Fox	Endangered	No	No Effect	2021-0907_SERAL_2.0_SNRF_ConsiderationDocumentation
Whitebark Pine	Threatened	No	MANLAA	2024_DRAFT_SERAL_2.0_Botany_BiologicalAssessment

MALAA – May Affect Likely to Adversely Affect; MANLAA – May Affect Not Likely to Adversely Affect; MANL-FL - May Affect, But Not Likely to Contribute to the Need for Federal Listing or Result in Loss of Viability in the Planning Area.

Additional Supporting Project Documentation

Documentation Title	File Name
U.S. Fish and Wildlife Service ECOS-IpaC Online Species List	2024_SERAL_2.0_SpeciesList_SacramentoFishAndWildlifeOffice

6.03 Forest Service Sensitive Species (Forest Service Manual 2670)

Sensitive species are those designated by the Regional Forester with the goal of proactively developing and implementing management practices to ensure that those species do not become Threatened or Endangered, and therefore require protection under the Endangered Species Act because of Forest Service actions (FSM 2670.12). Stanislaus National Forest resource specialists reviewed the proposal and made determinations as to whether the status of Forest Service Sensitive species would be impacted. The summary determinations and documentation references are provided in Table 41.

Table 40. Effect determinations for Forest Service Sensitive Species.

Species	FSM Determination	Documentation Title and File Name
California Spotted Owl	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Pacific Marten	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
American Goshawk	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Willow Flycatcher	No Effect	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Bald Eagle	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Great Gray Owl	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Pallid Bat	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Townsend's Big-eared Bat	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation

Species	FSM Determination	Documentation Title and File Name
Western Bumblebee	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Fringed Myotis	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Wildlife_BiologicalEvaulation
Limestone Salamander	No Effect	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Hardhead	May affect individuals but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_AquaticBiologicalAssessmentEvaluation
Allium jepsonii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Allium tribracteatum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Allium yosemitense	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Arctostaphylos nissenana	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Balsamorhiza macrolepis	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Boechera evadens	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Boechera tularensis	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium ascendens	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium crenulatum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium lineare	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium lunaria	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium minganense	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium montanum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium pedunculosum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation

Species	FSM Determination	Documentation Title and File Name
Botrychium pinnatum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Botrychium tunux	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
*Botrychium yaaxudakei*t	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Bruchia bolanderi	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Calochortus clavatus	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Clarkia australis	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Clarkia biloba ssp. *Australis*	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Clarkia lingulata	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Cypripedium montanum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Dendrocollybia racemosa	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Draba asterophora var. asterophora	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Draba asterophora var. macrocarpa	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Eriastrum tracyi	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Eriogonum luteolum var. *saltuarium*	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Eriophyllum congdonii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Eriophyllum nubigenum	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Erythronium taylorii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Erythronium tuolumnense	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation

Species	FSM Determination	Documentation Title and File Name
Fissidens aphelotaxifolius	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Helodium blandowii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Horkelia parryi	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Hulsea brevifolia	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Iris hartwegii ssp. Columbiana	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Lewisia congdonii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Lewisia kelloggii ssp. *Hutchisonii*	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Lewisia kelloggii ssp. *Kelloggii*	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Lomatium stebbinsii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Meesia uliginosa	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Mielichhoferia elongata	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Mielichhoferia shevockii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Mimulus filicaulis	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Mimulus pulchellus	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Peltigera gowardii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation
Pinus albicaulis	May Affect, Not Likely to Adversely Affect	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation & 2024_DRAFT_SERAL_2.0_Botany_BiologicalAssessment
Tauschia howellii	May affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability.	2024_DRAFT_SERAL_2.0_Botany_BiologicalEvaluation

6.04 Management Indicator Species (Forest Service Manual 2630)

Management Indicator Species (MIS) are animal species identified in the Sierra Nevada Framework MIS Amendment Record of Decision (ROD) signed December 14, 2007, which was developed under the 1982 National Forest System Land and Resource Management Planning Rule (1982 Planning Rule) (36 CFR 219). Guidance regarding MIS directs Forest Service resource managers to (1) at project scale, analyze the effects of proposed projects on the habitat of each MIS affected by such projects, and (2) at the bioregional scale, monitor populations and/or habitat trends of MIS, as identified in the Stanislaus Forest plan Direction.

An MIS report was completed to evaluate and disclose the impacts of SERAL 2.0 on the habitat of the thirteen (13) MIS identified in the Stanislaus National Forest – Forest Plan (USDA 2017). This report documents the effects of the proposed action on the habitat of selected project-level MIS.

Additional Supporting Project Documentation

Documentation Title	File Name
Management Indicator Species Report	2024_DRAFT_SERAL_2.0_MIS_Report

6.05 Invasive Species Management (Forest Service Manual 2900, Executive Order 13112)

The Stanislaus National Forest conducted an analysis to assess the risk of introducing, establishing, or spreading invasive plants as a result of the SERAL 2.0 proposed actions and included mitigation measures to reduce the risk. In addition, the SERAL 2.0 proposed actions include an early detection rapid response proposal to control or eradicate existing or future infestations. The results of this analysis and the proposed invasive weed treatments are documented in the invasive plant risk assessment document.

Additional Supporting Project Documentation

Documentation Title	File Name
Invasive Weed Risk Assessment	2024_DRAFT_SERAL_2.0_InvasiveWeedRiskAssessment

6.06 National Historic Preservation Act (NHPA) – Section 106 Review

The National Historic Preservation Act of 1966 is the principal, guiding statute for the management of cultural resources on NFS lands. Section 106 requires federal agencies to consider the potential effects of a project on historic, architectural, or archaeological resources that are eligible for inclusion on the National Register of Historic Places and to afford the President's Advisory Council on Historic Preservation an opportunity to comment. The criteria for National Register eligibility and procedures for implementing Section 106 are outlined in the U.S. Code of Federal Regulations (36 CFR Parts 60 and 800, respectively). Section 110 requires federal agencies to identify, evaluate, inventory, and protect National Register of Historic Places resources on properties they control.

A. *Programmatic Agreement*

Compliance to Section 106 is accomplished through in the "Programmatic Agreement Among the U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Processes for Compliance with Section 106 of the National Historic Preservation Act For Management Of Historic Properties By The National Forests Of The Pacific Southwest Region" (Regional Programmatic Agreement), signed February 2013, and amended 2018.

The entire project area was completely surveyed for the presence of historic, architectural, or archaeological resources. Sites will be protected in compliance with the Regional Programmatic

Agreement, and we anticipate that current design features [see Chapter 2.12 C Management Requirements] will ensure that no significant effects would occur.

B. *Tribal Consultation*

The Stanislaus National Forest consulted with the Tuolumne Band of Me-Wuk, Chicken Ranch Tribal Council, California Valley Miwok Tribe also known as the Sheep Ranch Rancheria of Me-Wuk Indians of California, and Washoe Tribe of Nevada and California in July and August 2023. The Forest only received a verbal supportive comment from the Tuolumne Band.

6.07 Soil Quality and Hydrologic Function (FSM 2500 – USDA 2010)

FSM 2500 establishes the management framework for sustaining soil quality and hydrologic function while providing goods and services outlined in the Forest Plan. Primary objectives of this framework are to inform managers of the effects of land management activities on soil quality and to determine if adjustments to activities and practices are necessary to sustain and restore soil quality. Soil quality analysis and monitoring processes are used to determine if soil quality conditions and objectives have been achieved.

Supporting Project Documentation

Documentation Title	File Name
Soil Report	2024_ DRAFT_SERAL_2.0_SoilsReport

6.08 Soil Conditions (FSM 2500 Chapter 2550 Supplement – USDA 2012)

FSM 2500 Chapter 2550 Supplement establishes soil functions (support for plant growth (productivity) function, soil hydrologic function, and filtering and buffering function) that the Region uses to assess soil conditions. The analysis standards are used for areas dedicated to growing vegetation. They are not applied to lands with other dedicated uses, such as system roads and trails or developed campgrounds.

Supporting Project Documentation

Documentation Title	File Name
Soil Report	2024__DRAFT_SERAL_2.0_SoilsReport

6.09 Water Quality Management Handbook (FSH 2509.22, Chapter 10 - USDA 2011b)

The Forest Service Region 5 Water Quality Management Handbook (WQMH) includes requirements for best management practices (BMP) implementation monitoring of all projects with the potential to adversely affect water quality using a "checklist" approach (FSH 2509.22 Chapter 10). The Forest Service water quality protection program relies on implementation of prescribed BMPs. The checklists are the primary means for early detection of potential water-quality problems and should be completed early enough to allow corrective actions to be taken, if needed, prior to any significant rainfall or snowmelt throughout the duration of the project.

These BMPs are procedures and techniques that are incorporated in project actions and determined by the State of California to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. Forest Service BMPs, as presented in the 2011 Handbook include detailed descriptions of individual BMPs (section 12), a requirement that site-specific BMPs be included in timber sale contracts (section 13), and direction that legacy sites (sites disturbed by previous land use that is causing or has potential to cause adverse effects to water quality) within timber project boundaries will be restored or improved. Additionally, the 2011

Handbook amendment establishes an expanded water quality management monitoring program (section 16).

Supporting Project Documentation

Documentation Title	File Name
SERAL BMP Checklist	2024_DRAFT_SERAL_2.0_BMP_checklist.pdf

6.10 National Best Management Practices for Water Quality Management on National Forest System Lands (Vol. 1 – National Core BMP Technical Guide. FS-990a).

http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

Current Forest Service policy directs compliance with required CWA permits and State regulations and requires the use of BMPs to control nonpoint source pollution to meet applicable water quality stands and other CWA requirements. The SERAL 2.0 BMP checklist was prepared to identify all of the applicable BMPs that need to be followed during implementation of the SERAL 2.0 project.

Supporting Project Documentation

Documentation Title	File Name
BMP Checklist	2024_DRAFT_SERAL_2.0_BMP_checklist.pdf

6.11 Protection of Wetlands (Executive Order 11990) and Floodplain Management (Executive Order 11988)

Wetlands within the project area include meadows, stream channels, springs, fens, and shorelines. This project is consistent with Executive Order 11990 since this project would maintain or improve the condition of wetlands in the project area.

Supporting Project Documentation

Documentation Title	File Name
Watershed Report	2024_DRAFT_SERAL_2.0_WatershedReport.docx

6.12 Clean Water Act (CWA)

The Clean Water Act of 1948 (as amended in 1972 and 1987) establishes federal policy for the control of point and non-point pollution and assigns the states the primary responsibility for control of water pollution. The Clean Water Act regulates the dredging and filling of freshwater and coastal wetlands. Section 404 (33 USC 1344) prohibits the discharge of dredged or fill material into waters (including wetlands) of the United States without first obtaining a permit from the U.S. Army Corps of Engineers. Wetlands are regulated in accordance with federal Non-Tidal Wetlands Regulations (Sections 401 and 404). No dredging or filling is part of this project and no permits are required.

Compliance with the Clean Water Act by national forests in California is achieved under state law. The California Water Code consists of a comprehensive body of law that incorporates all state laws related to water, including water rights, water developments, and water quality. The laws related to water quality (sections 13000 to 13485) apply to waters on the national forests and are directed at protecting the beneficial uses of water. Of particular relevance for the SERAL 2.0 project is section 13369, which deals with non-point-source pollution and best management practices. All actions proposed result in the maintenance of the applicable beneficial uses of water in the Water Quality Control Plan for the California Central Valley Water Quality Control Board.

Supporting Project Documentation

Documentation Title	File Name
Watershed Report	2024_DRAFT_SERAL_2.0_WatershedReport.docx

6.13 Migratory Bird (Executive Order 13186)

Direction for integrating migratory bird conservation into forest management and planning includes the Landbird Conservation Strategic Plan (USDA Forest Service 2000), Executive Order 13186 (2001), and the Partners in Flight North American Landbird Conservation Plan (Rosenberg et al. 2016), and the 2017 Department of Interior Solicitor's Opinion M-37050.

Within the National Forests, migratory bird conservation focuses on providing a diversity of bird habitats at multiple spatial and temporal scales over the long-term. Our actions also include promoting migratory bird conservation through collaboration and cooperation with the Fish and Wildlife Service as well as other agencies, non-profit organizations and private citizens.

Although some project actions may have incidental short-term adverse effects on some individual birds, eggs or nests, we do not expect adverse effects at the species population level. Additionally, potential adverse effects to migratory bird species have been reduced through the adherence of Forest Plan Standards and Guidelines such as: riparian reserve buffers; select tree thinning that maintains a variety of forest canopies and canopy gaps needed for migratory birds; limited ground disturbance; snag/down woody debris retention and others. Forest management generally creates and maintains migratory bird habitat heterogeneity (including late-seral and early-seral habitats), as well as creating habitat with greater resilience to ecosystem stressors such as abnormal high severity fire, insect and disease infestation and prolonged drought.

Supporting Project Documentation

Documentation Title	File Name
Migratory Bird Assessment	2024_DRAFT_SERAL_2.0_MigratoryBird_Report

6.14 National Forest System Land Management Planning Rule (36 CFR 219)

A. *Identification of the Need to Change the Plan (36 CFR 219.13(b)(1))*

The 1991 Stanislaus National Forest Land and Resource Management Plan, as amended and as consolidated in the Stanislaus National Forest Plan Direction (USDA 2017) provides the current management direction — land allocations, desired conditions, management intents, objectives, and standards and guidelines (S&Gs) — specific to the California spotted owl (CSO).

Much of the current direction pertaining to the CSO originates from the 2004 Sierra Nevada Framework amendments. The Framework presented management guidance focused on retaining suitable habitat and minimizing disturbance to breeding CSO. Since that time, much research and additional monitoring has been conducted providing updated information related to the status, habitat preferences and habitat needs of the CSO. This new information indicates threats to owls are shifting and evolving, environmental conditions are changing, threats of habitat loss due to large scale high-severity wildfire are increasing, and owl populations are declining in some areas of the species range and particularly in areas where habitat has been lost due to disturbance. During the lengthy fire season of 2020 alone, of the fires with RAVG data, over 55,000 acres of CSO PACs were located within a fire perimeter. Of those CSO PAC acres, more than half, almost 28,000 acres of the existing PAC habitat, were lost based on estimated loss of basal area. Retention of suitable habitat by avoiding management actions in CSO habitat is no longer acceptable and comes at a great risk (Jones et al. 2021(a); Jones et al. 2021(b)). An all-lands approach, including CSO PACs and territories, to manage the vegetation structure and composition towards a condition that accepts fire at more regular intervals and at lower intensities, and a landscape that can persist and evolve with other natural processes such as fire, insects, disease, and drought is necessary.

In April of 2019, the *Conservation Strategy for the California Spotted Owl in the Sierra Nevada* (hereafter referred to as the "**CSO Strategy**") was published by the USDA Forest Service (USDA 2019). A central goal of the CSO Strategy is to move the Sierra Nevada forests as a whole toward the natural range of variation where there would be an abundance of resilient and dynamic owl nesting, roosting, and foraging habitat distributed across the landscape and having specific management constraints in regard to CSO habitat would no longer be necessary. The CSO Strategy recognizes that vegetation management has the potential to increase forest resilience at the landscape scale — including vegetation management, that in some instances, may reduce spotted owl habitat quality in the near-term but preserve long-term sustainability of spotted owl habitat by promoting additional, future, spotted owl habitat. To accomplish this balance of short-term disturbance with long-term conservation, the CSO Strategy synthesized newly available science into recommended management approaches and conservation measures, including management constraints, that provide some immediate stability for individual owls while allowing landscape treatments to occur.

In order to apply an all-lands approach to forest management based on NRV (Approach 2, USDA 2019) while ensuring highest-quality habitat is maintained, especially around occupied nest sites (Approach 1, USDA 2019) as presented in the CSO Strategy it is necessary to adopt a suite of forest plan amendments. The suite of needed amendments include plan components which: (1) Update the plan to promote landscape scale NRV-based restoration; (2) Eliminate PAC avoidance based plan content; (3) Add standards and guidelines to constrain management activities in PACs and Territories; (4) Update PAC designation direction to better define high quality CSO habitat; (5) Add new guidelines which address post-disturbance management; (6) Convert plan content from HRCA to Territory; (6) Update and add new PAC retirement standards.

Appendix C, Table C.02-1 presents the suite of project-specific forest plan amendments applied to the proposed action. The specific need for each category of amendments are further addressed below.

i. Update the plan to promote landscape scale NRV-based restoration

NRV-based restoration is a central and guiding principle of the CSO Strategy. NRV is a relatively new, well supported, concept that was not contemplated or considered during the development of the current forest plan in 1991 or during the development of the 2004 Framework amendments. The CSO Strategy as well as numerous other studies, conclude that restoring landscape structure and function to be within the NRV can help develop a resilient landscape including habitat conditions that provide CSO conservation in the long term.

ii. Eliminate PAC avoidance-based plan content

For more than a quarter of a century, the Forest Service has been engaging in proactive California spotted owl (CSO) conservation focusing on retaining suitable habitat and minimizing disturbance to breeding owls by locating mechanical vegetation treatments to "avoid" PACs to the greatest extent feasible, as is demonstrated by S&G 72. However, new science indicates threats to spotted owls are shifting and evolving, environmental conditions are changing, and owl populations are declining in some areas of the species' range. In the CSO Strategy, active management within PACs is promoted where necessary to increase resiliency and sustainability (USDA 2019, p. 28). This concept recognizes that PACs are not immune to the risk of large-scale, high-severity wildfire or severe tree mortality from insects and disease and drought. The 2019 CSO Conservation Strategy provides updated guidance and recommendations focusing on maintaining highest-quality habitat, while allowing for the development of resilient habitat across the landscape (USDA 2019), including the use of mechanical treatments within PACs. Shifting management direction from a single, limiting resource focus and general PAC avoidance to a more landscape level approach is needed in order to allow management an opportunity to consider, if, where, and what restoration is needed across the landscape, including within PACs, to best achieve landscape

scale resiliency. The CSO Strategy and local experts stipulate that a more wholistic approach to treating the landscape is critical for reducing the risk of habitat loss.

iii. Add standards and guidelines to constrain management activities in PACs and territories

A central goal of CSO Strategy is to improve the overall resilience of forest vegetation types relative to stressors including altered fire regimes and drought, for the long-term benefit of the ecosystems and the species found therein. In regard to habitat for California spotted owl, the goal is to move Sierra Nevada forests as a whole toward the natural range of variation where there would be an abundance of resilient and dynamic owl nesting, roosting, and foraging habitat distributed across the landscape and having specific management constraints in spotted owl territories would no longer be necessary. In the interim, however, management constraints within protected activity centers and territories are an important component of a comprehensive approach that considers both near- and long-term needs of the species.

Plan components for California spotted owl applicable to either protected activity centers or territories are necessary to balance the application of NRV-based management and species conservation needs. Protected activity centers are intended to meet the specific habitat needs that support successful reproduction of breeding owls. Territories, which contain protected activity centers, are areas defended by the resident pair of owls and include foraging and other important habitat. Desired conditions for protected activity centers and territories align with both the near-term need for high quality nesting and roosting habitat, and increased resilience and sustainability of this habitat into the future. Given the role vegetation management plays in increasing forest resilience at the landscape scale, vegetation management that does not reduce spotted owl habitat quality needs to be encouraged within and around owl territories and, if necessary, in protected activity centers. In some instances, vegetation management that may reduce spotted owl habitat quality in the near term may also be necessary to preserve long-term sustainability of spotted owl habitat and the forest plan needs to be modified provide this allowance.

Because of the need to protect human safety, some plan components to define exceptions which allow management constraints to be modified in order to meet safety objectives or mitigate extreme risks to habitat sustainability need also to be included in the forest plan.

iv. Update PAC designation direction to better define highest-quality nesting and roosting habitat

The current forest plan directs that 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 codominant 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).

The CSO Strategy suggests that PACs be designated to include 300-acres of the highest-quality nesting and roosting habitat rather than the best-available. The difference between highest-quality nesting and roosting habitat and best-available nesting and roosting habitat was further defined by authors of the CSO Strategy and incorporated into the SERAL 2.0 proposed project-specific forest plan amendments, the proposed actions, and analysis. The updated definitions of highest-quality and best available habitat add a snag and down woody debris aspect that is not included in the current forest plan. The slight, albeit important, differentiation from best available to both highest-quality and best available is needed in order to more effectively meet the specific habitat needs of the California spotted owl and will better ensure that near-term impacts to reproductive owls and nest stands are minimized and the highest-quality nesting and

roosting habitat is maintained and promoted —based on characteristics identified as the most important by the most current science.

v. Add new guidelines which address post-disturbance management

Prior to the 20th century, regular patters of fire created a mosaic of vegetation patters including varying degrees of canopy cover and forest openings at densities far less susceptible to insect-, disease-, or drought mortality. Now, when insect- or disease-outbreaks or lengthy droughts occur mortality is common. CSO PACs are not immune to these disturbances. Large scale mortality leads to an accumulation and eventual overabundance of fuels: coarse woody debris, snags, litter, and duff. These fuels collectively heighten the landscape's risk (including PACs) to experience high severity wildfire. In these instances, management activities to reduce the fuels may be necessary to restore resilient conditions based on NRV.

Generally, NRV can inform the salvage needs in response to both fire and insect related mortality. Historically, fire effects that mimic NRV would have produced a mosaic of patches burned at low (30 to 60 percent) and moderate (15 to 35 percent) severities interspersed with large, unburned patches (10 to 30 percent) and small, high-severity patches (1 to 10 percent) (USDA 2019). High severity burns are most likely to result in tree mortality. Where that occurs in excess of 10 percent of the landscape, there would be an NRV-based restoration need to salvage.

Similarly, insect and disease outbreaks that mimic NRV would have produced patches of beetle- or disease-killed trees between 0.25 and 10-acres over up to 15 percent of the landscape (Fettig 2012 *in* USDA 2019). When insect or disease cause mortality in excess of this condition, there would be an NRV-based restoration need to salvage.

The current forest plan specifically prohibits salvage harvest in PACs outside of WUI defense zones unless a Biological Evaluation determines the area is rendered unsuitable. This PAC avoidance-based management direction, as addressed in section A.2 above, is contradictory to NRV-based landscape restoration and impacts management's ability to move the landscape into a condition more resilient to future disturbances. To correct this, S&G 35 in the current forest plan needs to be amended to provide guidelines for conducting vegetation management within highly disturbed areas including allowing the determination of desired conditions for amount, location, and configuration of patch retention to be informed by best available science as referenced above.

vi. Convert plan content from HRCA to territory

Owls benefit from mature forests with a mosaic of vegetation types and seral stages. A mosaic condition of small open areas or gaps and edges interspersed with highest-quality nesting/roosting habitat is considered an important predictor for owl occupancy and reproduction. Circular territories rather than Home Range Core Areas (HRCA) better recognize the need to manage toward NRV and fine scale habitat heterogeneity that recent research shows owls prefer for nesting, roosting, and foraging. In contrast, HRCA focus mainly on canopy cover over a large area which may result in homogenization, densification, and continuous fuel profiles that increase the risk of sustained crown fire. Circular territories also better recognize how owls are central place foragers (i.e., tend to focus activities in a circular pattern). In contrast, HRCA delineation requirements often result in more "amoeba" like or long linear features that may not actually be defended by owls (an owl territory is the area defended by a resident pair).

vii. Update and add new PAC retirement standards

The CSO exhibits high site fidelity. However, when a PAC becomes abandoned, research suggests the probability of recolonization of a vacant PAC is relatively low (0.34 one-year post vacancy) and continues to decline through time (USDA Forest Service 2019). The recolonization probability is 0.20 the

fourth year and 0.06 the tenth year after abandonment (Wood et al. 2018). CSO occupancy and reproduction are best predicted by previous year occupancy, and previous year occupancy and reproduction, respectively (Hobart et al. 2019), suggesting unoccupied PACs tend to stay unoccupied and, if colonized, are not reproductive the following year. To best maintain highest-quality habitat while protecting it from risk of loss from high-severity wildfire and other stressors, there is a need for PAC management to continually improve the effectiveness and dynamic nature of the PAC network (USDA Forest Service 2019). Local observations of owls conclude that these abandoned and non-active PACs have poor habitat quality and lack nest structures. Retiring these poorer condition PACs, lacking highest-quality habitat characteristics, not likely to support reproduction, will allow a broader array of management actions designed to increase long-term suitable habitat development and promote future recruitment of owls into those same areas. The objective for areas that were once but are no longer in active PACs is to increase long-term suitable and sustainable habitat development in a dynamic landscape (Ibid).

B. *Substantive Requirements Directly Related to the Amendments (36 CFR 219.13(b)(5))*

In accordance with 36 CFR 219.13(b)(5), based on the proposed amendments' purpose and anticipated effects, the Responsible Official has determined the following substantive provisions are directly related to the proposed amendments:

36 CFR 219.8 Sustainability, **(a)** Ecological sustainability, **(1)** Ecosystem Integrity

36 CFR 219.9: Diversity of Plant and Animal Communities, **(a)** Ecosystem plan components **(b)** Additional, species-specific plan components

36 CFR 219.10 Multiple Use, **(a)** Integrated resource management for multiple use,

(1) Aesthetic values, cultural and heritage resources, ecosystem services, fish and **wildlife species**, forage, geologic features, grazing and rangelands, **habitat and habitat connectivity**, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, **timber**, trails, **vegetation**, viewsheds, and other relevant resources and uses;

(5) Habitat conditions, subject to the requirements of § 219.9, for **wildlife**, fish, and plants commonly enjoyed and used by the public; for hunting, fishing, trapping, gathering, observing, subsistence, and other activities (in collaboration with federally recognized Tribes, Alaska Native Corporations, other Federal agencies, and State and local governments);

(8) System drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of the terrestrial and aquatic ecosystems on the plan area to adapt to change (§ 219.8(a)(1)).

36 CFR 219.11 Timber requirements based on National Forest Management Act, **(c)** Timber harvest for the purposes other than timber production; and **(d)** Limitations on timber harvest, **(3)** Timber harvest would be carried out in a manner consistent with the **protection** of soil, watershed, fish, **wildlife,** recreation, and aesthetic resources.

Each of the substantive requirements set forth in 36 CFR 219.8 through 36 CFR 219.11 provide an overarching purpose to which the regulation is directed as well as specific means to meet that purpose, generally with the inclusion of plan components.

C. *Applying the Substantive Requirements that are Directly Related*

Each of the substantive requirements set forth in 36 CFR 219.8 through 36 CFR 219.11 provide an overarching purpose to which the regulation is directed as well as specific means to meet that purpose,

generally with the inclusion of plan components. Application of the directly related substantive requirements listed in the preceding section entails documenting that 1) the amended plan will meet the overarching purpose of each specific substantive requirement; 2) identifying specific plan components which ensure that purpose is met; and 3) explaining how the agency action triggering the amendments (in this case the SERAL 2.0 project) is consistent with the purpose of the substantive requirement (Table 42).

Table 41: Application of the Directly Related Substantive Requirements.

Directly Related Substantive Requirements	How the plan amendments meet the purpose of the substantive requirement	Plan components that meet purpose of the of the substantive requirement	How the SERAL 2.0 Project will meet the purpose of the substantive requirement
36 CFR 219.8(a)(1)	Compliance with requirements of paragraph (a) item (1) of this section is intended to provide for the **ecological sustainability** and **ecosystem integrity** of the plan area. The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity. **Ecological sustainability** is defined as the maintenance or restoration of the composition, structure, and processes of ecosystems including the diversity of plant and animal communities and the productive capacity of ecological systems. **Ecological Integrity** refers to the ability of an ecosystem to support and maintain ecological processes and a diverse community of organisms. **Ecological sustainability** requires a persistent, present, functioning ecosystem. Under current forest conditions both ecological sustainability and integrity are compromised because compared to historic conditions, the existing forested landscape is unnaturally dense with unbalanced species diversity and lush understory ladder fuels, and overly stressed due to changes in precipitation (drought), increasing temperature, and decades long absence of regular fire regimes. Together, these landscape characteristics impact the landscape's ability to experience and survive change or disturbance. Competition for limited resources in stressed, overly dense and lush forests increases the forests vulnerability to insect and disease infestations, drought, and the persistent and growing threat and occurrences of large-scale, high-severity megafires (USDA 2019, p. 2). The project-specific forest plan amendments were developed to adopt the management approaches and conservation measures of the CSO Strategy. Moving the landscape toward the natural range of variation (NRV) is a central and guiding principle of the CSO Strategy. The concept of restoring the landscape into closer alignment with historic reference conditions, as in NRV, is rooted in the assumption that the structural and species composition of forests occurring in pre-settlement times, were, and would still be, more resilient to disturbances such as insects, disease, drought, and climate change, and less susceptible to large-scale, high-severity wildfires (USDA 2019, p. 19 [Kalies and Kent 2016, Larson et al. 2013, Stephens et al. 2016]). The NRV is recognized as a means in which to assess **ecological integrity.** NRV can help identify key structural, functional, compositional, and connectivity characteristics which may be important for either maintenance or restoration of such ecological conditions. The CSO Strategy, and thus the proposed forest plan amendments, stipulate that landscape forest structure is an appropriate indicator of overall health of forests across the landscape, and that restoring forest structure to its NRV will increase the landscape's resilience and adaptive capacity. Collectively, improving landscape resilience and increasing adaptive capacity will directly promote ecological sustainability and integrity in the project area. Development of a resilient landscape able to sustain during and after disturbances, will not happen overnight. Aligning the landscape with NRV is the first step towards an eventual resilient future range of variation (USDA Forest Service 2019; pp. 2, 19) composed of a persistent, present, and functioning ecosystem (ecological sustainability) which will support and maintain ecological processes and a diverse community of organisms (ecological integrity). The CSO Strategy supports the use of active management utilizing forest thinning, fuel reduction and prescribed fire to achieve both short-term and longer-term objectives to develop more resilient, sustainable, and dynamic habitat to support a diverse community of organisms (USDA 2019, pp. 29). The proposed plan amendments developed to adopt approach 2 of the CSO Strategy encourage and support the maintenance and restoration of ecological sustainability by adding goals (broad statements of intent) and desired conditions whose main objectives address restoring resilient forest conditions guided by NRV (USDA Forest Service 2019, Approach 2, pp 30-33).	TERR-SERAL-GOAL-01, TERR-SERAL-GOAL-02, TERR-SERAL-GOAL-03, SPEC-CSO-DC-01, SPEC-CSO-DC-02, SPEC-CSO-DC-03, SPEC-CSO-DC-04, SPEC-CSO-DC-05, TERR-SERAL-STD-01, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-06, SPEC-CSO-GDL-01, SPEC-CSO-GDL-02, SPEC-CSO-GDL-03, SPEC-CSO-GDL-04, SPEC-CSO-GDL-05, SPEC-CSO-GDL-06, SPEC-SERAL-MA-01	The management approaches synthesized in the CSO Strategy directly influenced aspects of SERAL 2.0's purpose and need for action and the need to amend the plan. The overall objectives of the SERAL 2.0 project are focused on restoring ecological sustainability as related to landscape resilience to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the project area, as demonstrated by Purpose and Need 1.01: Increase Landscape Resilience to Natural Disturbances (Chapter 1, 1.01). More specifically, the proposed action which was developed to fully incorporate the proposed amendments, was designed to promote ecosystem sustainably and increase ecosystem integrity by increasing forest heterogeneity, reducing stand densities, retaining large structurally diverse trees and snags, increasing the relative abundance of fire-tolerant and shade-intolerant trees, and reducing understory and surface fuels. These objectives will be met via a combination of mechanical forest thinning, mechanical fuel reduction, and prescribed fire techniques. Through implementation, NRV conditions will be mimicked by creating a pattern of individual trees, clumps of trees, and openings (ICO structure) of various sizes, similar to what was once found in historical forests prior to logging and fire suppression. Desired conditions will be further restored and maintained via broadscale, regular prescribed fire. Salvage actions to respond to tree mortality occurring outside the natural range of variability will also be implemented on a limited basis. Treatment areas were located based on a few objectives. Research scientists from the University of Washington (UW) conducted an assessment of the landscape resiliency of the SERAL 2.0 project area. UW's efforts provided a modeled estimate of the landscape's departure from NRV as compared to reference conditions. Similarly, research scientists from the Rocky Mountain Research Station conducted an assessment to determine wildfire risk across the landscape. Their efforts produced a value of the expected net value change as a result of wildfire. Their assessment focused on key weighted Forest Service mission-oriented resources and assets identified by the forest leadership team. Areas of the project area most departed from NRV **and** expected to experience the greatest losses due to wildfire were prioritized when locating treatment areas throughout the project area. The environmental consequences section of the DEIS includes an assessment of how well our proposed actions meet Purpose and Need 1.01 and further corroborate consistency with the purpose of 36 CFR 219.8(a)(1).
36 CFR 219.9(a)	36 CFR 219.9 adopts a complimentary ecosystem (coarse filter) and species-specific (fine filter) approach to maintaining the diversity of plant and animal communities and the persistence of native species in the plan area. Compliance with the ecosystem requirements of paragraph (a) of this section is intended to provide the ecological conditions to both maintain the diversity of plant and animal communities and support the persistence of most native species in the plan area. Compliance with the requirements of paragraph (b) of this section is intended to provide for additional ecological conditions not otherwise provided with paragraph (a) of this section for individual species (addressed in the next row in this table – 36 CFR 219.9(b)). 36 CFR 219.9(a)(1) re-emphasizes the importance of maintaining or restoring **ecological integrity** of terrestrial and aquatic ecosystems in the plan area as required by 36 CFR 219.8(a)(1)(see previous row) and includes the added	(**1) Ecosystem integrity.** TERR-SERAL-GOAL-01, TERR-SERAL-GOAL-02, TERR-SERAL-GOAL-03, SPEC-CSO-DC-01, SPEC-CSO-DC-02, SPEC-CSO-DC-03, SPEC-CSO-DC-04, SPEC-CSO-DC-05, TERR-SERAL-STD-01, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-06, SPEC-CSO-GDL-01, SPEC-CSO-GDL-02, SPEC-CSO-GDL-03, SPEC-CSO-GDL-04, SPEC-CSO-GDL-05, SPEC-CSO-GDL-06, SPEC-SERAL-MA-01	The SERAL 2.0 project recognizes that maintaining the diversity of plant and animal communities and the persistence of native species in the plan area is dependent on a resilient landscape composed of diverse, heterogenous forests that mimic historic conditions (distribution, densities, and species composition). Locating the proposed treatment areas in areas most departed from NRV and at greatest risk of wildfire contributes to increasing ecosystem integrity by moving the project area as a whole to a more resilient condition. In doing so, treatments will increase within- and between stand structural diversity, reduce stand densities, retain large, old, and structurally diverse trees and snags,

Directly Related Substantive Requirements	How the plan amendments meet the purpose of the substantive requirement	Plan components that meet purpose of the of the substantive requirement	How the SERAL 2.0 Project will meet the purpose of the substantive requirement
	importance of maintaining or restoring **ecosystem diversity (**(§219.9(a)(2)).In particular, §219.9(a)(2) states, the plan must include plan components, including standards and guidelines, to maintain or restore the **diversity of ecosystems and habitat types** throughout the plan area. In doing so, the plan must include plan components to maintain or restore: (i) key characteristics associated with terrestrial and aquatic ecosystem types; (ii) Rare aquatic and terrestrial plant and animal communities; and (iii) The diversity of native tree species similar to that existing in the plan area. Additional supporting documentation for how the plan amendments meet the purpose of 36 219.9(a)(1) **Ecosystem Integrity** is addressed above. After a decade's long over-emphasis on fire suppression, Sierran mixed-conifer forests, like the SERAL 2.0 project area, have lost the ecosystem diversity of historic conditions. Both structural and species diversity have been impacted. Forests are now composed of homogenous expanses of overly dense, even-aged, fire-intolerant and shade-tolerant species (USDA 2019 p. 18 citing Barbour et al. 2002, Dolanc et al. 2014, Guarin and Taylor 2005, McIntyre et al. 2015, Stephens et al. 2015). This shift in species composition coupled with uncharacteristically dense, homogenous forests with a heavy presence of surface and ladder fuels directly compromises both the ecological integrity and resilience of the landscape. Lack of structural and species diversity creates conditions that are highly susceptible to large, high-severity fire as well as large scale mortality due to insect or disease outbreaks or drought conditions. The proposed project-specific forest plan amendments increase **ecological integrity** and maintain or restore **ecosystem diversity** in the plan area because they include standards and guidelines which direct active management to: (1) increase structural and species diversity (forest heterogeneity); (2) reduce tree densities while retaining diversity of size and age classes consistent with NRV; (3) retain large, old trees and snags; (4) restore the proportion and distribution of tree species on the landscape consistent with NRV and potential vegetation type (e.g., increase species diversity by increasing the relative abundance of fire tolerant and shade-intolerant tree species); (5) reduce ground fuels; (6) increase management by fire; and (7) restore habitat after disturbances that do not align with NRV (USDA 2019, Approach 2, p. 30 – 33). Each of these objectives supported by the proposed project-specific plan amendments are critical to mitigating the threat of large, high-severity wildfire and increasing the landscape's resilience to other natural disturbances such as insect and disease outbreaks (USDA 2019).	**(2) Ecosystem diversity**. TERR-SERAL-GOAL-01, SPEC-CSO-DC-02, SPEC-CSO-DC-03, SPEC-CSO-DC-04, SPEC-CSO-DC-05, TERR-SERAL-STD-01, SPEC-CSO-STD-06	increase species diversity by creating openings to promote regeneration of shade-intolerant species (pines), reduce ground and ladder fuels, and selectively remove or retain trees to achieve the desired species composition (larger abundance of fire-tolerant and shade-intolerant trees – PP, SP, JP, and BO). Ecosystem integrity and diversity will be further achieved by locating openings, where possible, adjacent to healthy, mature conifers and oaks to promote oak regeneration and to limit water and soil competition within immature trees nearby the crown of the mature trees. The integrity of meadow and aspen stands will also be maintained and restored by selective removal of encroaching conifers and shrubs growing within meadows or aspen stands where large numbers of conifers have not historically occurred. The objective is to reestablish the historic meadow edge and enhance meadow function, or to promote and/or stimulate aspen growth. Ecosystem diversity is further supported by the SERAL 2.0 project because the proposed action specifically targets the location and intensity of forest thinning and removal of trees by species and location (Chapter 2.01 Table 1 and Table 2). For example, outside of CSO PACS and Territories, the proposed action limits the thinning of shade-intolerant trees to 30-inches DBH but allows shade-tolerant (fire intolerant) trees up to 34-inches DBH to be removed where at least one 30-inch shade-intolerant conifer is left within 1-tree height of the tree removed. The same pattern is applied within CSO Territories, but the DBH limits are lowered to 24-inch DBH for shade-tolerant, and 30-inch DBH for shade-intolerant. Within CSO PACs the DBH limit is further lowered to 20" DBH for all species and mechanical treatments of any kind are limited to a maximum of 100 acres per individual CSO PAC. These specificities of the proposed action are important factors that are included to comply with the proposed project-specific forest plan amendments which are intended to balance short term impacts sensitive wildlife habitat while reducing forest densities and rearranging the composition of structural and species diversity as guided by NRV across the project area. The proposed action was designed to achieve the desired ecosystem diversity based on NRV by varying the proposed treatment prescriptions by tree species and land allocations to best ensure ecosystem integrity is restored.
36 CFR 219.9(b)	Compliance with paragraph (b) of this section is intended to provide for additional ecological conditions not otherwise provided by compliance with paragraph (a) (addressed in previous row) for individual species. In particular paragraph (b) requires the responsible official to determine whether or not the plan components required by paragraph (a) of this section provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area. If the responsible official determines that the plan components required in paragraph (a) are insufficient to provide such ecological conditions, then additional, species-specific plan components, including standards or guidelines, must be included in the plan to provide such ecological conditions in the plan area. The proposed project specific forest plan amendments include plan components which were developed to conserve CSO habitat and habitat elements around occupied CSO sites (USDA 2019, Approach 1, pp 25 – 29) as a critical component of the landscape effort to increase resiliency. Locally, the Stanislaus National Forest experienced firsthand the importance of landscape resiliency to maintaining important ecological conditions and habitat characteristics which support viable populations of CSO and the vulnerability of the landscape to habitat loss. For example, the 2013 Rim Fire overlapped with 46 CSO PACs. After a post-disturbance analysis was conducted by wildlife biologists , with technical assistance from PSW researchers, it was found that these 46 PACs clustered into three categories related to high-severity fire: Category 1 – burned primarily at high-severity with small amounts of post-fire suitable habitat remaining (10 PACs); Category 2 – lower amounts of high-severity fire, lower amounts of suitable habitat loss so high amounts of post-fire suitable habitat remaining (27 PACs); Category 3 – intermediate levels of high-severity burning, suitability of habitat unknown (9 PACs). The 10 PACs (approximately 3,000 acres) that primarily burned at high-severity were ultimately retired because it was clear that those sites had very low to no probability of continued occupancy. These CSO specific plan components will ensure the ecological conditions (e.g., habitat conditions) necessary to ensure successful CSO reproduction and persistence across the project area is maintained and promoted into the	LAND-SERAL-WILDLIFE-01, LAND-SERAL-WILDLIFE-02, LAND-SERAL-WILDLIFE-03, SPEC-CSO-DC-01, SPEC-CSO-DC-06, SPEC-CSO-DC-07, SPEC-CSO-STD-01, SPEC-CSO-STD-02, SPEC-CSO-STD-03, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-07, SPEC-CSO-STD-08, SPEC-CSO-GDL-01, SPEC-CSO-GDL-02, SPEC-CSO-GDL-03, SPEC-CSO-GDL-04, SPEC-CSO-GDL-05, SPEC-CSO-GDL-06, SPEC-SERAL-MA-01, S&G 80, first three sentences of unamended S&G 71 (USDA 2017, p. 34).	A primary purpose and need component of the SERAL 2.0 project is to retain, large, old, and structurally diverse trees and snags across the project area (Appendix A, Item A.03). The California spotted owl (CSO) depends on these large, old, and structurally diverse trees and snags for nesting and roosting (USDA 2019). The SERAL 2.0 project was developed to specifically maintain and promote these important habitat characteristics for the CSO. The proposed action in particular includes the following CSO specific constraints which provide the ecological conditions necessary to provide some immediate stability for individual owls while allowing landscape treatments to occur: (1) limit forest thinning to 100 acres per CSO PAC and constrain tree removal within PACS to trees 20 inches DBH and below; (2) limit tree removal during forest thinning within Territories to 24 inches DBH for shade-intolerant pines and Douglas firs and up to 30 inches DBH for shade-tolerant cedars and red and white fir ; (3) no mechanical harvest within 10-acres surrounding the most recent known nest site; and (4) application of an limited operating period (from March 1 to August 15) which prohibits mechanical harvest within 0.25 mile of a known nest or roost site and prescribed fire within 500 feet of a known nest or where the location of a nest site is unknown, application of the limited operating period to the entire PAC (Chapter 2.01 and Chapter2.03 F). The areas of PAC selected for treatment were chosen after a two-step assessment. First, key CSO habitat characteristics were assessed to inform where treatments within PACs were needed. Priority considerations were made to ensure highest-

Directly Related Substantive Requirements	How the plan amendments meet the purpose of the substantive requirement	Plan components that meet purpose of the of the substantive requirement	How the SERAL 2.0 Project will meet the purpose of the substantive requirement
	future, considering both short-term and long-term needs of the species. The proposed project-specific plan amendments include new components which specify the desired ecological conditions which will best support CSO, standards and guidelines which constrain management actions within CSO protected activity centers and territories and guide the consideration of treatment needs and locations, as well as where and when a particular treatment type is applied. Collectively these plan components aim to maintain highest-quality habitat while protecting it from risk of loss from high-severity wildfire and other stressors. These plan components balance highest-quality habitat retention while allowing treatments to increase landscape resiliency.		quality habitat — CWHR 5D and 5M — is maintained within PACs. Treatable PAC areas contain greater than 50% of lesser quality habitat — CWHR 4D and 4M or less — and/or a greater proportion of large, high density trees — CWHR 5D and 5M — than reference conditions. Within the treatable PAC areas, up to 100 acres were then selected in areas most departed from NRV — as represented by a resiliency departure metric developed by UW, and the risk of loss of resources and assets as represented by the mission oriented expected net value change developed by the RMRS. The project's effectiveness at maintaining highest-quality CSO (and other wildlife) habitat is considered in the effects analysis in the DEIS (from two perspectives: (1) How the proposed treatments are located to maintain highest-quality habitat — through avoidance or treatment constraints; and (2) How the proposed treatments lead to long-term maintenance of habitat as represented by a reduction in wildfire risk and loss of habitat (DEIS Chapter 3.01 Issue 1A, Chapter 3.02 Need 1). This analysis demonstrates the proposed action and the proposed project-specific forest plan amendments are consistent with the complementary ecosystem and species-specific approach to maintaining the diversity of plant and animal communities and the persistence of native species in the plan area.
36 CFR 219.10(a)	The overarching purpose of substantive requirement 36 CFR 219.10(a) ***Integrated Resource Management for Multiple Use*** is to ensure that the forest plan provides for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildfire, and fish within Forest Service authority and the inherent capability of the plan area. To do so, § 219.10(a) stipulates that the plan must include plan components, including standards and guidelines for integrated resource management to provide for ecosystem services and multiple use in the plan area. This substantive requirement then lists 10 itemized descriptions of what the responsible official shall consider when developing the plan components for integrated resource management. Not every consideration listed — or aspects of each consideration listed — are directly related to the scope and scale of the proposed project-specific plan amendments. The directly related considerations include aspects (emphasized in bold below) of item (1), (5), and (8). The proposed forest plan amendments recognize the interdependence of ecological resources. 36 CFR 219.10(a)(1) In particular, 36 CFR 219.10(a)(1) stipulates that when developing the plan components for integrated resource management, the responsible official shall consider (1) aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and **wildlife species**, forage, geologic features, grazing and rangelands, **habitat and habitat connectivity**, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, **timber**, trails, **vegetation**, viewsheds, wilderness, and other relevant resources and uses. The CSO, a sensitive wildlife species, and the critical habitat needs of the CSO, were directly considered in the development of the proposed project-specific forest plan amendments because the amendments were developed adopt the central goals, management approaches and conservation measures presented in the CSO Strategy (USDA 2019). . The central tenet of the suite of proposed project-specific forest plan amendments are focused developing a resilient landscape as guided by NRV. The general assumption is that conducting NRV-based restoration to improve landscape resilience to multiple disturbances, considering climate change, is synonymous with an overall healthier landscape, and a landscape more apt to support a fully functioning ecosystem and opportunities for a variety of uses. Restoring and maintaining critical CSO habitat needs, consisting of dynamic owl nesting, roosting, and foraging habitat, is mutually beneficial to supporting ecological sustainability and providing forested lands to meet the needs of present and future generations, including outdoor recreation, cultural and heritage resources, forage, grazing and rangelands, trails, and viewsheds. The proposed project-specific forest plan amendments support, and encourage, effective use of timber harvest, other mechanical thinning of vegetation, and fire to reduce stand densities and ladder fuels to increase the resilience of forests to fire, drought, and other disturbances incited by drought (USDA 2019 p. 29 citing: Fettig et al. 2019, Kolb et al. 2016, North et al. 2015a, North et al. 2015b). The amendments include desired conditions which will be best achieved through actions which will naturally provide **timber,** such as density reduction (mechanical forest thinning), species composition conversion, and response to natural disturbance (salvage) (USDA 2019, p. 30 – 33).	TERR-SERAL-GOAL-01, TERR-SERAL-GOAL-02, TERR-SERAL-GOAL-03, LAND-SERAL-WILDLIFE-01, LAND-SERAL-WILDLIFE-02, LAND-SERAL-WILDLIFE-03, SPEC-CSO-DC-01, SPEC-CSO-DC-02, SPEC-CSO-DC-03, SPEC-CSO-DC-04, SPEC-CSO-DC-05, SPEC-CSO-DC-06, SPEC-CSO-DC-07, TERR-SERAL-STD-01, SPEC-CSO-STD-01, SPEC-CSO-STD-02, SPEC-CSO-STD-03, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-06, SPEC-CSO-STD-07, SPEC-CSO-GDL-01, SPEC-CSO-GDL-02, SPEC-CSO-GDL-03, SPEC-CSO-GDL-04, SPEC-CSO-GDL-05, SPEC-CSO-GDL-06, SPEC-SERAL-MA-01	Many uses of public lands occur within and adjacent to the SERAL 2.0 project area — including, but not limited to livestock grazing, hiking, swimming, hunting, motorized recreation (OHV), gathering, and camping. The SERAL 2.0 project recognizes the interdependence of a healthy functioning ecosystem to provide and sustain multiple-uses in the area. The surrounding communities near the project area have social and economic ties to National Forest System lands. Management decisions made by the Forest Service can often impact the economies of smaller, resource-based communities nearby. Economic effects can include changes in local employment and income, as well as changes in local services and community infrastructure. Businesses in small rural towns often rely on tourism and wood product revenue throughout the year, so maintaining safe and consistent access to National Forest System lands for recreation and industry uses (timber and concessionaire businesses operated on or nearby NFS lands) contribute to resilient communities. Forest products resulting from restoration and management activities on National Forest System lands contribute to the local economy and to the sustainability of the local forest products industry. Improved recreation opportunities and conservation and restoration of terrestrial habitats also sustain livelihoods and provide economic benefits to businesses and industries supporting recreation, hunting, fishing and other such uses on public lands. Long-term closures, or limits to public access due to tree mortality, active wildfires, or unsafe post-fire conditions on the Stanislaus National Forest in recent years have closed or reduced tourist traffic for several months to popular destinations. These impacts weigh heavily on local business owners, make operating seasonal businesses in small towns more difficult, and have led directly to business closures. Hazard tree abatement is critical to maintaining safe access to the project area to sustain multiple uses of National Forest System lands to best meet the needs of the American people (Public Law 86–517; Approved June 12, 1960). The SERAL 2.0 project's main objectives are rooted in the assumption that a resilient landscape is overall healthier and more apt to support a fully functioning ecosystem and opportunities for a variety of uses. Increasing ecosystem resilience and integrity will ensure the project area will experience less severe or catastrophic losses as a result of wildfire, insect, disease, or drought. This is the essence of landscape sustainability. In order to provide a full suite of multiple uses across the project area,

Directly Related Substantive Requirements	How the plan amendments meet the purpose of the substantive requirement	Plan components that meet purpose of the of the substantive requirement	How the SERAL 2.0 Project will meet the purpose of the substantive requirement
	36 CFR 219.10(a)(5) In particular, 36 CFR 219.10(a)(5) stipulates that the responsible official shall consider **habitat conditions, subject to the requirements of § 219.9**, **for wildlife**, fish, and plants commonly enjoyed and used by the public; for hunting, fishing, trapping, gathering, observing, subsistence, and other activities (in collaboration with federally recognized Tribes, Alaska Native Corporations, other Federal agencies, and State and local governments). The aspects of substantive requirement § 219.10(a)(5) that are directly related to the scope and scale of the proposed project-specific plan amendments are narrow. We have demonstrated that wildlife habitat conditions subject to the requirements of § 219.9 were considered and those are addressed above (see § 219.9 (a) and (b)). None of the proposed project specific plan amendments directly modify or impact opportunities to hunt, fish, trap, gather, observe, gather subsistence, or other public uses. Each of these common uses of public lands, however, are at risk due to the imminent threat of large, high-severity wildfire. The proposed project-specific forest plan amendments promote the opportunity to move the project area as a whole to a condition more resilient to large-scale, stand-replacing disturbances such as high-severity wildfire or insect outbreaks. Maintaining habitat conditions and a healthy ecosystem is key to providing persistent and sustainable opportunities for the public to hunt, fish, trap, gather, observe or other activities. 36 CFR 219.10(a)(8) In particular, 36 CFR 219.10(a)(8) stipulates that the responsible official shall consider system drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of terrestrial and aquatic ecosystems of the plan area to adapt to change (§ 219.8(1)(iv)). This consideration re-emphasizes the importance of ecological sustainability and integrity as defined and addressed in 36 CFR 219.8(a)(1) above. The proposed project-specific forest plan amendments promote forest restoration toward the NRV which serve two main habitat goals: (1) the maintenance and creation of key habitat elements and (2) the resilience of habitat to natural disturbances and climate change (USDA 2019, p. 19). Restored forests provide the range of conditions in which terrestrial and aquatic ecosystems evolved and survived prior to European settlement. Restored forests are more heterogeneous and resilient to many disturbances, such as large-scale, high-severity fire; insects; disease; drought; and climate change. Restoring forest composition, structure, and processes based on NRV conditions is linked to greater resilience to wildfire, climate change, and other stressors (Kalies and Kent 2016, Larson et al. 2013, Stephens et al. 2016a). The proposed project-specific forest plan amendments which were developed to adopt CSO Strategy's Management Approach 2 encourage forest managers to increase landscape resiliency to fire and other disturbances as guided by NRV. Generally, the project specific-forest plan amendments provide plan components, including standards or guidelines, which support meeting these objectives through active management to (1) increase within- and between-stand heterogeneity; (2) reduce stand densities; (3) increase the large tree component on the landscape; (4) increase the relative abundance of fire-tolerant and shade-intolerant tree species; (5) reduce ground fuels; (6) restore natural disturbance regimes through increase management by fire, both prescribed and managed wildfire; and (7) actively restore habitat after disturbances that do not align with NRV (USDA 2019, p. 30-33).		the landscape must be able to support and maintain ecological processes and a diverse community of organisms. As previously noted, treatment needs were primarily assessed considering wildfire risk, landscape departure from historic conditions, and key CSO habitat characteristics, but economic viability was also considered. Much of the forest restoration needs will be achieved via forest thinning and timber harvesting. Portions of the project area which met all or some of the objectives were prioritized over other areas. The proposed actions developed to meet these objectives, promote and provide for ecological sustainability and ecosystem integrity as guided by NRV while incorporating the newly amended goals, desired conditions, standards, guidelines, and potential management approaches. The environmental consequences section of the DEIS devoted to presenting how well our proposed actions achieve the purpose and needs of the project (DEIS Chapter 3.02) further corroborates consistency with the purpose of 36 CFR 219.10(a).
36 CFR 219.11(c)	Compliance with paragraph (c) of this section is intended to support inclusion of plan components that allow timber harvest for the purposes other than timber production throughout the plan area as a tool to assist in achieving or maintaining one or more applicable desired conditions or objectives of the plan in order to protect other multiple-use values, and for salvage, sanitation, or other public health or safety. Examples include using timber harvest to improve wildlife habitat and thinning to reduce fire risk — both of which are applied in the SERAL 2.0 project. To correct the landscape's current departure from historic conditions, as in NRV, the CSO strategy and the amended plan recognize the important role timber harvesting will play to achieve the desired forest structure, density, and composition across the landscape. The project specific forest plan amendments recognize, support, and allow vegetation management (including timber harvest) for the purpose of reducing the risk of undesired wildfire effects, increasing landscape resilience to natural disturbances (drought, insects, disease) by restoring forest conditions as guided by the NRV, and maintaining and improving wildlife habitat (Purpose and Need 1.01) at the landscape scale.	SPEC-CSO-DC-02, SPEC-CSO-DC-03, SPEC-CSO-DC-04, SPEC-CSO-DC-05, TERR-SERAL-STD-01, SPEC-CSO-STD-01, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-06, SPEC-CSO-STD-07, SPEC-CSO-GDL-05, SPEC-CSO-GDL-06, SPEC-CSO-GDL-07, SPEC-SERAL-MA-01, S&G 1 (first paragraph), S&G 2, S7G 3, S&G 4, S&G 5, S&G 7 (unamended portion, USDA 2017, p. 34)	The SERAL 2.0 proposed actions include timber harvest as a mechanism to achieve our landscape desired condition which is aimed at restoring the natural range of variation and reducing the risk of resource losses due to wildfire (Chapter 2.01).

Directly Related Substantive Requirements	How the plan amendments meet the purpose of the substantive requirement	Plan components that meet purpose of the of the substantive requirement	How the SERAL 2.0 Project will meet the purpose of the substantive requirement
36 CFR 219.11(d)(3)	Compliance with paragraph (d) item (3) of this section is intended to ensure that timber harvest would be carried out in a manner consistent with the protection of soil, watershed, fish, **wildlife**, recreation, and aesthetic resources. The aspects of item (3) directly related to the proposed project-specific forest plan amendments are limited to those related to wildlife. The proposed project specific forest plan amendments developed to adopt Approach 1 of the CSO strategy (USDA 2019, p. 25-29) were designed to conserve California spotted owl habitat and habitat elements around occupied CSO sites (USDA 2019, p. 25). These plan components are focused on the immediate need for maintaining highest-quality habitat, especially around occupied nest sites, while resilient habitat Is developed across the landscape as promoted and presented in Management Approach 2 of the CSO Strategy (USDA 2019, p. 25). They provide some immediate stability for individual owls while allowing landscape treatments (including timber harvest) to occur.	TERR-SERAL-STD-01, SPEC-CSO-STD-01, SPEC-CSO-STD-04, SPEC-CSO-STD-05, SPEC-CSO-STD-06, SPEC-CSO-STD-07, SPEC-CSO-GDL-03, SPEC-CSO-GDL-04, SPEC-CSO-GDL-06, SPEC-CSO-GDL-07, S&G 7 (unamended portion; USDA 2017, p. 34), S&G 13 (USDA 2017, pp. 34-35); Practice 13-A Soil Support Services — all S&G in that section (USDA 2017, p. 57); Practice 18-A- Water Quality Management — all S&G in that section (USDA 2017, p. 60); Riparian Conservation Objectives —S&G 95 through S&G 122 (USDA 2017, pp. 189-191), and Practice 15-A- Timber Program Administration —(USDA 2017, pp. 120-121 and p. 156).	See response for 36 CFR 219.9(b) above.

D. *Potential Species of Special Concern Determination and Consideration (36 CFR 219.13(b)(6))*

The proposed project-specific forest plan amendments will apply to the 1991 Stanislaus National Forest Land and Resource Management Plan (as amended) which was developed and revised under the 1982 Planning Rule. The Regional Forester has not yet identified species of special concern for the plan area. Public comments received during scoping expressed concern about the potential for the proposed project-specific forest plan amendments to lessen protections for the California spotted owl. The NEPA effects analysis does not reveal a substantial adverse impact of the amendments or the other proposed actions (DEIS, Chapter 4). Nonetheless, § 219.9(b) is directly related to the proposed project-specific forest plan amendments and has been applied as if the CSO were a species of special concern. See 36 CFR 219.9(b) in Table 42.

6.15 Clean Air Act (CAA), Air Quality, and Smoke Emissions

The Clean Air Act of 1970 (amended in 1977 and 1990) requires the Unites States Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment, and it was designed to "protect and enhance" the quality of the nation's air resources. The Clean Air Act identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of 'sensitive' populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. The EPA has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, which are called 'criteria' air pollutants and they include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter less than 10 microns in size (PM_{10}), particulate matter less than 2.5 microns in size ($PM_{2.5}$), and sulfur dioxide. As of February 7th, 2024, a new rule to strengthen standards pertaining to primary fine particulate matter ($PM_{2.5}$) is in effect (Environmental Protection Agency, 2024a).

The level of primary annual $PM_{2.5}$ pollution classified as "good" within the Air Quality Index (AQI) is reduced from 12 micrograms per cubic meter to 9. Furthermore, scale breakpoints for "unhealthy", "very unhealthy", and "hazardous" are similarly modified to reflect the EPA's evolving understanding of particle pollution impacts on human health (Environmental Protection Agency, 2024b). The EPA recognizes that wildland fires account for 44% of the nation's primary emissions of fine particulate matter and that prescribed fire is a necessary tool in reducing both the risk and the adverse effects of high severity wildfire (Environmental Protection Agency, 2024c). The 2023 Memorandum of Understanding (MOU) on Wildland Fire and Air Quality Coordination signed by the EPA, USDA, Department of the Interior (DOI), and the Centers for Disease Control and Prevention (CDC) aims to align air quality goals amongst federal departments and agencies, as well as improve policies, communications, and programs related to the usage of prescribed fire and protecting the public from the impacts of wildland fire (Environmental Protection Agency, 2024c; USDA Forest Service, Environmental Protection Agency, US Department of the Interior, and Centers for Disease Control, 2023).

The EPA's General Conformity Rule, established under Section 176(c)(4) of the Clean Air Act, provides a specific process for ensuring that federal actions do not interfere with a state's plans to attain or maintain NAAQS. Compliance with the CAA by national forests in California, including prescribed fire authorizations, is achieved under state and local law (e.g., Tuolumne County Air Pollution Control District [APCD]). The California Air Resources Board (CARB) leads this effort under the process established by the California Smoke Management Program (Title 17). The legal basis of the program is found in the Smoke Management Guidelines for Agricultural and Prescribed Burning adopted by the CARB. The Guidelines provide the framework for state and local air district regulators to conduct the program. Elements of the program include registering and permitting of agricultural and prescribed burns; meteorological and smoke management forecasting; daily burn authorization; and enforcement.

The Great Basin Unified (which Alpine County is part of), Calaveras, Tuolumne and Mariposa County Air Pollution Control Districts (APCDs) are responsible for implementing and regulating air quality programs for projects occurring on the Stanislaus National Forest. The SERAL 2.0 project is in Tuolumne County, but smoke dispersion can travel in all directions, and affect multiple states and countries during large wildfires (e.g., 2021 Dixie Fire). See Tuolumne County APCD website for rules and thresholds (available online at https://www.tuolumnecounty.ca.gov/364/Air-Pollution-Control-District).

Tree stand densities and surface fuels accumulations are far greater than the natural range of variation. These dense, largely contiguous fuel and vegetation conditions have direct, significant contributions to generate large amounts of smoke during proposed prescribed burns, or during potential natural- and human-caused wildfires. The amount of prescribed burning that may occur under the proposed action might cause short-term, sporadic diminished air quality, but they create long-term gains for subsequent

reductions in size of wildfires and their associated smoke emissions for up to about 10 years (depending on amount of consumed material and meteorological conditions). If the proposed actions are not implemented (no action) the potential future wildfire behavior, timing, and amount/intensity of emissions would remain unmanaged. It is highly likely, that if no action is taken, another long-term multi-month, wildfire smoke event would occur, with the potential to impact multiple states (e.g., 2013 Rim Fire, 2021 Caldor Fire).

During mechanical treatments, fossil fuel use, emissions and changes to atmospheric chemistry from proposed mechanical implementation will be minor in the context of ongoing global fossil fuel use and changes to our climate. Management requirements (DEIS Chapter 2.03) and best management practices include provisions that help to minimize the impacts to air quality.

Quantitative estimates of emissions have been done for nearby, similar mixed conifer ecosystems of the Sierra Nevada and are presumed to be similar to those proposed in the SERAL 2.0 project. For quantification reference see: Sequoia and Sierra National Forest, Land Management Plan FEIS (USDA Forest Service 2023(c)). The bioregional science synthesis (i.e., PSW-GTR-247) chapter on air quality and related pollutants is also relevant to the SERAL 2.0 project and proposed prescribed burning treatments (see Chapter 8.1). By following the regulations and procedures outlined above, and by utilizing Best Available Control Measures and Best Smoke Management Practices, as described in DEIS Chapter 2.03 D, effects to air quality should be predicable and be more manageable than effects from large, unplanned wildfires. The SERAL 2.0 proposed action will comply with the CAA, and burning on NFS lands would not occur unless prior approval is granted by Tuolumne County APCD in coordination with other regional and state agencies and fire events.

The wildfire crisis is a public health crisis. As wildfires increases in size and severity, the related public health impacts, including from smoke exposure, will continue to grow. There are negative human health impacts from all forms of wildland fire smoke. At the same time, significantly increasing the application of all forms of wildland fire, including prescribed fire, in a strategic and coordinated manner is needed to mitigate the risk and adverse effects of high severity wildfire and future smoke exposure. USDA, DOI, EPA, and CDC are working together and investing in the mutually important objectives of protecting public health from the impacts of smoke and enabling land management practices that reduce the future risk of large, high severity wildfire events. The SERAL project is a key example of this partnership. USFS, EPA, CDC and the local Tuolumne County Health Department meet biweekly to advance public health preparedness and minimize smoke impacts on the public from the SERAL 2.0 proposed prescribed fire project.

6.16 Environmental Justice (Executive Order 12898, as amended by EO 14008 and supplemented by 14096)

Executive order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” states (Section 1-101), “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States.” Environmental Justice concerns are also a priority of the current administration, as affirmed by the January 27, 2021 Executive Order 14008 - Tackling the Climate Crisis at Home and Abroad,4 which amends aspects of EO 12898.

Demographic information is useful to determine if, and where project activities might impact minority or low-income populations. The 2022 American Community Survey (ACS) and 2020 decennial census were used to gather information for the areas of Tuolumne, Mariposa, Alpine, and Calaveras counties surrounding the SERAL 2.0 project area. The data show all counties have lower percent minority populations than the state of California and the United States as a whole (U.S. Census Bureau, 2020). One exception to this being that the Native American population is proportionally higher than the U.S. average

in all four counties. Environmental justice concerns also focus on low-income populations and age discrimination can be an issue for the Civil Rights Act. The median age in all countries is higher than the U.S. average, and 25 percent or more of the population is over age 65 in all four counties (U.S. Census Bureau, 2022a). In 2022 median household income for Alpine Calaveras, Mariposa, and Tuolumne County was $101,125, $77,526, $60,021, and $70,432, respectively. Median income for all but one of these counties is below that of California as a whole ($91,905) (U.S. Census Bureau, 2022b). As of 2022, the percentage of individuals in the United States living at or below the poverty line is 12.5%. For Alpine, Calaveras, and Mariposa County, the percentage of individuals living below the poverty line is slightly higher (U.S. Census Bureau, 2022c). The supporting project documents below, offer more details on demographics and socioeconomic indicators for communities around the SERAL 2.0 project area.

These data represent county-wide parameters, but variation exists within county boundaries. Some communities lie closer to the Stanislaus' boundary where SERAL 2.0 actions would occur, and have median household incomes lower than county-wide, and higher poverty rates. While it is difficult to estimate economic changes and effects of the SERAL 2.0 project to those communities directly, the effects to the landscape surrounding those communities have been discussed in more detail throughout this DEIS. Issues 1B and 3A detail how project activities would affect conditional flame length and annual burn probability. It is possible that low-income populations in the area may rely more heavily on fuelwood than the general population. This impact is expected to be minimal since the roads identified for fuelbreaks are generally main roads where hazard trees are usually felled and removed regularly, and there is an abundance of road miles open for fuelwood cutting within the project area which will not be maintained as fuelbreaks. Additionally, within fuelbreaks or thinning treatments where product removal is not operationally or economically feasible, cut material in accessible areas will be decked or piled and available for fuelwood cutting prior to burning. Potential adverse impacts of the project are not expected to disproportionately impact minority or low-income populations. Communities and individuals most adversely impacted through minor disturbances such as short-term increased traffic, noise and potential road closures or delays are the ones expected to benefit most in the long-term due to their proximity to fuels reduction treatments and reduction in subsequent fire behavior. In short, the proposed action shows improvement in these indicators when compared to Alternative 2 (no action), indicating project activities could have a beneficial impact to communities adjacent to the SERAL 2.0 boundary by reducing the overall risk of negative fire effects.

Air and water quality: Communities in closer proximity to the SERAL 2.0 boundary, or in the case of prescribed fire treatments those that are downwind of treatments, could be subject to slightly more days where smoke from prescribed burning is present than larger communities more distant from the project area. The NATA respiratory hazard index estimates the risk to respiratory health associated with continuous exposure to air toxins generated by sources such as wildfire. Data derived from the EJScreen tool indicates that most of the four county area experiences risk less than the 50th percentile as compared to all of California (Environmental Protection Agency, 2024a). Only the eastern portion of Tuolumne County ranks between the 60th-70th percentiles for risk. Section 6.15 outlines additional considerations to reduce air quality impacts in collaboration with partners at the federal and local level. Local smoke impacts from SERAL 2.0 are expected to be fewer in number, and be much less severe, than what has occurred in recent years as a result of many large wildfires across California. With the scale of fuel reduction and prescribed fire treatments proposed, these local smoke impacts may occur more often, but the intent is they could reduce the likelihood of larger, smokier unplanned wildfires. The primary conveyance of drinking water to most of Tuolumne County's population is connected to Pinecrest, Beardsley, and Lyons Reservoirs (i.e., South and Middle Fork Stanislaus Rivers), and all of these are within or bordering the SERAL 2.0 project area. The Tuolumne Main Canal ditch and flume system was identified as a highly valued asset/resource during the SERAL 2.0 wildfire risk assessment which informed the prioritization of treatment locations. The SERAL 2.0 fuelbreak treatments (as described in FEIS Chapter 2.03 Fuelbreaks encompasses this water system, providing additional level of fuels reduction treatment and protection. This canal provides 95% of Tuolumne Utility District's water supply,

and also services other agencies, including the Mi Wuk water system. Fuel reduction treatments to protect this system would benefit many communities in Tuolumne County and additional downstream communities and counties (e.g., those connected to New Melones and Lake Tulloch).

Supporting Project Documentation

Documentation Title	File Name
Headwaters Economics Demographic Profiles	US_DeptOfCommerce_2020.pdf

6.17 Consideration of Climate Change

On January 9th, 2023, the Council on Environmental Quality published the National Environmental Policy Act (NEPA) Guidance on Consideration of Greenhouse Gas (GHG) Emissions and Climate Change (U.S. EPA, 2023). The guidance provides numerous recommendations that pertain to land and resource management projects, including recommendations that agencies consider the projected GHG emissions or reductions for proposed actions and their reasonable alternatives and use these to assess potential climate change effects. This guidance also advises agencies to assess the potential future state of the affected environment in NEPA analyses, including considering the impacts of climate change on project actions and alternatives. To do so, it recommends the use of the best available science and information, including relevant data and quantification tools where appropriate, to guide these analyses. However, CEQ advises agencies should be guided by a rule of reason and the concept of proportionality in determining the appropriate depth of analysis: precision of emissions quantification should not come at the expense of efficient and accessible analysis. This includes a recognition of the inherent complexities and uncertainties that are associated with analyzing the projected biogenic carbon sources and carbon stocks associated with land and resource management actions under uncertain future climate conditions.

In October of 2023, the U.S. Department of Agriculture (USDA), Forest Service Washington Office (WO) Ecosystem Management Coordination (EMC) in coordination with the Office of Sustainability & Climate (OSC) released Forest Service 'step-down' guidance titled Considering Climate Change in USDA Forest Service National Environmental Policy Act Analysis (USDA Forest Service 2023d).

A Carbon Assessment for the Stanislaus National Forest (STF Carbon White Paper) was prepared to assess carbon stocks and fluxes using a qualitative and programmatic approach to analyzing biogenic carbon dioxide sources and carbon stocks (USDA Forest Service 2024, Forest Carbon Assessment for the Stanislaus National Forest in the Forest Service's Pacific Southwest Region), consistent with current step-down guidance. Further, the SERAL 2.0 team then considered climate change at the project-level documented in the SERAL 2.0 Consideration of Climate Change and Greenhouse Gas Emissions Report.

Supporting Project Documentation

Documentation Title	File Name
Forest Carbon Assessment for the Stanislaus National Forest in the Forest Service's Pacific Southwest Region	USDA Forest Service 2024_StanislausNF_CarbonWhitePaper_final.pdf
SERAL 2.0 Consideration of Climate Change and Greenhouse Gas Emissions Report	2024_SERAL2.0_DRAFT_Climate Change & GHG Report.pdf

The Intergovernmental Panel on Climate Change (IPCC) released its sixth assessment report synthesizing the status of our understanding of climate change in March of 2023 (IPCC 2023). Key findings include: Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming; climate change is already affecting many weather and climate extremes leading to widespread adverse impacts and related losses and damages to nature and people (IPCC 2023). Climate change vulnerabilities have been assessed specifically for the Sierra Nevada. According to Halofsky, "climate change is likely to alter the species composition and structure of vegetation in the Sierra Nevada. Altered

disturbance regimes (e.g., drought, insects, wildfire) are likely to be the major catalysts of vegetation change (Safford et al. 2012). The 2012–2017 drought, insect damage, and associated forest mortality in the Sierra Nevada (Fettig et al. 2019) illustrate how extreme climatic events can affect ecosystems in the region." In addition, "a warming climate in future decades will have profound effects on fire frequency and extent in the Sierra Nevada". Both acres burned and fire severity may increase (Halofsky 2021).

The main objective of the SERAL 2.0 project is to increase landscape resilience to natural disturbances, including climate change (DEIS Chapter 1.01). Under Alternative 1, focusing prescriptions to reduce fire behavior and decrease stand densities in locations most highly departed or at greatest risk of loss to wildfire will improve resiliency in the landscape, which is critical in light of changing conditions anticipated to be exacerbated by climate change, such as increased forest insect and disease outbreaks and increased occurrence of high severity wildfires. Actions proposed under alternative 1 are consistent with the Forest Service's Principles of Carbon Stewardship (See STF Carbon White Paper, USDA Forest Service 2024) managing lands withing the project area for climate adaptation and carbon stabilization. In summary, this proposed project affects a relatively small amount of forest land and carbon on the Stanislaus and might temporarily contribute an extremely small quantity of GHG emissions relative to national and global emissions. This proposed action will not convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the proposed action to have a temporary influence on atmospheric GHG concentrations, because carbon will be removed from the atmosphere over time as the forest regrows. The Stanislaus NF will continue to have an important role in maintaining the carbon sink, regionally and nationally, for decades to come. The SERAL 2.0 project, potentially affecting up to 11% of forested lands within the Stanislaus NF, will contribute to this effort by increasing the stability of this carbon stock.

APPENDIX A: LANDSCAPE RESILIENCE OBJECTIVES

A.01 Increase Forest Heterogeneity (Within- and Between Stands)

Multiple publications on forest restoration emphasize "the importance of managing for wide and flexible ranges of variation at multiple scales rather than managing for one specific condition at any one scale" (Jeronimo et al., 2019; Larson and Churchill, 2012; Hessburg et al., 2015; Collins et al., 2016). A strict application of narrow targets or stand level averages such as thinning from below in every stand tends to result in homogenous conditions. As discussed in North et al. (2009): "'Average' stand conditions were rare in active-fire forests because the interaction of fuels and stochastic fire behavior produced highly heterogeneous forest conditions. Creating "average" stand characteristics replicated hundreds of times over a watershed will not produce a resilient forest, nor one that provides for biodiversity. Managers could strive to produce different forest conditions and use topography as a guide for varying treatments."

Forest heterogeneity is lacking in the SERAL 2.0 project area. Relatively even-aged, dense stands, with closed canopies is the dominant stand structure. Treatments are needed to increase structural and compositional heterogeneity within and between stands in the SERAL 2.0 project area. To meet this objective, treatments must be designed and located to increase the amount of open canopy and reduce the proportion of closed canopy conditions, particularly in mid- and late-seral stages (USDA 2019; Safford and Stevens 2017; Meyer and North 2019; North et al. 2022). This is best achieved through applied silviculture and prescribed fire treatments designed to create a pattern of individual trees, clumps of trees, and openings. Similarly, the diversity in the understory of mid- and late-seral stage stands can be increased by designing treatments which will create a patchy distribution of shrubs, forbs, tree regeneration patches, and bare ground throughout the stands while reducing fuel loading and fuel continuity.

A.02 Reduce Stand Densities (SDI)

Native insects and diseases are major contributors to natural disturbance, ecosystem dynamics, and nutrient cycling in forests. Much of the time, their impacts are minor and localized, but the synergistic effects of high tree densities, coupled with drought, create conditions that are optimal for intense insect infestations and outbreaks. Low- to mid-elevation coniferous forests of the Sierra Nevada range have recently experienced one of the largest tree mortality events in recent history. Since 2010, more than 10 million trees have been killed within the Stanislaus National Forest, according to U.S. Forest Service Forest Health Protection's Aerial Detection Survey Data (2019). Between 2014 and 2017, tree mortality levels increased more than 100-fold in many areas of the southern Sierra Nevada. During this period, 55% of the California spotted owl protected activity centers on the southern Sierra national forests (Sierra, Sequoia, and Stanislaus) experienced tree mortality of more than 20 trees per acre with greater loss in larger-diameter trees (USDA 2019, Koontz et al. 2021). The vast majority of these millions of dead trees remain on the landscape, and tens of thousands of acres of live trees in the SERAL 2.0 project area remain at risk to insect outbreaks and associated widespread, ecosystem-altering mortality due to current densities of live trees.

Recent results from USFS insect and disease aerial detection surveys (ADS) have shown moderate insect activity throughout the SERAL 2.0 project area. While level of insect activity and tree mortality has fluctuated in recent years (2014-2023), some areas have started to become significantly impacted. Among recent years, 2016 saw the most activity of insect-related damage, with groups of mortality ranging from 15-30 trees/acre; activity was also clustered in the southwestern end of the project boundary, primarily in ponderosa and sugar pines.

Prevention strategies for minimizing further tree mortality by reducing water stress and competition are critical. A common metric used to quantify the level of competition in forested areas is stand density index (SDI), which is based on the number of trees per unit area—trees per acre, for example—and the diameters of those trees. It can be used to describe "how dense" trees in a forest are growing and is also an indicator of forest health. In general, higher stand densities predispose trees to damage and/or mortality from drought, bark beetles and other forest pests due to increased inter-tree competition for limited resources (Oliver 1997). Hayes et al. (2009) reported that stand density, measured as basal area or SDI is the most important predictor of western pine beetle-caused tree mortality at large spatial scales in California, likely due to the effect of stand density on individual tree vigor and water availability. Areas with the highest stand densities tend to experience the highest levels of tree mortality on both an absolute (trees/acre) and proportion (percentage of mortality) basis (Hayes et al. 2009, Fettig 2012). Multiple studies have shown that forest thinning can relieve competitive stress among residual trees, improve their vigor, and make them less prone to successful attack by bark beetles (Restaino et al. 2019, Fettig 2012, Hayes et al. 2009, Long and Shaw 2012).

Current SDI values of conifer stands within the SERAL 2.0 project area are often close to 100% of maximum SDI, which is the "theoretical maximum" (similar to the concept of "carrying capacity" in ecology) for combinations of mean diameter and density of trees. Recent research of historic SDI values in the Sierra Nevada suggests that relative SDI in pre-settlement stands averaged 23-28% of the maximum SDI, and that "tree densities on average increased by six to seven-fold while average tree size was reduced by 50%" between 1911 and 2011 (North et al. 2022). They suggest that managers could use a range of 14-36% of maximum SDI "to create stands with higher relative SDIs on sites with greater soil moisture availability and lower potential fire intensity, and lower relative SDI values on drier, steeper slopes more prone to drought and higher intensity burns."

USDA Forest Health Protection has utilized SDI thresholds (Table A.02-1. High risk SDI thresholds (USDA 2021(c)).Table A.02-1) in order to identify forested areas considered to be at high risk of drought- and bark beetle-induced tree mortality and to have a high likelihood of experiencing stand-replacing wildfire.

Current SDI values within the SERAL 2.0 project area indicate that more than 35,000 total acres of conifer forest stands having SDI values considered to be at "High-risk" to mortality from drought, insects, disease, and wildfire (Table A.02-1; USDA 2021c). Left unmanaged, high levels of inter-tree competition would persist and continue to increase. Stand vigor will stagnate, and resilience to drought-, insect-, disease-, and wildfire-related mortality will continue to decline.

With the current increase in multiple stressors such as drought, bark beetles, and high-severity wildfire, resilience in the project area is dependent on creating stands with significantly lower densities than historical ranges and minimal competition (North et al. 2022).

Table A.02-1. High risk SDI thresholds (USDA 2021(c)).

Forest Type	High Risk SDI	Acres at High Risk
Pine	>220	17,494
Dry Mixed Conifer	>270	13,667
Fir / Moist Mixed Conifer	>330	4,562

A.03 Retain Large, Old, and Structurally Diverse Trees and Snags

The California spotted owl (CSO) requires both highest-quality nesting and roosting habitat and sufficient habitat diversity / heterogeneity to provide for foraging (USDA Forest Service 2019). The status of the existing CSO habitat within the SERAL 2.0 project area was assessed at multiple scales (PAC, Territory, and HUC 6 Watershed).

For the purposes of SERAL 2.0, WHR size and density as well as canopy cover, were modeled using the F3 framework (Huang et al. 2018). F3 extrapolates the details of forest inventory plots (FIA) and individual-tree model outputs to a spatially-contiguous landscape by fusing tree-list field measurements, individual tree growth and yield models, remote sensing including lidar, and environmental geospatial datasets.

Using these imputed size, density, and canopy cover metrics, habitat quality categories for CSO nesting and roosting based on structural characteristics of forests were classified into two general categories: 1) highest-quality habitat and 2) best-available habitat (Table A.02-2).

Table A.02-2. Habitat quality categories for CSO nesting and roosting based on structural characteristics of forests.

Habitat Quality Categories Based on Structural Characteristics	WHR Classification	Tree Size	Canopy Cover
Highest-Quality	5D, 5M, 6	More than 24-inches	40 to 100 Percent
Best-Available	4D, 4M	11 to 24 inches	40 to 100 Percent

Defining habitat quality using these data provides a rough metric to quantify, in acres, the existing quality of structural characteristics of nesting/roosting and foraging habitat at multiple scales across the project area (Table A.02-3). Table A.02-3 presents the acres of CSO habitat at multiples, but the quantification presented was calculated simply on the size and density of the trees as the lone indicator of habitat quality. Other factors such as high-risk densities, mid-story canopy densities, high fuel loads, competition, drought conditions, insect and disease infestations, and warming temperatures are not accounted for in Table 4 but are no less important. These other abiotic parameters should be considered when assessing and defining habitat quality and when determining where retention of large, old, structurally diverse trees and snags are appropriate.

Table A.02-3. Acres of California spotted owl habitat at multiple scales[12].

Land Allocation	Highest-Quality	Best-Available	All Other	Total Acres
PAC	3,042	9,622	2,438	15,102
Territory	2,758	18,049	10,277	31,084
All Other	7,797	62,847	47,170	117,814
Total	13,597	90,520	59,885	164,000

Management objectives and desired conservation outcomes vary across each land allocation as it relates to CSO habitat (Table A.02-4). Each of these objectives and desired conservation outcomes helped to identify the need for management actions across the project area. Knowing the quantity and quality of the existing habitat also provides the foundation in which to analyze each alternative's effectiveness of maintaining quality habitat. During development of the proposed action and when locating treatments and assessing treatment needs, the management objectives and desired conservation outcomes as well as forest plan direction were considered and adhered to (Appendix B).

Table A.02-4. California spotted owl management objectives and desired conservation outcomes.

Land Allocation	Overall Management Objective	Desired Conservation Outcome
PAC	Maintain highest-quality habitat at occupied nest sites while more resilient habitat is developed across the landscape	Manage PACs for resiliency and sustainability while minimizing potential near-term effects of resiliency treatments
Territory	Maintain and increase highest-quality nesting, roosting, and foraging habitat while increasing habitat heterogeneity and resilience	Maintain and promote 40 to 60 percent of a territory in mature tree size classes with moderate and high canopy cover for nesting, roosting and foraging.
Watershed Matrix (HUC 6)	Restore resilient forest conditions guided by NRV	Increase resiliency and promote the development of future nest sites within territories at the watershed scale by reducing tree density of smaller trees that are prohibiting growth of larger trees.

Management activities that maintain the structural characteristics of highest-quality habitat while protecting it from risk of loss from high severity wildfire and other natural disturbances, require trade-offs. Balancing the retention of highest-quality habitat with necessary treatments to increase resiliency, may cause short-term decreases in habitat quality. To minimize near-term effects of resiliency treatments, such treatments should be implemented only when needed (e.g., where landscape is vulnerable to natural disturbance and loss of habitat) and should be designed to maintain the most important habitat components, such as areas of high canopy cover (more than 55 percent) in large/tall trees within PACs.

It is important to note that maintaining or improving CSO habitat is complex and requires a multi-faceted evaluation. It is imperative to avoid putting an over-emphasis or narrow focus on structural habitat characteristics and failing to consider that areas containing these desirable structural owl habitat characteristics may contain other characteristics that put them at high-risk from natural disturbances such as insect-, disease-, drought-, and high severity wildfires (e.g., high SDIs; accumulated surface and ladder fuels, and too few shade-intolerant and fire-tolerant trees).

It is well documented that a forest, PAC, or Territory containing the large trees and high canopy cover (structural characteristics of the highest-quality and best-available habitat), can also be overly dense, lack forest openings, contain lush understory vegetation which act as ladder fuels, and experience the same

[12] PAC acres are located only on NFS-lands. Territory and All Other acres include non-NFS lands. Total acres includes all lands: NFS and non-NFS lands. Territory excludes PAC acres.

climate related stressors (lack of precipitation, warmer temperatures,) as the rest of the landscape across the Sierra Nevada. Characteristics which are supported indicators to assess the landscapes vulnerability to natural disturbances are just as critical to maintain and improve CSO habitat quality. To fail to comprehensively evaluate all of the habitat characteristics when assessing habitat quality and developing a project would be inconsistent with the overall CSO Strategy and fail to promote resilient CSO habitat throughout the landscape.

The SERAL 2.0 project was developed to find a balance between maintaining structural characteristics associated with the highest-quality and best-available habitat while promoting resilient CSO habitat and across the landscape.

A.04 Increase the Abundance and Distribution of Fire-Resilient and Resistant Species (Pines and Oaks) and Decrease the Abundance of Shade-Tolerant Species (Firs and Cedars).

Throughout Sierra Nevada montane forests, many decades of fire suppression have led to a major shift from the dominance of shade-intolerant, fire-resilient species, such as pines and oaks, to the dominance of shade-tolerant species, primarily white fir and incense cedar (Safford and Stevens 2017).

When fire occurred frequently, generally burning at low and moderate severity, pine dominance in many stands was maintained. Thus, historically, more fire-resistant and shade-intolerant pine and oak trees represented a greater proportion of trees across the landscape than current conditions. To correct this imbalance, forest restoration treatments need to be designed to favor shade-intolerant species for retention while removing fire-sensitive species that would not have survived under a natural fire regime.

A.05 Reduce Surface and Ladder Fuels

Within a frequent fire regime when surface and ladder fuels were regularly consumed, a mosaic of vegetation and fuel load conditions were common across the Sierra Nevada. In the absence of a regular low-intensity fire regime, accumulated surface and ladder fuels, including coarse woody debris and tall, dense shrubs, increase the risk of higher flame lengths, residence or burning time, resistance to control a fire, and fire severity. Collectively these effects are likely to result in loss of wildlife habitat and community infrastructure and impact the stability and health of soil and water.

Under an average range of weather conditions, lower fuel loads generally have lower flame lengths, reduced fire severity, and are more likely to burn as a surface fire rather than enter into the tree crowns (or move as a crown fire). Fuel and vegetation reduction treatments are needed to rebalance the ratio of fuel loading and reduce the moderate and high fuel loads across the landscape.

A.06 Increase Management by Fire, both Prescribed and Managed Wildfire.

Fire fills an important role in nutrient cycling, biodiversity maintenance, and habitat structure. Fire returns nutrients to soils, encourages growth of older fire-resistant trees, and creates forest openings. Opening the forest canopy increases sunlight reaching the forest floor, promoting diverse understory plants and tree seedlings (new growth). Fire also reduces the continuity of grasses, shrubs, and saplings in the understory which can become ladder fuels, through which flames can climb into the forest canopy. Once fire enters a forest canopy, fires can spread easily and are likely to result in tree mortality.

Prior to the 20th century, fires were a common occurrence in the Sierra Nevada and foothills for thousands of years. Much of the forests burned at regular intervals on a 15- to 30-year cycle from natural causes like lighting or intentional ignitions and vegetation management by indigenous people. This historic, regular pattern of fire, known as a fire regime, created a mosaic of vegetation patterns including

varying degrees of canopy cover and forest openings. Historic fires regularly consumed surface vegetation and fuels and maintained a diverse range (e.g., spacing, age cohorts, species heterogeneity) of less dense understory and overstory vegetation. Under these historic conditions and fire regimes, fire severities and flame lengths were low. As the fire return interval increases beyond those which ecosystems evolved with, then the landscape's vulnerability increases to disturbances such as intense wildfires, insect and disease infestations, and drought mortality. After nearly a century long over-emphasis on fire suppression, Sierra Nevada forests are now uncharacteristically dense with understory ladder fuels often coupled with suppressed to codominant sized trees, and a thick layer of dead and down woody material, litter, and duff. So now, when fires ignite, forests erupt into massive infernos which generate their own weather, burning large expanses of forested lands at much higher intensities and severities than historic levels, consuming or killing most of the live vegetation, and leaving long-lasting fire scars on huge expanses of our public lands (USDA 2023).

The fire history within the SERAL 2.0 project area is fire deficient. Very little area has burned over the past few decades. Approximately 70% and 20% of the SERAL 2.0 project area is highly departed (Condition Class 3) and moderately departed (Condition Class 2[13]) respectively, from the frequency of fire that occurred prior to Euro-American settlement[14] (Table A.06- 1).

Table A.06- 1. Acres of estimated fire return interval departure by condition class (CC) category.

Fire Return Interval Departure		NFS-lands	All-Lands
Less Frequent (+ CC)	High (CC3)	73,440	110,836
	Moderate (CC2)	25,503	29,024
	Low (CC1)	4,240	4,831
More Frequent (- CC)	High (-CC3)	2	2
	Moderate (-CC2)	2,406	2,692
	Low (-CC1)	3,129	3,456
No Data or Unburnable Areas (e.g., rock and water)		9,561	11,327
Total		118,282	162,168

The large-fire simulation system, or FSim (Finney et al. 2011), was used to model conditional flame length estimates under existing landscape conditions (given the condition that a wildfire burns the pixel under different simulated wildfire conditions). A pixel is a spatial unit of land, for example one pixel equals a 90 by 90-meter area of land for this FSim model. FSim predicted that greater than 80% of the landscape in the project area (all lands) have flame lengths between 4 to 8 feet or greater than 8 feet (Table A.06-2). A correlation exists between flame lengths and wildfire vegetation severity: high severity (stand-replacing) fire is greatest when flame lengths exceed 8 feet, as these flame lengths are commonly associated with tree torching and crown fire initiation (Collins et al. 2013; Stephens et al. 2016).

Table A.06-2. Acres of conditional flame length categories.

Conditional Flame Length	Non-NFS lands	NFS-Lands	All Lands
0	6	577	584
Greater than 0 to 4 feet	2,334	26,791	23,727
Greater than 4 feet to 8 feet	9,802	32,286	42,089

[13] Positive condition classes (CC) have greater fire return intervals – fires burned less often – than presettlement frequencies, while negative condition classes have experienced more frequent fire than presettlement frequencies.

[14] To conduct a comparative fire return interval departure (FRID) analysis and quantify the difference between presettlement and current FRI the current existing vegetation types within the SERAL 2.0 project area were organized into four presettlement fire regime (PFR) groups according to their historical relationships with fire (Van de Water and Safford 2011, Safford and Van de Water 2014). For each PFR group, presettlement and current FRIs were calculated based on Van de Water and Safford 2011. Van de Water and Safford 2011 organized the vegetation types into 28 PFR groups. For SERAL 2.0 these 28 PFR groups were further clumped.

Greater than 8 feet	31,743	58,626	90,369
Total	43,886	1182,81	162,168

Another good indicator of the health and resilience of forested landscapes is the prediction of crown fires. Crown fires pose increased safety hazards for personnel and risks to ecosystem resiliency because crown fires often have sustained flame lengths above 4 ft (often times higher), move in unexpected, fast patterns that are difficult to control or suppress, and often burn across large landscapes in one burn period (i.e., one day) with limited time for evacuation and contingency planning. Forested landscapes with a lower proportion of areas experiencing active crown fires and higher proportion of surface fires would experience lower severity wildfire effects and related vegetation mortality across the landscape.

FSim was also used to estimate annual burn probability or likelihood across the SERAL 2.0 area (Table A.06-3). Annual burn probability is calculated for each pixel on the landscape as the number of iterations that resulted in the pixel burning divided by the total number of iterations (10,000). Burn probability and expected flame lengths vary substantially across the project area, and the highest ratio of acres in the project area (all lands) have 1 to 5 percent chance of burning annually for the existing conditions.

Table A.06-3. Acres of annual burn probabilities from FSim modeling.

Annual Burn Probability	Non-NFS lands	NFS-Lands	All Lands
0	4	566	571
Less than or equal to 1%	2,993	41,862	44,855
Greater than 1% to 2 %	14,451	53,664	68,116
Greater than 2% to 5 %	26,438	22,188	48,627
Total	43,866	118,281	162,168

Collectively, the estimated proportion of the landscape predicted to burn at greater than 4-foot flame lengths (Table A.06-2), and elevated annual burn probabilities (Table A.06-3) quantifies the threat to resources and the health and well-being of surrounding communities. Management actions are urgently needed to change the wildfire risk, also known as the combination of fire hazard and vulnerability of this landscape. Increased use of prescribed fire supported by the construction and maintenance of a fuelbreak network is key to addressing this urgent need across the landscape.

A.07 Construct and Maintain a Network of Fuelbreaks to Support Prescribed Fire and Wildfire Operations.

The concept behind fuelbreaks is to create a corridor or safer space that facilitates firefighter operations before and during prescribed fire projects or wildfire incidents, a travel corridor to support safer ingress and egress routes for emergency responders, firefighters, management activity personnel, and the public.

Fuelbreaks are generally not designed to stop a high intensity or fast-moving wildfire on their own, but instead, landscape features where vegetation and fuels have been altered to reduce fire behavior and to help facilitate safer, more efficient, and more successful fire management actions. These corridors are created and maintained by measurably reducing the understory vegetation, surface vegetation, and large woody debris to reduce fuel continuity.

When fuelbreaks are constructed and maintained in advance of a potential future wildfire, they become high value, proactive, and existing landscape tools or features that are ready to be employed during prescribed and wildfire management operations (Kennedy et al. 2019, Hersey and Barros 2022). Fuelbreaks are designed to break up large expanses of continuous fuels, creating safer corridors largely free of hazard trees with increased tree spacing and sparse or short understory vegetation. When maintained, fuelbreaks provide emergency responders and firefighters safer access to incidents and operations, increase suppression opportunities, and provide pre-existing control points for prescribed fires and wildfires (USDA 2017, p. 37, USDA 2020). Fuelbreaks also provide more effective retardant

application areas and prescribed fire or backfire ignition zones. They serve as critical attack locations to anchor and improve containment lines, as well as to modify high-intensity wildfire behaviors.

Active and effective fuelbreaks contain a vegetative arrangement that supports reduced wildfire intensity as it burns as a surface fire with low flame lengths across the fuelbreak. This vegetative arrangement retains the dominant tree or shrub canopies to create shaded conditions. The goal is to create shaded fuelbreaks, and the shaded part is key to limit rapid herb and shrub growth; the shade lowers temperatures and increases humidity levels underneath the dominant vegetation. The remaining trees create wind resistance, that when coupled with lower temperatures and higher humidity all can reduce fire behavior compared to wide open sunny spaces with no wind barriers. This vegetative arrangement includes the removal of ladder fuels so fire cannot easily spread to tree or shrub canopies, and where the contiguous vertical and horizontal understory, dead and downed, and canopy fuel arrangement is interrupted. This general arrangement retains species diversity of individual younger, middle aged and older plants, which allows the opportunity for an uneven aged vegetative type, without compromising fire behavior or safety objectives.

When evaluating initial or maintenance treatment needs or timing, effective fuelbreaks are based on safe human conditions in terms of reduced amounts of live and dead surface and understory vegetation. These include increased fire vehicle maneuvering and parking; increased visibility during travel along roads to ease navigation and fire lookout observations; increased ability for firefighter movement across the landscape (e.g., limited amounts of: dead shrubs, large expanses of shrubs that are difficult to walk through, dead or hazardous trees, and large, numerous logs or piles of dead and down material); and reduced fire ember production and reception (e.g., reduce fire's ability to spread into and from tree crowns where embers are lofted, and reduce dead and downed woody fuel where embers can establish).

Currently, an important strategic need for additional fuelbreaks exists across the project area, and several existing fuelbreaks have critical improvement and maintenance needs.

A.08 Salvage Drought, Insect, Disease, and Wildfire Disturbed Areas

Prior to the 20th century, regular patterns of fire created a mosaic of vegetation patterns including varying degrees of canopy cover and forest openings at densities far less susceptible to insect-, disease-, or drought mortality. Now, when insect- or disease-outbreaks or lengthy droughts occur widespread mortality is common. Extensive mortality creates a measurable increase in accumulated fuels (e.g., coarse woody debris, snags, litter, and duff) and increases the risk of high severity wildfire across the landscape. Historically, fire effects that mimic NRV would have produced a mosaic of patches burned at low (30 to 60 percent) and moderate (15 to 35 percent) severities interspersed with large, unburned patches (10 to 30 percent) and small, high severity patches (1 to 10 percent) (USDA 2019). High severity burns are most likely to result in tree mortality. Where high severity burned areas exceed 10 percent of a watershed, a restorative need to salvage the excessive dead trees may be warranted.

Similarly, historic insect and disease outbreaks in a healthy forested landscape would have produced patches of beetle- or disease-killed trees between 0.25 and 10-acres over up to 15 percent of the landscape (Fettig 2012 *in* USDA 2019). When insect or disease activity cause mortality in excess of these estimates a restorative need to salvage the excessive dead trees may be warranted.

In the face of uncertainty, and the heightened risk that large scale mortality events may occur, the forest needs to be prepared to respond rapidly before the trees stability and economic viability decline. Treatments to remove dead trees become more costly and more dangerous as the trees weaken. Therefore, eliminating or reducing delays in responding to mortality is important.

APPENDIX B: CONSIDERING NRV AND CALIFORNIA SPOTTED OWL DURING TREATMENT AREA SELECTION

B.01 NRV Assessment

What is NRV?

Natural Range of Variation (NRV): The "variation of ecological characteristics and processes over scales of time and space appropriate for a given management application. The NRV concept focuses on a subset of past ecological knowledge developed for use by resource managers incorporating a past perspective into management and conservation decisions. The pre-European-influenced reference period is considered to include the full range of variation produced by dominant natural disturbance regimes such as fire and flooding and should also include short-term variation and cycles in climate" (USDA 2019).

Why conduct an NRV Assessment?

Natural Range of Variation (NRV) assessments provide baseline information on the composition, structure, and function of forested ecosystems that can be compared to current conditions to develop an idea of trend over time and an idea of the level of departure from their natural state (Safford and Stevens 2017; Meyer and North 2019, Appendix B.02). Restoring forest composition, structure, and processes based on NRV conditions has been linked to greater resilience to wildfire, climate change, and other stressors and is a central and guiding principle of the Conservation Strategy for the California Spotted Owl in the Sierra Nevada (USDA 2019). The concept of restoring the landscape into closer alignment with historic reference conditions is rooted in the assumption that the structural composition of forests occurring in pre-settlement times, were, and would still be, more resilient to disturbances such as insects, disease, drought, and climate change, and less susceptible to large-scale, high severity wildfires.

Resilience objectives (Appendix A) designed to move the landscape into closer alignment with the NRV, however, only in part, inform the restoration needs across a landscape. Along with conducting an assessment to determine what restoration treatments are needed to restore forest resilience, responsible officials must also consider climate change trends, invasive weeds (Chapter 1.02), the habitat needs and status of sensitive species (Appendix B.02), social needs like providing economic opportunities to local communities (Chapter 1.03), as well as maintaining access to public lands and how to minimize safety hazards across the forest (Chapter 1.04).

How is an NRV Assessment conducted?

Conducting an NRV assessment may be achieved using a number of different data sources or analytical approaches. The specific approach used in SERAL 2.0 is based on Safford and Stevens (2017) and Meyer and North (2019) and is similar to the process used in SERAL 1.0. Collectively the data is used to assess to what degree the current landscape condition is departed from the desired condition. Other forests may use similar, but different, methodologies for assessing the landscapes departure from NRV.

Ultimately, the methodology chosen for SERAL 2.0 was chosen based on best available, citable, science (Safford and Stevens 2017, Meyer and North 2019) using modeled estimates derived from lidar-based imputed data (Huang et al. 2018).

Stafford and Stevens (2017) and Meyer and North (2019) present modeled estimates of the landscape structure representing the distribution of different forest types as they are hypothesized to have existed prior to Euro-American settlement. They present this information as percentages of the landscape occupied by each of five successional classes: early, mid-closed, mid-open, late-open, and late-closed successional class by dominant vegetation types (Figure 13– Safford and Stevens 2017; Figure 21 – Meyer and North 2019; SERAL 2.0 Table B.01-1). The reported percentages in Table B.01-1 are

snapshots of the average landscape condition during presettlement times for landscapes greater than 5000 ha (12,355 acres) under a presettlement fire regime.

Table B.01-1. Percentage of the landscape occupied by successional classes as they are hypothesized to have existed prior to Euro-American settlement.

Successional Class	CWHR Classifications	Dry Mixed Conifer	Fir/Moist Mixed Conifer
Early	<=2 all densities	20%	20%
Mid-Open	3S,3P, 4S, 4P	25%	20%
Mid-Closed	3M,3D,4M,4D	10%	15%
Late-Open	5S,5P	40%	25%
Late-Closed	5M,5D,6	5%	20%

1. Vegetation Type:

Vegetation type informs the degree in which the landscape is meeting the desired condition because desired conditions are quite variable among different vegetation types. For example, the desired proportion of late-closed seral class across the landscape for dry mixed conifer forested areas is 5% while the desired proportion of late-closed seral class for moist mixed conifer/fir is 20% (Table B.01-1).

Like SERAL 1.0, F3 (Huang et al. 2018) was used to distinguish between dry vs. moist mixed conifer and other vegetation types for SERAL 2.0. F3 is an algorithm that combines ground-based Forest Inventory and Analysis (FIA) plots and remote sensing data (Landsat, 20x20 m pixel resolution) to create maps of ecosystem metrics (Huang et al. 2018). F3 uses 2019 imagery, 2020 lidar-acquired data, and FIA plots as inputs. Each input is then projected forward to 2022 using the Forest Vegetation Simulator (FVS).

This approach identifies the estimated existing vegetation (Table B.01-2). Stand exams conducted in the SERAL project area were used to compare the F3 produced vegetation type to the vegetation on the ground. The results confirmed that the F3 approach was very accurate to the true existing condition.

The data generated using F3 were then aggregated to the SERAL 2.0 treatment area selection polygons based on a series of logic statements and threshold values to assign each polygon a dominant vegetation type.

Table B.01-2. Dominant vegetation types in SERAL 2.0 project area.

Vegetation Type	All Acres	NFS Acres
Pine	25,902	16,720
Dry Mixed Conifer	62,148	41,451
Hardwood	1,195	1,115
Shrub	16,844	13,296
Moist Mixed Conifer / Fir	34,944	28,542
Herbaceous	17,809	14,014
Non-Vegetated	3,326	3,143
Total	162,168	118,281

2. Slope Position and Aspect

Slope position and aspect can influence an area's suitability for different vegetation types and ability to support a healthy and resilient forest. For example, drainages and northeast mid-slopes are typically cooler, with higher moisture content and may be more able to better persist during a wildfire than areas along ridges or southwest mid-slopes where conditions are typically drier and more stressed.

For SERAL 2.0, the ForSys treatment area selection units were drawn first-hand by our local forestry staff as operational units for the entire project area. Our staff believed that first drawing selection units based

on operational features would better translate to implementation and would more acutely parse up the landscape into smaller polygons. The forestry staff used lidar data and aerial imagery during their delineations. Changes in vegetation type and density based on aerial imagery were the first factors reviewed when drawing units. Slope layers were toggled on and off during the process as well to look for appropriate / necessary unit breaks based on operability. Next, the treatment area selection units were further subdivided by 4 topographic positions as well as many other land allocations which inform the type of management actions which may occur there (e.g., PACs, territories, Near Natural, WUI defense).

3. CWHR Classification

CWHR classifications (Table B.01-3) are commonly used to discuss California spotted owl habitat quality, which is discussed in more detail in Section B.02. Modeled estimates of quadratic mean diameter (QMD) (ACCEL) and canopy cover (lidar) were used to assign areas of the landscape into CHRW size and density classes based on the values presented in Table B.01-3. The CWHR size / density classifications were then grouped into successional classes.

Table B.01-3. CWHR Classification

Size / Density	Size Classification	Tree Size Class (DBH in.)	Canopy Cover	Successional Class
<= 2 All	Seedlings / Saplings	<6 in.	-	Early
3S	Poles	6 - < 11 in	10-25%	Mid-Open
3P	Poles	6 - < 11 in.	25-40%	Mid-Open
3M	Poles	6 - < 11 in.	40-60%	Mid-Closed
3D	Poles	6 - < 11 in.	60-100%	Mid-Closed
4S	Small Trees	11 - <24 in.	10-25%	Mid-Open
4P	Small Trees	11 - <24 in.	25-40%	Mid-Open
4M	Small Trees	11 - <24 in.	40-60%	Mid-Closed
4D	Small Trees	11 - <24 in.	60-100%	Mid-Closed
5S	Medium / Large Trees	>24 in.	10-25%	Late-Open
5P	Medium / Large Trees	>24 in.	25-40%	Late-Open
5M	Medium / Large Trees	>24 in.	40-60%	Late-Closed
5D	Medium / Large Trees	>24 in.	60-100%	Late-Closed
6	Medium / Large Trees With Multi-Level Canopy	>24 in.	>60%	Late-Closed

S = Open Cover; P = Sparse Cover; M = Moderate Cover; D = Dense Cover.

4. Successional Class Distribution

The area of the landscape distributed into each of the successional classes was then compared to the reference conditions described in Safford and Stevens (2017) and Meyer and North (2019) (Figure 19).

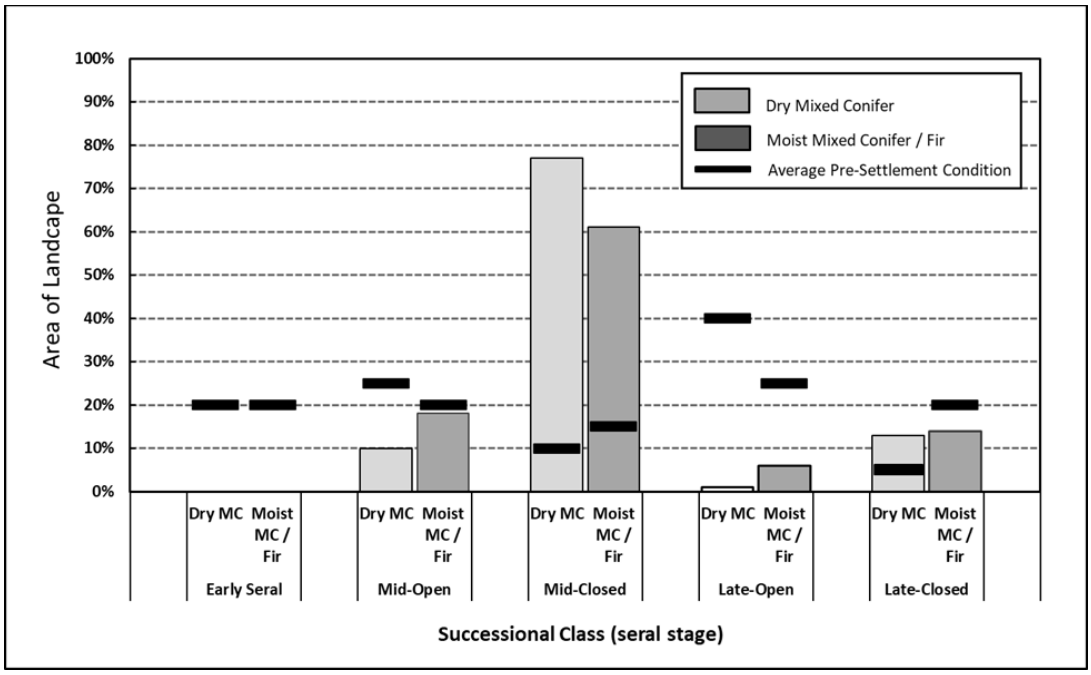

Figure 19. Current landscape structure within dominant forest types compared to average pre-settlement conditions.

Figure 19 shows that within SERAL 2.0 there is a deficiency in the mid-open and late-open successional classes and an abundance in the mid-closed class for each vegetation type. There is also an abundance in the late-closed class for dry-mixed conifer. At a broad scale these imbalances can be corrected by a forest thinning timber harvest operation (Table B.01-4).

Table B.01-4. Restoration needs.

Seral Stage Excess (CWHR Class)	Seral Stage Deficit (CWHR Class)	Restoration Need	Dry-Mixed Conifer	Moist-Mixed Conifer / Red Fir	Total
Mid-Closed (3, 4 M&D)	Mid-Open (3, 4 S & P)	Forest thinning and/or non-stand replacing fire	9,537	546	10,083
Mid-Closed (3, 4 M&D)	Early (2 or less)	Small gap creation via forest thinning and/or fire.	12,180	6,989	19.169
Mid-Closed (3, 4 M&D)	Late-Open (4, 5 S & P)	Forest thinning and/or non-stand replacing fire to transition from mid-seral closed to mid-seral open canopy, followed by growth with periodic, non-stand replacing fire.	19,724	6,556	26,280
Mid-Closed (3,4 M&D)	Late-Closed (5,6 M&D)	Succession: Growth without fire or with periodic low-intensity fire	0	2,061	2,061
Late-Closed (5, 6 M&D)	Late-Open (4, 5 S & P)	Forest thinning and/or non-stand replacing fire	4,720	0	4,720
Total Structural Restoration Need			**46,162**	**16,151**	**62,313**

S & P = Sparse / Open Cover; M & D = Moderate and Dense Cover.

In addition to the dry-mixed conifer and moist-mixed conifer / fir dominant vegetation types there are approximately 25,900 acres of pine forest type in the project area, the vast majority of which are

ponderosa and/or Jeffrey pine plantations. Among these planted forests, there are a wide range of ages, size classes, and densities represented across the project area. Many of these plantations have experienced significant mortality due to bark beetles and drought in recent years, and many of the surviving acres remain at high risk to density-related mortality in their current condition. The vast majority of the plantations need restoration (via forest thinning) to reduce the risk of continued, widespread mortality. Forest thinning is needed in plantations with elevated stand densities to reduce them down to levels of very low competition—approximately 100 SDI, or 25-35% of SDI max—as described by North et al (2022). In addition to creating stocking levels that provide for well-spaced tree crowns and low levels of competition, silvicultural and fuels reduction treatments in plantations are needed to: (1) accelerate the development of key habitat and old forest characteristics, (2) increase stand heterogeneity, (3) promote hardwoods, and (4) reduce risk of loss to wildland fire.

The restoration needs presented in Table B.01-4 and the restoration needs within plantations are just one aspect of what informs (rather than prescribes) the desired composition of different tree sizes and densities by vegetation type across the project area and informs the purpose and need and development of the proposed action.

The information gleaned from the results presented above, helped to inform the restoration needs on the landscape, but the results are not prescriptive. Other information, including the conservation needs of sensitive wildlife, like the California spotted owl (CSO), were considered when assessing restoration needs and development of the proposed action (Section B.02).

B.02 California Spotted Owl Criteria

The SERAL 2.0 team integrated CSO desired conditions, standards, and guidelines into proposed action development and treatment area selection to balance the needs of the owl while locating and designing treatments to reduce the landscape's susceptibility to natural disturbance, The CSO Strategy (USDA 2019) and the proposed forest plan amendments (Appendix C) define CSO territory and PAC desired conditions (SPEC-CSO-DC-06, SPEC-CSO-DC-07). Other components provide direction to maintain and promote or improve habitat quality in CSO PACs (SPEC-CSO-STD-04) and territories (SPEC-CSO--STD-05) and to maintain habitat connectivity across the landscape (SPEC-CSO-STD-05). These plan components played an integral role in the development of the SERAL 2.0 proposed action. In order to balance the needs of the owl while locating and designing treatments to reduce the landscape's susceptibility to natural disturbance, the SERAL 2.0 team integrated the CSO desired conditions, standards, and guidelines into proposed action development and treatment area selection.

Protected Activity Centers (PACs)

Minimizing impacts to breeding success and restoring resiliency of the area are equally critical needs, thus nesting and roosting habitat within CSO PACs was an important facet of designing the proposed action. The project-specific forest plan amendments, described in the following Appendix C, include desired conditions, standards, and guidelines which provide management direction for activities within CSO PACs.

First and foremost, PAC activity centers are protected from operational disturbance and mechanical treatments by applying a "no mechanical treatment" 10-acre buffer around nest sites (SPEC-CSO-STD-04 and SPEC-CSO-STD-07). During treatment area selection of forest thinning and mechanical fuel reduction units, the 10-acre buffers surrounding the activity center were eliminated from the acres available for selection. Prescribed burning or other pre-treatment hand thinning prior to burning may be conducted within this 10-acre area to protect important elements of owl habitat but mechanical treatments may not.

SPEC-CSO-STD-04 requires that all management activities must maintain or improve habitat quality in the highest-quality nesting and roosting habitat (CWHR 5D/5M/6). An assessment of the existing

condition of each CSO PAC was performed based on size and density classes (Table B.02-1). Based on the existing condition assessment we know that some CSO PACs have no CWHR 5D/5M habitat and others are composed of up to 95% CWHR 5D/5M habitat (Table B.02-1). As required by SPEC-CSO-STD-04, any treatments applied within CSO PACs must maintain the existing CWHR 5D and 5M classifications. Modeling estimates indicate that although the 20-inch DBH limit is quite effective in retaining CWHR classification 5D and 5M, CWHR 5D may be reduced in some instances. To account for this, the proposed action was updated to require that forest thinning in areas classified as 5D must retain canopy cover above 60% to ensure the 5D classification is retained.

Guidelines SPEC-CSO-GDL-01 and SPEC-CSO-GDL-02b address how treatments should be prioritized within CSO PACs: to increase resiliency and sustainability in areas that are at highest risk of large-scale, high severity wildfire, severe tree mortality from insects and drought, or those that are likely unsustainable long-term (SPEC-CSO-GDL-01) and by minimizing or avoiding treatments that may reduce habitat quality in the near term in PACs with the highest likely contribution to reproductive success (SPEC-CSO-GDL-02b).

Multiple landscape condition metrics are used to incorporate SPEC-CSO-GDL-01 into the treatment area selection process (Appendix E). Reproductive status and success is variable from year to year. Survey history of individual PACs is also variable. A comprehensive survey effort for SERAL 2.0 began in the summer of 2023. Prior to the SERAL 2.0 effort, most of the PACs in the project area hadn't been surveyed in the past 5 years. Of those that had been surveyed, reproductive status was documented as unknown. Surveys are ongoing and will continue to occur throughout implementation. It is common for PACs to have consecutive years of pairs with reproductive success, then a year or two with no evidence of nesting. Despite a clear need to continue survey efforts to better determine occupancy status, we estimate that all but one PAC is highly likely to contribute to reproductive success. This single PAC (TUO0146) is located in a high-severity burn area with no birds recently detected (>1 year of survey). For all other PACs, there is no single PAC more likely than another to contribute to reproductive success. Surveys conducted this year (2023) are confirming reproduction is occurring in the majority of CSO PACs in the project area and occupancy and reproduction in new areas as well. As more consecutive year survey information is gathered, and new PACs are added, we can better assess reproductive status and success. For now, the project is being developed while considering all of the PACs within the project area are highly active and reproductive, and all but one has a high likelihood of contributing to reproductive success. As such, the proposed action was developed to include multiple PAC treatment constraints and treatment area selection criteria which were designed to minimize or avoid treatments that may reduce habitat quality in the near term (Table B.01-1).

Table B.02-1. Existing condition within California spotted owl PACs.

PAC ID	Total Acres	Total Acres Project Area	Acres 4M	Acres 4D	Acres 5M	Acres 5D	Acres Other	% 4D/4M	% 5D/5M	% Other	Notes or Treatment Adjustment Considerations
CAL0045 – NF Stanislaus	302	0	0	0	0	0	0	100%	0%	0%	
TUO0007 Sheering Cr	302	302	28	274	0	0	0	100%	0%	0%	
TUO0035 – Hull Crk	309	309	38	97	6	158	10	44%	53%	3%	
TUO0036 Griswold Crk South	300	300	63	234	0	0	3	99%	0%	1%	
TUO0053 – Brushy Crk	304	304	43	33	26	202	0	25%	75%	0%	
TUO0054 – Thompson Peak	301	273	8	165	11	80	9	63%	33%	3%	
TUO0057 - NF Tuolumne	302	302	12	269	0	21	0	93%	7%	0%	
TUO0059 – L 13 Mile Crk	299	299	46	29	17	196	12	25%	71%	4%	
TUO0061 – Bear Spring Crk	302	302	175	37	0	4	86	70%	1%	28%	Dropped from forest thinning treatment selection
TUO0062 – Trout Crk	308	308	152	136	15	0	5	94%	5%	2%	
TUO0063 – Jonnie Gulch	153	153	11	129	0	0	13	92%	0%	8%	Small PAC
TUO0068 – Mount Lewis	306	306	3	292	0	11	0	96%	4%	0%	
TUO0069 – Basin Crk	300	300	0	278	0	22	0	93%	7%	0%	
TUO0070 Herring Cr	303	303	75	26	87	13	102	33%	33%	34%	Small PAC
TUO0101 McKee Hill	313	313	32	281	0	0	0	100%	0%	0%	
TUO0117 Strawberry North	306	67	26	32	0	6	2	87%	10%	3%	
TUO0126 – Merill Spring	304	304	185	112	0	0	7	98%	0%	2%	
TUO0128 – L Trout Crk	306	306	148	156	0	0	2	99%	0%	1%	
TUO0129 – U 2 Mile Crk	305	305	41	144	3	103	14	61%	35%	5%	
TUO0130 – Camp Clavey	306	236	49	41	75	54	16	38%	55%	7%	70 acres of PAC outside project area.
TUO0132 – Hull Crk Camp	301	301	40	71	41	150	0	37%	63%	0%	
TUO0133 – High Sierra N	303	303	84	143	36	28	12	75%	21%	4%	
TUO0141 – N Marble Mtn	302	302	22	257	0	22	0	93%	7%	0%	
TUO0142 – Marble Mtn S	305	305	0	305	0	0	0	100%	0%	0%	
TUO0146 – Hunter Crk	250	250	65	9	0	0	176	30%	0%	70%	Dropped from forest thinning treatment selection
TUO0148 – U 13 Mile Crk	300	300	0	9	6	276	10	3%	94%	3%	
TUO0149 – Cottonwood Crk	301	301	108	49	104	12	28	52%	39%	9%	

PAC ID	Total Acres	Total Acres Project Area	Acres 4M	Acres 4D	Acres 5M	Acres 5D	Acres Other	% 4D/4M	% 5D/5M	% Other	Notes or Treatment Adjustment Considerations
TUO0151 – L Cottonwood Crk	304	296	42	55	26	79	94	33%	35%	32%	Dropped from forest thinning treatment selection
TUO0156 – High Sierra S	301	301	7	254	0	19	20	87%	6%	7%	
TUO0157 – S Bald Mtn	299	299	164	36	0	0	99	67%	0%	33%	
TUO0164 Dodge Ridge	295	295	55	64	42	102	32	40%	49%	11%	
TUO0165 – Fahey Cabin	300	300	4	267	0	20	8	90%	7%	3%	
TUO0176 – Clavey Wolfin	301	0	0	0	0	0	0	100%	0%	0%	
TUO0180 Sheering West	305	305	91	213	0	0	0	100%	0%	0%	
TUO0181 – Lily Lake	303	302	108	178	6	10	1	95%	5%	0%	
TUO0187 – Thompson Meadow	302	302	0	29	13	259	0	10%	90%	0%	
TUO0189 – Stanislaus Tunnel	300	2	0	0	0	0	2	0%	0%	100%	
TUO0204 – McCormick Meadow	301	301	101	198	0	0	2	99%	0%	1%	
TUO0210 - Buchanan	301	301	34	267	0	0	0	100%	0%	0%	
TUO0213 Griswold Cr N	30	30	0	30	0	0	0	100%	0%	0%	Tiny PAC, nest on small NFSL parcel surrounded by private lands.
TUO0214 – Camp Ida	300	300	0	162	0	139	0	54%	46%	0%	
TUO0215 Upper Skull Cr	306	306	7	291	0	8	0	97%	3%	0%	
TUO0239 – Fisher Crk	305	305	16	276	0	12	0	96%	4%	0%	
TUO0241- East Fisher	291	291	98	160	0	22	11	89%	8%	4%	
TUO0245 - S F Griswold	143	143	56	82	0	0	5	96%	0%	4%	
TUO0253 Bell Meadow	305	305	220	52	8	15	11	89%	7%	3%	
TUO0255 – Box Spring	303	303	45	84	0	159	15	43%	53%	5%	
TUO0256 – Clavey Rvr	301	33	10	23	0	0	0	100%	0%	0%	Most of PAC outside of project area.
TUO0257 – Westside E	304	304	143	0	0	162	0	47%	53%	0%	
TUO0258 – Westside W	308	308	130	88	25	12	52	71%	12%	17%	
TUO0260 – Lily Creek	300	300	147	76	5	63	8	74%	23%	3%	
TUO0261 – U Camp 25	301	301	7	232	12	39	10	80%	17%	3%	TUO0261

Table B.02-2. California spotted owl PAC treatment constraints and treatment area selection criteria.

Design Element	Purpose
Mechanical thinning may not exceed 100 acres per PAC	The inclusion of a hard 100-acre mechanical thinning cap is designed to ensure that treatments that **may** reduce habitat quality are **avoided** (**no** treatments) in 200 acres of each PAC. This requirement also effectively **minimizes** mechanical treatments that may reduce habitat quality to only 100 acres of each PAC.. The CSO Strategy and project specific forest plan amendment SPEC-CSO-STD-02 **allow** mechanical treatments to be applied to the entire 300-acre PAC as long as habitat quality is not reduced in greater than 100 acres. For SERAL 2.0 we have not pursued this opportunity based on collaborative engagement and in response to comments and objections received during the SERAL 1.0 planning process. The inclusion of the hard 100-acre mechanical thinning cap provides a conservative application of SPEC-CSO-STD-02 by allowing needed restoration treatments to be applied but lessening the burden to document and support whether a treatment reduces habitat quality or not.
20" DBH limit	Neither the current forest plan or the proposed project-specific forest plan amendments require a 20" DBH limit in CSO PACs. However, the project specific forest plan amendments do require that "all management activities must maintain or improve habitat quality in the highest-quality nesting and roosting habitat" (SPEC-CSO-STD-04). Currently areas classified as CWHR 5 M and D commonly represent the "highest-quality nesting and roosting habitat". CWHR 5 M and D areas are composed of trees greater than 24 " DBH in densities of 40-60% and greater than 60% respectively. The intent of including a DBH limit in this habitat type is to ensure the highest-quality habitat is maintained wherever it exists throughout the PAC. This could have been accomplished with a 24" DBH limit, but we recognized the importance of CWHR 4 M and D as well, particularly in areas where the 5 D and M may be lacking, so we dropped the DBH limit down to 20-inches to be more measurably conservative. Choosing to apply a conservative DBH limit, is intentional because SERAL 2.0 (like SERAL 1.0) is adopting new management approaches and conservation measures from the CSO Strategy. Although SERAL 1.0 is implementing, there is no post-treatment monitoring of habitat or occupancy yet available to assess the effectiveness of the constraints, or the impacts (beneficial or negative) of the treatments themselves. Therefore, the 20" DBH limit is included to account for uncertainty and to both **avoid and minimize treatments that may reduce habitat quality in the near term.** The broad assumption is that the 20" DBH limit results in a traditional thin from below prescription which maintains the CWHR 5D and 5M classifications (hence avoiding a treatment that reducing the habitat quality of the highest quality habitat), as well as maintains some proportion of additional CWHR 4D and 4M (hence minimizing treatments which may reduce habitat quality of the best or next available habitat).
Avoid mechanical treatments within a 10-acre area surrounding the nest site.	Prohibiting any mechanical treatments within 10-acres of a nest site ensures that **any treatment that may reduce habitat quality is avoided** in this most sensitive area**.**
CSO_depart > 0.5	The California spotted owl departure index (ForSys input dataset = "CSOdprtF3W") was created to identify areas in CSO PACs that represent areas most in need of treatment to restore more favorable conditions for CSO (e.g., large trees, multi-layered canopies) and **avoid or limit** treatment in areas that were preferential for retention. The intent is to focus any potential treatment in

Design Element	Purpose
	areas that are most departed from desired owl habitat conditions, while avoiding areas that meet highest-quality habitat standards (as defined by the CSO Strategy, USDA 2019).
Topographic Position	Large trees and higher canopy cover are naturally found within drainages and along NE-mid-slopes where conditions tend to be wetter and cooler. Topographic position was included as a weighted objective in the forest thinning treatment area selection process to preferentially select forest thinning units classified as SW mid-slopes and ridges before units along NE mid-slopes or within drainages. Doing so, prioritizes retention of connected areas along drainages and NE mid-slopes where they are more likely to persist during natural disturbances or under more stressful climate conditions.

Territories

The CSO strategy and SERAL 2.0 SPEC-CSO-DC-07 define the desired condition of a territory to promote sustainable and resilient owl territories:

> Maintain and promote 40 to 60 percent of each territory in mature tree size classes with moderate and high canopy cover for nesting, roosting, and foraging. Priority should be given to maintaining and promoting the highest quality before best available in descending order: 6, 5D, 5M, 4D, and 4M. **Those territories in more mesic conditions and at higher elevations within the watershed should contain relatively more of this habitat than those in drier conditions and at lower elevations**. The remainder of the territory consists of a diversity of many different structure and canopy classes (USDA 2019, p. 29; SERAL 2.0 Scoping Package Appendix C.02).

"More mesic conditions" are commonly found in drainages or on northeast facing slope positions. Conversely, ridges and southwest mid-slopes provide drier conditions. Vegetation types may also be indicative of moist and dry conditions. Moist vegetation includes, moist-mixed conifer and red fir, while dry vegetation includes yellow pine and dry-mixed conifer. Every CSO territory in the SERAL 2.0 project contains some mesic and dry slope-positions as well as moist and dry vegetation. No territories contain a single vegetation type or slope-position. The CSO territory desired condition assessment for SERAL 2.0 considered the heterogeneity of each territory when determining whether each territory contains the desired proportion of CWHR 4D/4M/5D/5M as defined in SPEC-CSO-DC-07. Doing so avoids over generalizing the existing conditions and allows a broader variety of and more affective management options to restore landscape resilience and meet the purpose and need of the project. Results of the SERAL 2.0 CSO territory desired condition assessment are summarized in Table B.02-4.

Based on estimated existing conditions, only two of the territories located entirely in the project area fail to meet the desired condition (Table B.02-4). These territories (TUO0146 and TUO0061) contain very little 4D/4M/5D/5M and little to no 5D/5M (Table B.02-4). One of the territories is located in a high-severity burn area with no birds recently detected. The other has small clusters of large dense trees with occupancy recently detected. Because quality habitat is significantly lacking in these territories, restoration treatments have been limited to mastication, machine piling and burning, or prescribed fire to reduce or rearrange fuels. This suite of treatment types do not typically cause a change in the overstory composition (or CWHR classification) of a stand. Thus, limiting the treatments to only mastication, machine piling and burning or prescribed fire, will ensure the habitat quality in the highest quality nesting and roosting habitat will be retained wherever it exists throughout these territories not meeting the desired condition (SPEC-CSO-STD-08).

All of the remaining CSO territories meet or exceed the CSO territory desired condition and therefore, more management options are available than in territories not meeting the desired condition. Each

territory's existing condition was considered prior to conducting the treatment area selection process (Table B.02-4, see "Treatment Area Selection and Post-Treatment Considerations")

The most common consideration for CSO territories outside of PACs is "where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those areas located in more mesic conditions (drainages or northeast mid-slopes)." The intent is that areas with lower CWHR classifications and those located along ridges or on southwest mid-slopes would be selected before areas classified as CWHR 5D/5M or in drainages or on northeast mid-slopes. Where possible, this prioritization scheme focuses treatments in areas with smaller dense trees located in drier conditions less likely to support larger more dense stands of trees.

However, it is not possible to apply this prioritization scheme everywhere in the project area for two reasons; (1) the acres of FS lands that are available for treatment are significantly limited; and (2) the landscape scale restoration needs based on the NRV assessment indicate a shift in CWHR classification in both 5D/5M and 4D/4M areas are needed in order to restore landscape resiliency.

The CSO Strategy (USDA 2019, Approach 1, Territory/Watershed 2. C1, C2, and C3) and SERAL 2.0 SPEC-CSO-STD-05 (Appendix C.02) provides direction on how to increase resiliency while promoting the development of future nest sites within CSO territories.

> To increase resiliency and promote the development of future nest sites within CSO territories, vegetation treatments should be designed to:
>
> • minimize the loss of and to promote the growth and recruitment of trees greater than 24 inches DBH and especially large and very large trees greater than 30 inches DBH and 36 inches DBH, respectively.
> • retain clumps or patches of large/tall trees (greater than 24 inches DBH and 100 feet tall, and especially trees greater than 30 inches DBH and 150 feet tall, with canopy cover greater than 60 to 70 percent.
> • retain connected areas of moderate (at least 40 percent) and high canopy cover (at least 60 percent) in large/tall trees to promote habitat connectivity at the watershed scale.

As such, the proposed action was developed to include multiple CSO territory treatment constraints and treatment area selection criteria, which were designed to apply SPEC-CSO-STD-05's direction (Table B.02-3).

Table B.02-3. California spotted owl territory constraints and treatment area selection criteria.

Design Element	Purpose
24" DBH limit (shade-tolerant) and 30" DBH limit (shade-intolerant)	CWHR 5M and 5D is considered the highest quality CSO habitat. CWHR 5 M and D areas are composed of trees greater than 24-inch DBH with canopy cover of 40-60% and greater than 60%, respectively. The intent of including DBH limits is to ensure **the proposed treatment minimize the loss of and to promote the growth and recruitment of trees greater than 24-inches DBH and especially those greater than 30-inch DBH.** The inclusion of these DBH limits also help to retain clumps or patches of large/tall trees.
Topographic Position	Large trees and higher canopy cover are naturally found within drainages and along NE-mid-slopes where conditions tend to be wetter and cooler. Topographic position was included as a weighted objective in the forest thinning treatment area selection process to preferentially select forest thinning units classified as SW mid-slopes and ridges before units along NE mid-slopes or within drainages, where possible. Doing so, prioritizes retention of connected areas along drainages and NE mid-slopes where they are more likely to persist during natural disturbances or under more stressful climate conditions.
Avoid forest thinning	Because quality habitat is significantly lacking in territory TUO0146 and TUO0061 (Table B.02-4) restoration treatments were limited to mastication, machine piling and burning, or

Design Element	Purpose
	prescribed fire to reduce or rearrange fuels. This suite of treatment types do not typically cause a change in the overstory composition (or CWHR classification) of a stand. Thus, limiting the treatments to only mastication, machine piling and burning or prescribed fire will ensure the habitat quality will be retained wherever it exists throughout these two territories.

Post-treatment modeled estimates, applying the criteria described in Table B.02-3 above, were used to assess whether the CSO territory desired condition will be maintained post-treatment. Where post treatment estimates indicated the desired proportion of 4D/4M/5D/5M would no longer be met, additional treatment adjustments were considered (Table B.02-4). In general, the post-treatment modeled estimates indicate that the proposed CSO PAC and territory prescriptions are very effective at maintaining the appropriate proportion of CWHR 4D/4M/5D/5M (Table B.02-4 - see column "Treatment Area Selection and Post-Treatment Considerations".

CSO Territory Overlap with Private Property

The Forest Service does not manage private lands and therefore, does not have jurisdictional control to ensure the persistence of existing CSO habitat. Some territories overlap with private property, but the amount of overlap varies. An assessment of the amount of overlap, the type of vegetation and the quality of the habitat located on private land within each CSO territory was completed (Table B.02-5). Most of the private land in the project area is owned by Sierra Pacific Industries (SPI). SPI land is more likely than other private land owners to cut and remove trees. To simulate the largest potential loss of habitat, we assumed that all of the SPI land in the CSO territories will be clear-cut when determining whether each territory meets the territory desired condition before and after the SERAL 2.0 proposed treatments are implemented (Table B.02-5). Based on this assessment, additional considerations or treatment adjustments were made to best ensure the territory desired condition is maintained (Table B.02-5).

Table B.02-4. Territory desired condition assessment for each individual CSO territory occurring within SERAL 2.0 project area.

No.	ID	Total Acres	% Moist Veg	% Mesic Condition	Avg. Elevation	% 5D/5M	% 5D/5M in PAC	% 4D/4M	% 4D/4M/ 5D/5M	DC?	Notes	Treatment Area Selection and Post-Treatment Considerations
1	CAL0045 - NF Stanislaus	210	0	57	2699	0	0	0	0	NA	Very low elevation, mostly outside of project area. No 4D/4M/5D/5M in portion in project area.	Treatment option = fuel reduction and Rx Fire
2	TUO0006 Strawberry	291	8	58	5461	7	0	70	77	NA	Only 291 acres in project area (the PAC is outside project area). The majority of the 4D/4M/5D/5M is classified as 'dry' vegetation but small majority of the territory occurs in more mesic slope/aspects positions at moderate elevation. Therefore, this territory should contain relatively more CWHR 4D/4M/5D/5M than territories in drier conditions and lower elevations.	Where possible, prioritize the retention of 5D/5M in areas with more mesic slope/aspect positions. This may be accomplished by assigning treatment areas located in drier conditions a higher priority for selection. ***Post treatment estimates for these 291 acres specifically indicate that the % 5M/5D will increase but the % 4D/4M will decrease.*
3	TUO0007 Sheering Creek	1000	68	53	6384	0	0	76	76	Yes	High elevation territory. Mostly moist vegetation but almost equally containing drier and more mesic conditions. No 5D/5M but a high proportion of the territory is composed of 4D/4M. DC is exceeded.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. *** Post treatment 4D/4M is maintained above 50%*
4	TUO0018 Bumblebee	14	5	44	6231	100	0	0	100	NA	This territory only has 14 acres within the project area. PAC outside of project area.	NA
5	TUO0035 - Hull Crk	999	16	42	5688	24	16	52	76	Yes	Higher elevation territory, with very little moist vegetation and moderate majority in drier conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. However, because the DC of the territory is being met, the retention of 5D/5M is **not** required as long as the treatments maintain the overall DC of the territory. Post-treatment modeled estimates should be used to assess whether the treatments will retain the DC. ***Post treatment estimates indicate that the %5M/5D will increase. %4D/4M will lower but combined, the %5D/5M/4D/4M remains above 60%.*
6	TUO0036 - Griswold Crk South	994	0	66	3779	0	0	83	83	Yes	Lower elevation territory with no moist vegetation but the majority in more mesic conditions. No 5D/5M, but a lot of 4D/4M. DC is exceeded. However, over 80% of the territory is on SPI land. Most of the PAC is on private lands.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***There will be no change to the proportion of 4D/4M post-treatment because there isn't much forest thinning proposed; some in PACs with restrictive prescription; and the treatment applied to the other areas of the territory outside of the PAC only change from 4D to 4M. Therefore, no additional modifications to prescriptions to account for the large overlap with SPI lands are needed.*
7	TUO0037 Dry Meadows	127	90	90	5651	0	0	82	82	NA	Only 127 acres in the project area. Those areas are located in mesic conditions and are classified as moist vegetation. There is no 5D/5M but a lot of 4M/4D. The DC is exceeded. PAC outside of project area.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***Post Treatment estimates indicate there will be no change to the proportion of 4D/4M in this territory.*
8	TUO0053 - Brushy Crk	1000	5	38	5366	63	28	28	91	Yes	Higher elevation territory with more areas located in drier conditions and predominately composed of dry vegetation. This territory far exceeds the desired condition of a drier territory, even in the areas classified as 5D/5M. This territory contains relatively more 5D/5M than most other territories in the project area.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 90%.*
9	TUO0054 - Thompson Peak	771	1	67	4420	23	21	59	82	Yes	Lower elevation territory, with relatively large amount of moist conditions, but almost no moist vegetation. The DC is met	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%.*
10	TUO0057 - NF Tuolumne	1000	0	61	4787	3	2	84	87	Yes	Moderate elevation territory. A low majority of the territory is located in mesic conditions with no moist vegetation. 5D/5M is lacking in this territory, but there is a high proportion of 4D/4M. DC is exceeded for a territory in more mesic conditions.	Treatments that retain the small amount of 5D/5M while focusing on the high proportion of 4D/4M. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 70%.*
11	TUO0059 - L 13 MIle Crk	1000	18	58	4470	44	25	39	83	Yes	Lower elevation territory, with more moist conditions than dry but not a strong majority. This territory contains more 5D/5M than most other territories in the project area and proportion of 5D/5M/4D/4M exceeds the desired condition of a territory in more mesic conditions.	This territory may be susceptible to more harsh conditions because it is at a lower elevation with almost equal moist and dry conditions. Due to the high proportion of 4D/4M and 5D/%M there are management flexibilities available in this territory. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60%.*
12	**TUO0061 - D51 Bear Spring Crk**	**1000**	**0**	**32**	**4272**	**1**	**0**	**15**	**16**	**No**	**Territory has small clusters of large trees. Occupied in 2023. CWHR 5D/5M must be retained wherever it exists.**	**Limit treatments in this territory to mastication / Rx fire only. Mask this territory from forest thinning selection.**
13	TUO0062 - Trout Crk	778	61	62	5694	8	2	79	87	Yes	Moderate elevation territory. A low majority of the territory is located in mesic conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 70%.*
14	TUO0063 - Jonnie Gulch	768	0	67	3649	0	0	85	85	Yes	Lower elevation territory with more mesic conditions than dry, but no moist vegetation. This territory does not contain any 5D/5M, but greater than 80% is comprised of 4D/4M. 147 acres of PAC outside project area, no 5D/5M in PAC in project area.	This territory may be susceptible to more harsh conditions because it is at a lower elevation with such a high proportion of intermediate sized trees in high densities. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 80% due to PAC constraints, DBH limits for PACs and Territories.*
15	TUO0068 - Mount Lewis	1000	0	43	4973	1	1	94	95	Yes	Moderate elevation territory with more dry conditions and zero moist vegetation. Little 5D/5M but far exceeding the DC. Very high proportion of the territory contains 4D/4M.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. All of the 5D/5M is located within the PAC and is already being maintained via PAC treatment restrictions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%.*
16	TUO0069 - D51 Basin Crk	1000	1	65	3438	2	2	80	83	Yes	Low elevation territory with very little moist vegetation. A moderate majority of the territory exists in more mesic conditions. Very little 5D/5M, but a lot of smaller dense trees. All of the 5D/5M is located in moist conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%.*
17	TUO0070 - Herring Cr	1000	67	32	6981	14	10	38	52	Yes	This is a fairly high elevation territory, with mostly dry conditions but a high proportion of vegetation classified as moist mixed conifer / fir. Because this territory is located at a higher elevation with a moderate amount of moist veg, it is desirable for it to contain relatively more 5D/5M/4D/4M than territories at lower elevations and in drier conditions. The moist slope/aspect positions are lacking in this territory, but because it is at higher elevation it is more likely to be able to sustain larger trees at higher densities.	The proportion of 4D/4M/5D/5M should remain above 50% in this territory. Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 50%.*
18	TUO0101 - McKee Hill	1000	61	58	5722	1	0	75	76	Yes	Higher elevation territory with more moist conditions than dry but not a strong majority. Very low amount of 5D/5M but nonetheless, the DC is exceeded.	Should aim to maintain the proportion of 5D/5M/4D/4M above 50-60% of the territory. Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60%.*
19	TUO0117 Strawberry North	118	42	65	5857	5	5	93	98	NA	Only 118 acres in the project area. Areas are located in mostly mesic conditions. More 4D/4M than 5D/5M. High elevation.	
20	TUO0121 Sand Bar Flat	115	41	28	4533	16	0	63	80	Yes	Only 115 acres in the project area. Areas are located in mostly dry conditions. Almost half of the acres are classified as 5D/5M. PAC outside of project area	There is no forest thinning proposed in this territory.
21	TUO0126 - Merrill Spring	1000	0	58	4934	1	0	79	80	Yes	Moderate elevation territory with a low majority existing in more mesic conditions. Very little 5D/5M. DC is exceeded.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 55%.*
22	TUO0128 - L Trout Crk	987	44	58	5577	12	0	71	82	Yes	Moderate elevation territory. A low majority of the territory is located in mesic conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 80%.*
23	TUO0129 - U 2 Mile Crk	1000	35	38	5815	15	9	58	73	Yes	High elevation territory, mostly in drier conditions with dry vegetation. DC threshold is exceeded.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 65%.*

No.	ID	Total Acres	% Moist Veg	% Mesic Condition	Avg. Elevation	% 5D/5M	% 5D/5M in PAC	% 4D/4M	% 4D/4M/ 5D/5M	DC?	Notes	Treatment Area Selection and Post-Treatment Considerations
24	TUO0130 - Camp Clavey	373	41	78	5420	24	23	34	58	NA	Only 373 acres in the project area. Higher elevation territory, with a high proportion in moist conditions in the portion within the project area. Most all of the 5D/5M is located within the PAC.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions.
25	**TUO0132-Hull Crk Camp**	**1000**	**5**	**58**	**5842**	**30**	**18**	**45**	**75**	**Yes**	**High elevation territory, low majority in moist conditions, but there is very little moist vegetation. With only an only slight majority of the area containing mesic conditions and predominantly dry vegetation this territory doesn't clearly classify as moist or dry. Either way, the DC is exceeded.**	**Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions ***Post treatment indicate that the %5D and % 5M will be maintained, but the %4D/4M will be reduced to 12%. Total % of 4M/4D/5M/5D will remain above 40% (at 44%). A portion of the forest thinning treatments are located within the WUI and fuelbreaks – the SPEC-CSO-STD-08 exception area.***
26	TUO0133 - High Sierra N	1000	38	45	5738	14	6	68	82	Yes	High elevation territory, almost equal dry and mesic conditions, and moderate amount of moist vegetation.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. **Post-treatment estimates indicate that the % 5D/5M will increase but the %4D/4M will be sharply reduced. Despite this sharp reduction, the proportion of 4D/4M/5D/5M will remain above 40% (at 48%). Since this territory has a slight majority in more dry conditions, retaining 48% of the territory in 4D/4M/5D/5M meets the desired condition.*
27	TUO0141 - N Marble Mtn	1000	0	27	4992	8	2	84	92	Yes	Moderate elevation territory in mostly dry conditions and no moist vegetation. Very little 5D/5M, but the DC is far exceeded for a territory in more dry conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 70%.*
28	TUO0142 - Marble Mtn S	1000	0	28	3831	0	0	70	70	Yes	This is a very low elevation territory, with very little 5D/5M, no vegetation classified as moist, and very little area occurring in mesic conditions. For these reasons this territory far exceeds the desired condition for territories in 'drier conditions'. However approx. 51% of the Territory is on SPI lands.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. Conduct secondary post-treatment DC assessment considering the SPI lands. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 65% and even if all SPI lands are clear-cut the proportion of 4M/4D5M/5D will still be retained above 40%.*
29	**TUO0146 - Hunter Crk**	**1000**	**0**	**50**	**4378**	**0**	**0**	**10**	**10**	**No**	**Territory located in a high-severity burn area with no birds recently detected. Treatments in this territory should be limited to mastication / Rx fire only.**	**Mask this territory from forest thinning selection. Territory may be the only candidate for retirement due to lack of occupancy and poor habitat quality.**
30	TUO0148 - U 13 Mile Crk	1000	29	72	4741	53	32	20	74	Yes	This is a low elevation territory, with more 5D/5M than 4D/4M, and mostly mesic conditions. The territory meets the DC to contain relatively more 4D/4M/5M/5D than territories in drier conditions. Compared to other territories in the area, this territory contains a high proportion of 5D/5M.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60% and %5M/5D is maintained.*
31	TUO0149 - Cottonwood Crk	1000	0	25	5203	21	12	51	72	Yes	Moderate elevation territory, with a low proportion of mesic conditions and no moist vegetation. This territory is dominated by dry vegetation and dry conditions. Therefore, the DC is far exceeded.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***Post treatment estimates indicate that the DC will be maintained above 40%.*
32	TUO0151 - L Cottonwood Creek	996	8	56	4257	17	14	30	47	Yes	Territory has large gaps with solid stringers of good habitat. Occupied in 2023. Slightly more mesic conditions than dry. Desired Condition is met but not to convincingly.	Consider limiting treatments in this territory to mastication / Rx fire only. Mask this territory from forest thinning selection. ***Post treatment modeled estimates indicate all 5D/5M will be maintained with an only less than 2% reduction in 4D/4M.*
33	TUO0156 - High Sierra S	1000	7	49	5322	10	2	81	91	Yes	Moderate elevation territory with more dry conditions and very little moist vegetation. DC is exceeded.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized.
34	TUO0157 South Bald Mtn	719	0	53	5314	7	0	74	81	Yes	Moderate elevation territory with a low majority existing in more mesic conditions. Contains little 5D/5M, but a lot of 4D/4M. DC is exceeded.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 70%.*
35	TUO0160 Brushy Hollow	65	57	24	5893	0	0	100	100	NA	With only 65 acres in project area the DC assessment isn't valid. PAC outside of project area.	No treatment restrictions.
36	TUO0163 Rushing Meadow	48	0	59	4537	8	0	73	81	NA	With only 48 acres in project area the DC assessment isn't valid. PAC outside of project area.	No treatment restrictions.
37	TUO0164 - Dodge Ridge	1000	4	48	5581	55	14	29	83	Yes	High elevation territory, with more dry conditions and very little moist vegetation. Large proportion of the territory is 5D/5M and the DC for territory in drier condition is exceeded.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 65%. %5D/5M is increased slightly.*
38	**TUO0165 - Fahey Cabin**	**1000**	**0**	**35**	**5499**	**6**	**2**	**76**	**82**	**Yes**	**High elevation territory with more dry conditions and very little 5D/5M, but far exceeding the DC.**	**Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ** *Post treatment modeled estimates indicate that the proportion of 4D/4M/5D/5M may drop <u>slightly</u> below 40%. The majority of this territory is located within the SPEC-CSO-STD-08 exception area (Map 4; WUI and fuelbreak). The proposed treatments in this territory include forest thinning within and outside of fuelbreaks.***
39	TUO0172 Fraser Flat	58	0	0	5263	0	0	65	65	NA	Moderate elevation, very little acres in project area.	No treatment restrictions.
40	TUO0180 - Sheering West	1000	51	67	6167	2	0	82	84	Yes	High elevation territory in mostly mesic conditions. DC is met.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 80%.*
41	TUO0181 - Lily Lake	981	77	33	6649	5	1	58	63	Yes	High elevation territory, situated in mostly drier conditions but predominately moist vegetation. The combination of dry conditions, but moist vegetation doesn't clearly classify this territory as either dry or more mesic.	Where possible, prioritize retention of areas classified as CWHR 5D/5M and particularly those in areas located in more mesic slope/aspect positions. Aiming to maintain at least 50% of the territory in CWHR 4D/4M/5D/5M so that it contains relatively more than in a more obviously dry territory is warranted. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60%*
42	TUO0187 - Thompson Meadow	1000	6	63	4694	48	27	38	86	Yes	Moderate elevation territory. A low majority of the territory is located in mesic conditions. Compared to other territories in the project area, this territory contains a higher proportion of 5D/5M. This territory exceeds the desired condition for a territory in more mesic conditions.	Retain 50-60% of territory in CHWR 5D/5M/4D/4M post-treatment. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%*
43	**TUO0189 Stanislaus Tunnel**	**61**	**0**	**66**	**2175**	**0**	**0**	**0**	**0**	**NA**	**Very low elevation, mostly outside of project area. No 4D/4M/5D/5M in portion in project area.**	**Treatment option = fuel reduction and Rx Fire**
44	TUO0204 - McCormick Meadow	999	0	55	3803	0	0	77	77	Yes	There is no CWHR 5D/5M in this territory and the territory has a slight majority occurring in more mesic conditions, however, there is no forested vegetation classified as "moist". Nonetheless, the territory exceeds the desired condition for territories in more mesic conditions.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 65%*
45	TUO0210 - Buchanan	1000	0	53	2942	0	0	64	64	Yes	There is no CWHR 5D/5M in this territory but the desired condition threshold for territories in 'drier conditions' is exceeded. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes is warranted.	This territory is a high priority for treatment to promote the growth of larger trees. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60%*
46	TUO0213 - Griswold Cr N	1000	30	55	4690	0	0	84	84	Yes	Moderate elevation territory with almost equal dry and moist conditions and predominately dry vegetation. This territory far exceeds the desired condition of a territory. **Most of PAC outside project area, and most of territory occurs on private lands (>95% SPI). Small NFS parcel located within the SPI lands.	Remapping this territory was not possible because less than 100 acres of territory are on NFS lands which are completely landlocked by the SPI lands. The NFS are an island inside SPI lands. **No forest thinning has been proposed on the NFS lands.**
47	TUO0214 - Camp Ida	1000	0	46	5280	40	14	52	91	Yes	Higher elevation territory with more areas located in drier conditions and predominately composed of dry vegetation. This territory exceeds the desired condition of a drier territory.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%*
48	TUO0215 - Upper Skull Cr	1000	52	47	5496	1	1	78	79	Yes	High elevation territory, almost equal dry and mesic conditions. Almost half the territory classified as moist vegetation. DC exceeded.	**Post treatment modeled estimates indicate that the proportion of 4D/4M/5M/5D will be maintained above 70%. There is overlap with SPI lands but if all SPI lands are clearcut, the proportion of 4M/4D/5M/5D will still be maintained above 43%.

No.	ID	Total Acres	% Moist Veg	% Mesic Condition	Avg. Elevation	% 5D/5M	% 5D/5M in PAC	% 4D/4M	% 4D/4M/ 5D/5M	DC?	Notes	Treatment Area Selection and Post-Treatment Considerations
49	TUO0253 - Bell Meadow	904	80	34	6681	2	2	52	55	Yes	The majority of this higher elevation territory occurs in drier slope/aspect positions, although most of the forested vegetation is classified as moist. Nonetheless, this territory exceeds the desired condition for territories in 'drier conditions'.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. This may be accomplished by assigning treatment areas located in drier conditions and smaller trees as a higher priority for selection. However, because the DC of the territory is being met, the retention of 5D/5M is **not** required as long as the treatments maintain the overall DC of the territory. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained (and even slightly increased post treatment).*
50	TUO0239 Fisher Cr	656	81	37	5534	2	2	93	95	Yes	Moderate elevation territory with more dry conditions but mostly moist vegetation. DC is exceeded.	More flexibility in this territory for treatment. Encourage more acres be treated in this territory that others. Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 55%.*
51	TUO0241	1000	46	57	5067	2	0	67	69	Yes	Moderate elevation territory with a slight majority situated in mesic conditions. Very little 5D/5M. The desired range of the territory containing 4D/4M/5D/5M is exceeded.	A significant portion of this territory occurs on private SPI lands. The Forest Service does not have jurisdiction over the management of those lands. Therefore to account for the probability of much of the forested area to be clear cut, no forest thinning is proposed in this territory.
52	TUO0245	1000	64	52	5786	0	0	74	74	Yes	Moderate elevation territory, equally containing moist and dry conditions. With 74% of the territory containing 4D/4M the desired range is exceeded.	A significant portion of this territory occurs on private SPI lands. The Forest Service does not have jurisdiction over the management of those lands. Therefore to account for the probability of much of the forested area to be clear cut, no forest thinning is proposed in this territory.
53	TUO0255 - Box Spring	998	3	43	4717	23	21	47	70	Yes	Moderate elevation territory, with more dry conditions than moist, and very little moist vegetation. There is less 5D/5M than 4D/4M but combined the DC is far exceeded for a territory in drier conditions.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 60%.*
54	TUO0257 - Westside E	1000	21	22	5372	47	19	34	81	Yes	Higher elevation territory with mostly dry conditions and dry vegetation. DC is exceeded. Higher proportion of 5D/5M than most other territories in the project area. Not much of the 5D/5M is found in moist conditions.	Where possible prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 75%. %5M/5D increases slightly.*
55	TUO0258 - Westside W	1000	8	28	4828	22	12	38	60	Yes	Lower elevation territory, with mostly dry vegetation and conditions. This territory exceeds the desired condition for territories in 'drier conditions' and at lower elevations.	Where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. This may be accomplished by assigning treatment areas located in drier conditions a higher priority for selection. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 50%. %5M/5D increases slightly.*
56	TUO0260 - Lily Creek	1000	0	53	5531	11	7	63	74	Yes	Higher elevation territory, with slightly more moist conditions than dry, but zero moist vegetation. This territory has less 5D/5M than 4D/4M and far exceeds the desired condition for a territory in drier conditions as well as those in more mesic conditions.	Considering the lack of moist vegetation and almost equal availability of moist and dry conditions, where possible, prioritize retention of areas classified as CWHR 5D/5M, and particularly those in areas located in more mesic slope/aspect positions. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 50%. %5M/5D increases slightly.*
57	TUO0261 - U Camp 25	1000	40	26	5678	29	15	43	72	Yes	Higher elevation territory, little moist conditions. DC is exceeded. More management flexibilities available in this drier condition territory.	This territory is susceptible to harsher conditions due to the large proportion in dry conditions. Treatments prioritized in this territory would help to alleviate stand stressors, including reducing densities and canopy cover. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 65%.*
58	TUO0304 Game Refuge	162	63	8	6340	0	0	65	65	Yes	High elevation territory, mostly moist vegetation and dry conditions. No 5D/5M, but a large majority of the territory contains 4D/4M. PAC outside of project area.	Treatments to reduce the densities of the CWHR 4D/4M to increase the health and resiliency of the stands and to promote growth into larger size classes should be prioritized. Also, prioritize the retention of CWHR 4D/4M units located in more mesic slope/aspect positions. ***Post-treatment modeled estimates indicate the proportion of 4M/4D/5M/5D will be maintained above 50%.*

Table B.02-5. Territory desired condition assessment for territories which include private property.

Territory ID	Total Acres	% Private	% of Private = SPI	% 4D/4M Private	% 4D/4M SPI	% 4D/4M NFS	% 5D/5M Private	% 5D/5M SPI	% 5D/5M NFS	% 4D/4M/ 5D/5M Private	% 4D/4M/ 5D/5M NFS	% 4D/4M/ 5D/5M All Lands	% 4D/4M/ 5D/5M With SPI Clearcut	% 4D/4M/ 5D/5M With SPI Clearcut: Post-Treatment	DC NFS ?	DC All Lands?	DC SPI clear cut?	DC SPI clear cut: Post-Treatment?	Tx Adjust?	Additional Considerations
TUO0035 - Hull Crk	999	5	0	5	0	47	0	0	24	5	71	76	76	**60**	Y	Y	Y	Y	N	
TUO0036 - Griswold Crk South	994	81	99	76	75	7	0	0	0	76	7	83	8	8	N	Y	N	N	N	Greater than 80% overlap with private SPI lands. Based on post treatment modeled estimates of the proposed action there will be no change to the proportion of 4D/4M post-treatment because there isn't much forest thinning proposed; some in PACs with restrictive prescription; and the treatment applied to the other areas of the territory outside of the PAC only change from 4D to 4M. Therefore, no additional modifications to prescriptions to account for the large overlap with SPI lands are needed.
TUO0054 - Thompson Peak	771	10	0	2	0	57	0	0	23	2	80	82	82	80	Y	Y	Y	Y	N	
TUO0057 - NF Tuolumne	1000	6	0	5	0	79	0	0	3	5	82	87	87	72	Y	Y	Y	Y	N	
TUO0061 - D51 Bear Spring Crk	1000	29	77	4	4	12	0	0	1	4	12	16	12	12	N	N	N	N	Y	No Timber Harvest
TUO0063 - Jonnie Gulch	768	19	0	18	0	67	0	0	0	18	67	85	85	84	Y	Y	Y	Y	N	
TUO0069 - D51 Basin Crk	1000	36	93	22	20	58	0	0	2	22	61	83	63	59	Y	Y	Y	Y	N	
TUO0126 - Merrill Spring	1000	20	0	17	0	62	0	0	1	17	62	80	80	59	Y	Y	Y	Y	N	
TUO0142 - Marble Mtn S	1000	52	100	22	22	48	0	0	0	22	48	70	48	44	Y	Y	Y	Y	N	
TUO0146 - Hunter Crk	1000	35	99	6	6	4	0	0	0	6	4	10	4	4	N	N	N	N	Y	No Timber Harvest
TUO0148 - U 13 Mile Crk	1000	4	100	1	1	19	2	2	52	3	71	74	71	63	Y	Y	Y	Y	N	
TUO0156 - High Sierra S	1000	12	0	8	0	74	3	0	7	11	80	91	91	66	Y	Y	Y	Y	N	
TUO0157 South Bald Mtn	719	49	0	40	0	34	7	0	0	47	34	81	81	73	N	Y	Y	Y	N	
TUO0163 Rushing Meadow	48	61	0	38	0	35	8	0	0	46	35	81	81	49	N	Y	Y	Y	N	
TUO0164 - Dodge Ridge	1000	57	0	6	0	22	48	0	7	54	29	83	83	68	N	Y	Y	Y	N	
TUO0172 Fraser Flat	58	79	0	65	0	0	0	0	0	65	0	65	65	65	N	Y	Y	Y	N	
TUO0187 - Thompson Meadow	1000	29	57	18	6	20	0	0	48	18	67	86	80	70	Y	Y	Y	Y	N	
TUO0204 - McCormick Meadow	999	35	99	35	35	42	0	0	0	35	42	77	42	34	Y	Y	Y	N	Y	The nest stand is located on private property with a very small NFS lands parcel completely surrounded by private SPI lands. Territory is also located in the SPEC-CSO-STD-08 exception area. Very small amount of forest thinning proposed within this territory. Consider dropping these acres from the proposed action prior to analysis or within the decision.
TUO0210 - Buchanan	1000	25	33	9	3	55	0	0	0	9	55	64	60	59	Y	Y	Y	Y	N	
TUO0213 - Griswold Cr N	1000	96	100	80	80	4	0	0	0	80	4	84	4	4	N	Y	N	N	Y	Most of the PAC is outside project area because the nest is on SPI lands, and most of the territory occurs on private lands (>95% SPI). There is only a small isolated NFS parcel located within the SPI lands. No additional NFS lands to remap to. No forest thinning has been proposed within this small parcel.
TUO0214 - Camp Ida	1000	37	0	16	0	35	19	0	21	35	56	91	91	78	Y	Y	Y	Y	N	
TUO0215 - Upper Skull Cr	1000	38	99	27	27	51	0	0	1	27	52	79	52	44	Y	Y	Y	Y	N	
TUO241	1000	78	100	47	47	20	0	0	2	47	22	69	22	22	Y	Y	N	N	Y	To account for the overlap with SPI lands, all previously proposed forest thinning in this territory and associated PAC have been converted to fuel reduction treatment only.
TUO245	1000	67	100	47	47	27	0	0	0	47	27	74	27	25	Y	Y	N	N	Y	To account for the overlap with SPI lands, all previously proposed forest thinning in this territory and associated PAC have been converted to fuel reduction treatment only.
TUO0255 - Box Spring	998	10	0	2	0	44	0	0	23	2	67	70	70	67	Y	Y	Y	Y	N	
TUO0258 - Westside W	1000	9	0	0	0	37	0	0	22	0	59	60	60	51	Y	Y	Y	Y	N	

Territory ID	Total Acres	% Private	% of Private = SPI	% 4D/4M Private	% 4D/4M SPI	% 4D/4M NFS	% 5D/5M Private	% 5D/5M SPI	% 5D/5M NFS	% 4D/4M/ 5D/5M Private	% 4D/4M/ 5D/5M NFS	% 4D/4M/ 5D/5M All Lands	% 4D/4M/ 5D/5M With SPI Clearcut	% 4D/4M/ 5D/5M With SPI Clearcut: Post-Treatment	DC NFS ?	DC All Lands?	DC SPI clear cut?	DC SPI clear cut: Post-Treatment?	Tx Adjust?	Additional Considerations
TUO0260 - Lily Creek	1000	15	0	8	0	55	2	0	9	10	65	74	74	50	Y	Y	Y	Y	N	

APPENDIX C: PROJECT-SPECIFIC FOREST PLAN AMENDMENTS

C.01 Terminology Used in Proposed Forest Plan Amendments

Below we provide definitions for some of the common terminology used throughout the CSO Strategy and within the proposed project-specific forest plan amendments.

Large Trees are defined as those equal or greater than 30 inches diameter at breast height.

Very Large Trees are defined as those equal or greater than 36 inches diameter at breast height.

Gaps are defined as forest openings created by mechanical treatments with less than 10 percent tree cover, in various shapes and intermixed with groups of trees.

Small gaps are less than 0.25 acres in size, and

Medium gaps range between 0.25 and 1.25 acres.

Highest quality nesting and roosting habitat for California spotted owl contain the following structural (size, canopy cover, snag, and down woody material) characteristics:

a. Stands classified as CWHR 6, 5D, 5M;

b. Trees in the dominant and co-dominant crown classes averaging 24 inches DBH or greater. Large and tall trees, those greater than 30 inches DBH and/or 150 feet have been shown to be a critical owl habitat characteristic (Jones et al. 2021).

c. Average canopy cover greater than 60 percent (range 40 to greater than 70 percent).

d. Two or more tree canopy layers; and

e. Snags greater than 45 inches in diameter

f. Snags and down woody material levels higher than average.

Best-available nesting and roosting habitat for California spotted owl contain the following structural (size, canopy cover, snag, and down woody material) characteristics: Components a and b are the most critical characteristics:

g. Stands classified as CWHR 4D or 4M with very large remnant trees;

h. Average canopy cover ranging from 40 to 60%, including hardwoods;

i. Two or more tree canopy layers; and

j. Snags greater than 45 inches in diameter and other smaller snags;

k. Snags and down woody material levels in the moderate to high end of average.

Management activities that maintain the structural characteristics of highest-quality habitat while protecting it from risk of loss from high severity wildfire and other natural disturbances, may require trade-offs. This may require balancing the retention of highest-quality habitat with necessary treatments to increase resiliency which may cause short-term decreases in habitat quality. To minimize near-term effects of resiliency treatments, such treatments should be implemented only when needed (e.g., where landscape is vulnerable to natural disturbance and loss of habitat) and should be designed to maintain the most important habitat components, such as areas of high canopy cover (more than 55 percent) in large/tall trees within PACs (USDA 2019, p. 25).

When assessing the trade-offs, management activities should strive to maintain or improve the structural characteristics of the highest-quality CSO nesting and roosting habitat. To do so would:

a. Maintain existing proportion of highest-quality habitat (one example may be to retain the CWHR classifications in areas identified as highest-quality habitat);

b. Maintain clumps of the largest available trees greater than 24 inches DBH; and

c. Maintain at least two canopy layers at the stand/patch scale in areas where large trees occur.

It is important to note that maintaining or improving CSO habitat is complex and requires a multi-faceted evaluation. It is imperative to avoid putting an over-emphasis or narrow focus on structural habitat characteristics and failing to consider that areas containing these desirable structural owl habitat characteristics may contain other characteristics that put them at high-risk from natural disturbances such as insect-, disease-, drought-, and high severity wildfires (e.g., high SDIs; accumulated surface and ladder fuels, and too few shade-intolerant and fire-tolerant trees).

It is well documented that a forest, PAC, or Territory containing the large trees and high canopy cover (structural characteristics of the highest-quality and best-available habitat), can also be overly dense, lack forest openings, contain lush understory vegetation which act as ladder fuels, and experience the same climate related stressors (lack of precipitation, warmer temperatures, higher winds) as the rest of the landscape across the Sierra Nevada. To fail to comprehensively evaluate all of the habitat characteristics when assessing habitat quality will affect a projects effectiveness. In order to promote resilient habitat conditions, which will provide long-term CSO habitat, the landscape must be moved into closer alignment with NRV. Managing the landscape toward NRV is a central tenet of the CSO Strategy. The proposed project-specific forest plan amendments are designed to adopt the conservation measures aimed at maintaining the CSO and their habitat while designing and implementing treatments aimed at restoring the landscape into closer alignment with NRV.

C.02 Proposed Project-Specific Forest Plan Amendments

Each project-specific forest plan amendment is presented in Table C.02-1 and organized by plan component type: Goal, Land Allocation; Desired Conditions; Standards; Guidelines; then Other (e.g., Potential Management Approaches). The end of the table also describes amendments included to modify or remove existing plan content.

Table C.02-1. Proposed Project-Specific Forest Plan Amendments.

Component ID	Existing Plan Direction	Page	Component Type	Proposed Forest Plan Amendments	Component Type	Where does it apply?
TERR-SERAL-GOAL-01				Sierra Nevada forests occur within the natural range of variation (NRV) and contain an abundance of owl nesting, roosting, and foraging habitat distributed across the landscape. [CSO Strategy, p. 25, Approach 1 narrative, paragraph 1]	Goal	Project Area
TERR-SERAL-GOAL-02				Increase large-scale application of managed and prescribed fire to maintain dynamic ecosystem structure and function. [CSO Strategy, p. 33; Approach 2, 6.A]	Goal	Project Area
TERR-SERAL-GOAL-03				Manage prescribed fires and natural ignitions at multiple scales for a range of fire severity effects. [CSO Strategy, p. 33; Approach 2, 6.C]	Goal	Project Area
LAND-SERAL-WILDLIFE-01	California Spotted Owl Protected Activity Centers Designation: California spotted owl protected activity centers (PACs) are delineated surrounding each territorial owl activity center detected on National Forest System lands since 1986. Owl activity centers are designated for all territorial owls based on: (1) the most recent documented nest site, (2) the most recent known roost site when a nest location remains unknown, and (3) a central point based on repeated daytime detections when neither nest or roost locations are known.	179	Land Allocation	Designate California Spotted Owl PACs on National Forest System Lands surrounding territorial owl pairs based on documented nest site; recent roost site if nest location is unknown; or central point of repeated daytime detections when neither nest nor roost locations are known. Include 300-acres of nesting and roosting habitat in as compact a unit as possible, including the highest quality nesting and roosting habitat or when the highest quality nesting and roosting habitat is unavailable or scarce, areas including at least the best available nesting and roosting habitat [CSO Strategy, p. 26; PACs 1. C & D]	Land Allocation (Other)	CSO PAC
	California Spotted Owl Protected Activity Centers Designation: 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 codominant 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.	179	Land Allocation			
LAND-SERAL-WILDLIFE-02	California Spotted Owl Home Range Core Areas (HRCAs) Designation. A home range core area is established surrounding each territorial spotted owl activity center detected after 1986. The core area amounts to 20 percent of the area described by the sum of the average breeding pair home range plus one standard error. Home range core area sizes are as follows: 2,400 acres on the Hat Creek and Eagle Lake Ranger Districts of the Lassen National Forest, 1,000 acres on the Modoc, Inyo, Humboldt-Toiyabe, Plumas, Tahoe, Eldorado, Lake Tahoe Basin Management Unit and Stanislaus National Forests and on the Almanor Ranger District of Lassen National Forest, and 600 acres of the Sequoia and Sierra National Forests. Aerial photography is used to delineate the core area. Acreage for the entire core area is identified on national forest lands. Core areas encompass the best available California spotted owl habitat in the closest proximity to the owl activity center. The best available contiguous habitat is selected to incorporate, in descending order of priority, CWHR classes 6, 5D, 5M, 4D and 4M and other stands with at least 50 percent tree canopy cover (including hardwoods). The acreage in the 300-acre PAC counts toward the total home range core area. Core areas are delineated within 1.5 miles of the activity center.	184	Land Allocation	California Spotted Owl Territory Designation. ▪ A California spotted owl territory represents a 1,000-acre circle, which includes the 300-acre protected activity center, surrounding territorial owls, centered on a documented nest site or roost site if nest location is unknown or central point of repeated daytime detections when neither nest nor roost locations are known ▪ Territory boundaries may be adjusted to be non-circular, as needed, to include the entire protected activity center and the most sustainable areas of highest-quality habitat and exclude areas less likely to support suitable habitat. ▪ Contains diverse structural and seral conditions to facilitate nesting, roosting, and foraging. ▪ May overlap adjacent territories. ▪ Territories are established and retired together with protected activity centers. [CSO Strategy, p. 28; Approach 1, Territory/Watershed 1. A & B]	Land Allocation (Other)	CSO Territory
LAND-SERAL-WILDLIFE-03	California Spotted Owl Home Range Core Areas (HRCAs) Designation. When activities are planned adjacent to non-national forest lands, circular core areas are delineated around California spotted owl activity centers on non-national forest lands. Using the best available habitat as described above, any part of the circular core area that lies on national forest lands is designated and managed as a California spotted owl home range core area.	185	Land Allocation	When activities are planned adjacent to non-national forest lands containing known CSO nest stands, a 1,000-acre circle territory should be delineated around CSO activity centers on non-national forest lands. Any part of the circular core area that lies on national forest lands is designated and managed as a CSO territory.	Land Allocation	CSO Territory
SPEC-CSO-DC-01				Support conditions for a sustainable network of dynamic resilient, widely distributed California spotted owl nest or roost sites and habitat across heterogenous landscapes. [CSO Strategy, p. 25, Approach 1 narrative, paragraph 2]	Desired Condition	Project Area
SPEC-CSO-DC-02				Restore the proportion, distribution, diversity of tree species on the landscape consistent with NRV and potential vegetation type. • Design vegetation treatments to increase the abundance and distribution of fire-resilient and resistant species (for example, ponderosa pine, sugar pine, Jeffrey pine, and black oak) and decrease the abundance of shade-tolerant species (for example, white fir, incense cedar, Douglas fir). [CSO Strategy, p. 32; Approach 2, 4] • Remove smaller trees and fire-sensitive species that would not have survived under a natural fire regime. [CSO Strategy, p. 32; Approach 2, 4.A]	Desired Condition	Project Area
SPEC-CSO-DC-03				At the landscape scale, manage towards a mix of seral stages and canopy conditions consistent with NRV. This will generally entail increasing the amount of open canopy habitat in all seral stages and the amount of late seral stand conditions (open or closed canopy) to get a patchy distribution of diverse stand types. Seral stage desired conditions can be inferred by comparing current conditions with the level of departure from historic conditions (for example, Safford and Stevens 2017, pages 177 through 181; table 11, pages 178 and 179). [CSO Strategy, p. 30; Approach 2, 1.A.1]	Desired Conditions	Project Area
SPEC-CSO-DC-04				At the stand/patch scales, manage for within-stand and multi-stand diversity. Manage for a pattern of individual trees, clumps of trees, and openings (ICOs) containing various sizes of clumped trees and openings. These patterns range in size, configuration, and frequency based on NRV (Safford and Stevens 2017, table 8, page 140). [CSO Strategy, p. 31; Approach 2, 1.A.2]	Desired Conditions	Project Area
SPEC-CSO-DC-05				Manage the understory of mid- and late-seral areas for a patchy distribution of shrubs, orbs, tree regeneration patches, and bare ground to increase diversity, reduce fuels continuity, and provide habitat for owl prey species. [CSO Strategy, p. 30; Approach 2, 1.A.3]	Desired Conditions	Project Area
SPEC-CSO-DC-06	**California Spotted Owl Protected Activity Centers Desired Conditions, Intent and Objectives:** 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.	180	Desired Condition	California spotted owl protected activity centers provide high-quality nesting and roosting habitat that contributes to successful reproduction of California spotted owls and is resilient to high severity wildfire and other stressors. Protected activity centers encompass habitat that is essential for nesting and roosting, as defined by the following characteristics: The habitat has a high canopy cover (including large clumps of more than 70 percent canopy cover), with multiple layers of tree canopy, and many large trees, very large trees, and snags (including some greater than 45 inches in diameter). Basal area and tree density tend toward the upper end of the range of desired conditions for the relevant forest vegetation type. Large tree density, snag density, and coarse woody debris align with the old forest desired conditions for the relevant forest vegetation type. [CSO Strategy, p. 25; introductory to Approach 1.]	Desired Condition	CSO PAC
SPEC-CSO-DC-07	**California Spotted Owl Home Range Core Areas (HRCAs) Desired Conditions, Intent and Objectives.** HRCAs consist of large habitat blocks that have: (1) at least two tree canopy layers; (2) at least 24 inches DBH in dominant and co-dominant trees; (3) a number of very large (greater than 45 inches DBH) old trees; (4) at least 50 to 70 percent canopy cover; and (5) higher than average levels of snags and down woody material.	185	Desired Condition	(a) Maintain and promote 40 to 60 percent of each territory in mature tree size classes with moderate and high canopy cover for nesting, roosting, and foraging. Priority should be given to maintaining and promoting the highest quality before best available in descending order: 6, 5D, 5M, 4D, and 4M. Those territories in more mesic conditions and at higher elevations within the watershed should contain relatively more of this habitat than those in drier conditions and at lower elevations. The remainder of the territory consists of a diversity of many different structure and canopy classes. (b) For areas where multiple territories comprise greater than 75 percent of a watershed (typically a watershed unit greater than 10,000 acres in size) at least 30 to 50 percent (depending on the vegetation type and site conditions) of the watershed consists of the highest quality nesting and roosting habitat and the remainder of the watershed consists of a diversity of many different structure and canopy classes (aligned with desired conditions for terrestrial vegetation type). [CSO Strategy, p. 29; Approach 1, Territory/Watershed 2.A, 2.B, and 2.C]	Desired Condition	CSO Territory
TERR-SERAL-STD-01	**S&G 6.** For all mechanical thinning treatments, design projects to retain all live conifers 30 inches DBH or larger. Exceptions are allowed to meet needs for equipment operability.	34	Standard & Guideline	Retain live conifer trees greater than 30 inches in diameter except in the case of imminent threat to life and property, or if one of the conditions below is met:	Standard	Project Area

Component ID	Existing Plan Direction	Page	Component Type	Proposed Forest Plan Amendments	Component Type	Where does it apply?
	S&G 7. For mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) outside WUI defense zones: • Design projects to retain at least 40 percent of the existing basal area. The retained basal area should generally be comprised of the largest trees. • Where available, design projects to retain 5 percent or more of the total treatment area in lower layers composed of trees 6 to 24 inches DBH within the treatment unit. • Design projects to avoid reducing pre-existing canopy cover by more than 30 percent within the treatment unit. Percent is measured in absolute terms (for example, canopy cover at 80 percent should not be reduced below 50 percent.) • Within treatment units, at a minimum, the intent is to provide for an effective fuels treatment. Where existing vegetative conditions are at or near 40 percent canopy cover, projects are to be designed remove the material necessary to meet fire and fuels objectives.	34	Standard & Guideline	a) When required for equipment operability, individual trees less than 35 inches in diameter may be removed on an incidental basis. b) Outside of California spotted owl territories, where necessary to move towards terrestrial vegetation desired conditions, live trees greater than 30 inches but less than 40 inches in diameter may be felled to create coarse woody debris (where it's lacking), or removed, under the following limited circumstances: • When removing trees is needed for aspen, oak, or meadow restoration treatments or for cultural or Tribal importance. • In overly dense stands to favor retention or promote the growth of even larger or older shade-intolerant trees to more effectively meet tree species composition and forest structure restoration goals. • To promote the establishment, growth, and development of shade-intolerant species by creating small gaps (generally less than 0.5 acres) in stands historically dominated by shade-intolerant species. • To improve the growth and vigor of rust-resistant sugar pine trees greater than 16 inches in diameter by reducing competition from surrounding trees; or • To reduce loss of large diameter trees due to competition in overly dense stands within homogeneous plantations. [CSO Strategy, p. 32; Approach 2, 3.A; 3.B; 3.D]		
	S&G 7. Outside of California spotted owl Home Range Core Areas: Where existing vegetative conditions permit, design projects to retain at least 50 percent canopy cover within the treatment unit. Exceptions are allowed where project objectives require additional canopy modification (such as the need to adequately reduce ladder fuels, provide for safe and efficient equipment operations, minimize re-entry, design cost efficient treatments, and/or significantly reduce stand density.) Where canopy cover must be reduced below 50 percent, retain at least 40 percent canopy cover averaged within the treatment unit.	34	Standard & Guideline			
SPEC-CSO-STD-01	**S&G 33:** Conduct surveys in compliance with the Pacific Southwest Region's survey protocols during the planning process when proposed vegetation treatments are likely to reduce habitat quality in suitable California spotted owl habitat with unknown occupancy. Designate California spotted owl protected activity centers (PACs) where appropriate based on survey results.	40	Standard & Guideline	For vegetation treatments that maintain or improve habitat quality in California spotted owl nesting and roosting habitat outside of protected activity centers, pre-implementation surveys are not required. Before authorizing vegetation treatments in existing protected activity centers or that may reduce near-term habitat quality in California spotted owl nest or roost habitat of unknown occupancy, follow current guidance for the Pacific Southwest region to: •Determine occupancy status; •Identify owl nest sites (where nest location is not known, the most recent daytime roost); and •Delineate new or modify existing protected activity centers and territories, as necessary, within the project area. [CSO Strategy, p. 26; PACs 1. A and CSO Strategy, p. 27; PAC Modification A.1 through A.3]	Standard	Project Area and CSO PAC
	California Spotted Owl Protected Activity Centers Designation: As additional nest location and habitat data become available, boundaries of PACs are reviewed and adjusted as necessary to better include known and suspected nest stands and encompass the best available 300 acres of habitat.	179	Land Allocation			
SPEC-CSO-STD-02	**California Spotted Owl Protected Activity Centers Designation:** PACs are maintained regardless of California spotted owl occupancy status. However, after a stand replacing event, evaluate habitat conditions within a 1.5-mile radius around the activity center to identify opportunities for re-mapping the PAC. If there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network.	180	Land Allocation	**PAC retirement based on disturbance.** Before authorizing vegetation treatments in California spotted owl territories affected by a large-scale, high severity disturbance event, assess habitat conditions within a 1.5 mile radius of the most recent nest (where the nest is not known, the most recent daytime roost) to determine whether to modify or retire existing protected activity centers and territories following the 2019 Conservation Strategy for the California Spotted Owl in the Sierra Nevada, or more current guidance from the Pacific Southwest Region. If adequate suitable habitat remains, modify the boundary of the protected activity center to encompass the best remaining 300 acres of highest quality nesting and roosting habitat. [CSO Strategy, p. 27; PAC retirement based on disturbance B.1 and B.2]	Standard	CSO PAC
SPEC-CSO-STD-03				**PAC Retirement based on lack of occupancy.** Existing protected activity centers and territories may not be retired unless loss of suitable habitat or long-term occupancy criteria are met as defined in the 2019 Conservation Strategy for the California Spotted Owl in the Sierra Nevada, or more current guidance for the Pacific Southwest region. [CSO Strategy, p. 27; PAC retirement based on occupancy C.1 and C.2 and D]	Standard	CSO PAC
SPEC-CSO-STD-04	**S&G 7. Within California spotted owl PACs:** Where treatment is necessary, remove only material needed to meet project fuels objectives. Focus on removal of surface and ladder fuels.	34	Standard & Guideline	In California spotted owl protected activity centers (PACs), all management activities must maintain or improve habitat quality in the highest-quality nesting and roosting habitat. Where necessary to increase long-term resilience, vegetation treatments that may reduce near-term habitat quality may be authorized in up to 100 acres outside of the highest quality nesting and roosting habitat. Throughout protected activity centers all vegetation treatments must: • Retain the largest/oldest trees, known nest trees, and other large trees and snags with cavities, deformities, broken tops, or other habitat features of value to old forest species; [CSO Strategy, p. 31; Approach 2, 3.A] • Retain connected areas of moderate (at least 40 percent) and high (at least 60 percent) canopy cover between the known nest site (if nest site is not known, use the most recent known roost site) and areas in the rest of the protected activity center; • Avoid mechanical treatments within a 10-acre area surrounding the most recent known nest; • Avoid creating new landings, new temporary roads, or canopy gaps larger than 0.25 acres comprising no more than 5% of a stand; • Increase the quadratic mean diameter of trees at the protected activity center scale; and • Maintain the average canopy cover of the protected activity center above 50 percent. [CSO Strategy, p. 28, Approach 1 – 4.C, 4.F, 4.G]	Standard	CSO PAC
	S&G 72. Mechanical treatments may be conducted to meet fuels objectives in protected activity centers (PACs) located in WUI defense zones. In PACs located in WUI threat zones, mechanical treatments are allowed where prescribed fire is not feasible and where avoiding PACs would significantly compromise the overall effectiveness of the landscape fire and fuels strategy. Mechanical treatments should be designed to maintain habitat structure and function of the PAC.	181	Standard & Guideline			
	S&G 74. In PACs located outside the WUI, limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. In forested stands with overstory trees 11 inches DBH and greater, design prescribed fire treatments to have an average flame length of 4 feet or less. Hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches DBH), may be conducted prior to burning as needed to protect important elements of owl habitat.	181	Standard & Guideline			
SPEC-CSO-STD-05	**S&G 7. Within California spotted owl Home Range Core Areas:** Where existing vegetative conditions permit, design projects to retain at least 50 percent canopy cover averaged within the treatment unit. Exceptions are allowed in limited situations where additional trees must be removed to adequately reduce ladder fuels, provide sufficient spacing for equipment operations, or minimize re-entry. Where 50 percent canopy cover retention cannot be met for reasons described above, retain at least 40 percent canopy cover averaged within the treatment unit.	34	Standard & Guideline	To increase resiliency and promote the development of future nest sites within CSO territories, vegetation treatments should be designed to: • minimize the loss of and to promote the growth and recruitment of trees greater than 24 inches DBH and especially large and very large trees greater than 30 inches DBH and 36 inches DBH, respectively. • retain clumps or patches of large/tall trees (greater than 24 inches DBH and 100 feet tall, and especially trees greater than 30 inches DBH and 150 feet tall, with canopy cover greater than 60 to 70 percent. • retain connected areas of moderate (at least 40 percent) and high canopy cover (at least 60 percent) in large/tall trees to promote habitat connectivity at the watershed scale. [CSO Strategy, p. 29; Approach 1, Territory/Watershed 2. C1, C2, and C3] **Exceptions:** **Exceptions are also allowed in limited situations where additional trees must be removed to adequately reduce ladder fuels, provide sufficient spacing for equipment operations, or to minimize re-entry.**	Standard	CSO Territory
SPEC-CSO-STD-07	**S&G 73.** While mechanical treatments may be conducted in protected activity centers (PACs) located in WUI defense zones and, in some cases, threat zones, *they are prohibited within a 500-foot radius buffer around a spotted owl activity center within the designated PAC.* Prescribed burning is allowed within the 500-foot radius buffer. Hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches DBH), may be conducted prior to burning as needed to protect important elements of owl habitat. Treatments in the remainder of the PAC use the forest-wide standards and guidelines for mechanical thinning.	181	Standard & Guideline	Avoid mechanical treatments within 10 acres surrounding a nest tree or nest structure. Prescribed burning Is allowed within the 10 acres surrounding a nest tree or structure. Hand treatments, including handline construction, tree pruning, and cutting of small trees (less than 6 inches DBH), may be conducted prior to burning as needed. [CSO Strategy, p. 28, Approach 1 4.F]	Standard	CSO PAC
SPEC-CSO-STD-08		A		In California spotted owl territories that do not meet the territory desired condition (SPEC-CSO-DC-07), retain habitat quality in the highest quality nesting and roosting habitat wherever it exists throughout the territory. If the territory desired condition has been met, vegetation treatments to improve resilience and increase heterogeneity should be designed to ensure the desired condition in SPEC-CSO-DC-07 is maintained. **Exception Areas:** **Does not apply within fuelbreaks or WUI (Map 4)**	Standard	CSO Territory
SPEC-CSO-GDL-01	**Desired Conditions, Intent and Objectives:** Avoid vegetation and fuels management activities within PACs to the greatest extent feasible. Avoid vegetation and fuels management activities within PACs to the greatest extent feasible. Reduce hazardous fuels in PACs in defense zones when they create an unacceptable fire threat to communities. Where PACs cannot be avoided in the strategic placement of treatments, ensure effective treatment of surface, ladder, and crown fuels within treated areas. If nesting or foraging habitat in PACs is mechanically treated, mitigate by adding acreage to the PAC equivalent to the treated acreage wherever possible. Add adjacent acres of comparable quality wherever possible.	180	Management Objective	Fire, hand treatments, mechanical treatments, or a combination of these things may be necessary in PACs to increase resiliency and sustainability. Prioritize treatments in PACs to increase resiliency and sustainability to areas that are at highest risk of large-scale, high severity wildfire or severe tree mortality from insects and drought or those that are likely unsustainable long-term. [CSO Strategy, p. 28, Approach 1 4.A]	Guideline	CSO PAC

Component ID	Existing Plan Direction	Page	Component Type	Proposed Forest Plan Amendments	Component Type	Where does it apply?
SPEC-CSO-GDL-02a	**S&G 71.** Within the assessment area or watershed, locate fuels treatments to minimize impacts to PACs. PACs may be re-mapped during project planning to avoid intersections with treatment areas, provided that the re-mapped PACs contain habitat of equal quality and include known nest sites and important roost sites. Document PAC adjustments in biological evaluations.	180-181T	Standard & Guideline	(a) PACs may be re-mapped during project planning to avoid intersections with treatment areas, provided that the re-mapped PACs contain habitat of equal quality and include known nest sites and important roost sites.	Guideline	CSO PAC
SPEC-CSO-GDL-02b	***When treatment areas must intersect PACs and choices can be made about which PACs to enter, use the following criteria to preferentially avoid PACs that have the highest likely contribution to owl productivity.*** ***• lowest contribution to productivity: PACs presently unoccupied and historically occupied by territorial singles only.*** ***• PACs presently unoccupied and historically occupied by pairs,*** ***• PACs presently occupied by territorial singles, • PACs presently occupied by pairs,*** ***• highest contribution to productivity: PACs currently or historically reproductive.*** **Historical occupancy is considered occupancy since 1990. Current occupancy is based on surveys consistent with survey protocol (March 1992) in the last 2-3 years prior to project planning. These dates were chosen to encompass the majority of survey efforts and to include breeding pulses in the early 1990s when many sites were found to be productive. When designing treatment unit intersections with PACs, limit treatment acres to those necessary to achieve strategic placement objectives and avoid treatments adjacent to nest stands whenever possible.** **If nesting or foraging habitat in PACs is mechanically treated, mitigate by adding acreage to the PAC equivalent to the treated acres using adjacent acres of comparable quality wherever possible.**			(b) In addition to prioritization by risk level (SPEC-CSO-GDL-01), to minimize potential impacts to California spotted owl reproductive success, vegetation treatments that may reduce habitat quality in the near term should be minimized or avoided in protected activity centers with the highest likely contribution to reproductive success, and otherwise prioritized as follows (from highest to lowest priority for treatment): 1. Currently unoccupied and historically occupied by territorial singles only. 2. Currently unoccupied and historically occupied by pairs. 3. Currently occupied by territorial singles. 4. Currently occupied by pairs. 5. Currently occupied by pairs and currently or recently reproductive. Occupancy and historical occupancy status shall be assess as defined in the 2019 Conservation Strategy for the California Spotted Owl in the Sierra Nevada, or more current guidance provided by the Pacific Southwest region. [CSO Strategy, p. 28, Approach 1 4.B]		
SPEC-CSO-GDL-03				To limit fragmentation and maintain connectivity of nesting, roosting, and foraging habitat, construction of fuelbreaks should avoid intersecting with California spotted owl protected activity centers. Where avoiding overlap with a protected activity center is not feasible, the PAC should be remapped to maintain acreage equivalent to the quantity of the treated PAC acres using adjacent acres of comparable quality wherever possible.	Guideline	CSO PACs and Intersecting Fuelbreaks
SPEC-CSO-GDL-04	**S&G 75 and 78. For California spotted owl PACs:** Maintain a limited operating period (LOP), prohibiting vegetation treatments within approximately ¼ mile of the activity center during the breeding season (March 1 through August 31), unless surveys confirm that California spotted owls are not nesting. Prior to implementing activities within or adjacent to a California spotted owl PAC and the location of the nest site or activity center is uncertain, conduct surveys to establish or confirm the location of the nest or activity center. Breeding season LOP may be waived, where necessary, to allow for use of early season prescribed fire in up to 5 percent of CSO PACs per year on a forest.	181	Standard & Guideline	To minimize disturbance that may lead to breeding failure, during the breeding season (March 1 to August 15, or following current Pacific Southwest regional guidance) apply a limited operating period prohibiting: a. Mechanical harvest within approximately 0.25 mile of active nests. This LOP does not apply to existing road and trail use and maintenance. b. Prescribed burning within 500 feet of the nest. This restriction may be waived in up to 10 percent of PACs per year in the STF, where necessary to facilitate the benefits of using early season prescribed fire.	Guideline	CSO PACs
SPEC-CSO-GDL-05				To minimize impacts to overstory canopy and provide conditions for continued use for nesting and roosting within protected activity centers, reduce fuel loads with thinning and/or prescribed burning to minimize the risk of high severity fire and promote conditions that lead to lower intensity predicted fire effects (generally flame lengths averaging 4 to 6 feet). [CSO Strategy, p. 28, Approach 1 4.D]	Guideline	CSO PACs
SPEC-CSO-GDL-06	**S&G 16.** Outside of WUI defense zones, **salvage harvests are prohibited in PACs** and known den sites unless a biological evaluation determines that the areas proposed for harvest are rendered unsuitable for the purpose they were intended by a catastrophic stand-replacing event.	35	Standard & Guideline	Before authorizing vegetation treatment following a large-scale, high severity disturbance in an area that had large trees and high canopy cover prior to the disturbance; identify, retain and promote the best available patches of remaining high-quality nesting, foraging, and denning habitat (6, 5D, 5M, 4D, 4M in descending order of priority) to provide future habitat for old forest associated species. Desired conditions for amount, location, and configuration of patch retention should be informed by terrestrial vegetation desired conditions for the forest type. [CSO Strategy, p. 33, Approach 2, 7].	Guideline	CSO PACs
SPEC-SERAL-MA-01				When practical based on existing conditions, use prescribed fire, alone or in combination with mechanical thinning, to restore forest vegetation within California spotted owl protected activity centers. [CSO Strategy, p. 28, Approach 1 4.E]	Potential Management Approach	CSO PAC
MODIFY	A network of land allocations, including California spotted owl and American goshawk protected activity centers (PACs), **California spotted owl home range core areas**, forest carnivore den sites, and the southern Sierra fisher conservation area, with management direction specifically aimed at sustaining viable populations of at-risk species associated with old forest ecosystems well distributed across Sierra Nevada national forests;	11	Strategy	**Modify California spotted owl home range core areas to read territories as follows:** A network of land allocations, including California spotted owl and American goshawk protected activity centers (PACs), **California spotted owl territories,** forest carnivore den sites, and the southern Sierra fisher conservation area, with management direction specifically aimed at sustaining viable populations of at-risk species associated with old forest ecosystems well distributed across Sierra Nevada national forests;	Strategy	Project Area
REMOVE-1	**S&G 1.** Strategic placement of fuels treatments should also consider objectives for locating treatment areas to overlap with areas of condition class 2 and 3, high density stands, and pockets of insect and disease. **Avoid PACs to the greatest extent possible when locating area treatments.** Incorporate areas that already contribute to wildfire behavior modification, including timber sales, burned areas, bodies of water, and barren ground, into the landscape treatment area pattern. Identify gaps in the landscape pattern where fire could spread at some undesired rate or direction and use treatments (including maintenance treatments and new fuels treatments) to fill identified gaps.	33	Standard & Guideline	**Remove bold sentence.**	N/A	Project Area
REMOVE-2	Treatment patterns are to be developed using a collaborative, multi-stakeholder approach. Resource considerations factored into the strategic placement of fuels treatments include objectives for locating treatments to overlap areas of condition class 2 and 3, high density stands, and pockets of insect and disease. **Treatment areas are located to avoid PACs to the greatest extent possible.**	14	Strategy	**Remove bold sentence.**	N/A	Project Area
REMOVE-3	**California Spotted Owl Home Range Core Areas (HRCAs) Desired Conditions, Intent and Objectives.** Treat fuels using a landscape approach for strategically placing area treatments to modify fire behavior. Retain existing suitable habitat, recognizing that habitat within treated areas may be modified to meet fuels objectives. Accelerate development of currently unsuitable habitat (in non-habitat inclusions, such as plantations) into suitable condition. Arrange treatment patterns and design treatment prescriptions to avoid the highest quality habitat (CWHR types 5M, 5D, and 6) wherever possible.	185	Management Intent	**Remove.**	N/A	N/A
REMOVE-4	**California Spotted Owl Home Range Core Areas (HRCAs) Desired Conditions, Intent and Objectives:** Establish and maintain a pattern of fuels treatments that is effective in modifying wildfire behavior. Design treatments in HRCAs to be economically efficient and to promote forest health where consistent with habitat objectives	185	Management Objective	**Remove.**	N/A	N/A

APPENDIX D: LITERATURE CITED

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APPENDIX E: USING LANDSCAPE CONDITION METRICS

E.01 ForSys

ForSys (Ager et al. 2012; Ager et al. 2021; Belavenutti et al. 2021) is a flexible platform for exploring landscape management scenarios and optimizing decisions in terms of where and how to achieve landscape restoration and fuel management goals. ForSys synthesizes a suite of input data and applies multi-criteria prioritization, thresholds, constraints, and availability masks to rapidly identify spatially explicit restoration scenarios.

The efficacy of the ForSys scenario planning tool, or any other planning support tool, depends largely on the quality of the input data. Data development, quality and defensibility was a priority in this effort. Each metric comprising the ForSys input dataset was developed by a partnership of scientists and managers considered experts in their fields.

E.02 Delineation of ForSys Selection Process

ForSys operates by selecting spatially delineated selection polygons based on a set of criteria established by the user. Selection polygons can come in many different forms; even-sized cells or hexagons, stands, watersheds, etc. ForSys is scale independent thus the size of the selection polygon is set to match the application. For on-the-ground type applications like the SERAL 2.0 project, small polygons that capture largely homogeneous stands of vegetation were used.

The methodology used for SERAL 2.0 differs from that used for SERAL 1.0. For SERAL 1.0, the delineation of FoySys selection polygons began with a fundamental unit called Landscape Management Units (LMUs) classified into four categories: valley bottoms, ridge tops, northeast facing slopes, and southwest facing slopes. The first iteration of SERAL 1.0 LMUs included many large polygons (i.e., over 1,000 acres), especially some of the valley bottom polygons, so these were further divided using stream order segments. Next, the polygons were further segmented using a LANDSAT image and an image segmentation algorithm. Finally, several land management designations (e.g., land ownership, California spotted owl PACs, proposed fuelbreaks, steep slopes, etc.) were integrated into the LMU polygon delineation. The resultant polygons represented the SERAL 1.0 ForSys selection polygons which included 10,642 polygons. These selection polygons averaged slightly larger than 10 acres in size, but almost all selection units were between 5 and 200 acres.

For SERAL 2.0 a different approach was taken. The process of delineating ForSys selection polygons is a key aspect to applying the ForSys scenario planning tool and much was learned through the SERAL 1.0 effort. Based on the lessons learned through SERAL 1.0, we determined better aligning the location of proposed restoration treatment areas with on-the ground operational feasibility was critical. As such, the process to delineate selection polygons for SERAL 2.0 began by “hand”. Foresters on the Stanislaus National Forest manually digitized operational polygons using aerial imagery, vegetation type and slope information. The shift to “operational selection polygons” from LMUs was made to more closely align planning and implementation, a need that was identified by the team implementing SERAL 1.0. Next, the polygons were subdivided based on slope position (i.e., Ridge, NE mid-slope, SW mid-slope, and drainages) using an automated GIS process. Finally, the polygons were segmented as needed by several

land management allocations including land ownership, California spotted owl PACs and territories, American goshawk PACs, great grey owl PACs, inventoried roadless areas, near natural areas, and proposed fuelbreaks. The final set of SERAL 2.0 ForSys selection polygons consists of 13,196 selection polygons which average 12 acres, ranging from <1 to 150 acres.

E.03 Landscape Condition Metrics

To apply the ForSys scenario planning tool requires a single GIS dataset (shapefile or geodatabase) made up of discrete planning units containing variables (i.e., landscape condition metrics) which represent the information needed to make an informed decision about where to apply treatments. Each selection polygon has a value associated with it for every attribute in the geodatabase.

Developing, fine tuning, and quality control checking the single GIS dataset (the "ForSys input dataset") for SERAL 2.0 was conducted by Forest staff, scientists and land managers considered experts in their fields.

Although the development of some new metrics was considered, the suite of metrics included in the SERAL 2.0 input dataset were the same as those included in SERAL 1.0 which were developed from already established and published approaches. The majority of the metrics are quantified in a raster (cell-based GIS surface, usually 30-meter pixels) and assigned an aggregated value to each selection polygon using zonal mean or zonal majority operations.

The landscape condition metrics are used in two ways. Metrics that represent the existing condition of the landscape helped define the purpose and need and informed treatment area selection. Metrics that estimate post-treatment conditions will be used as indicators and measures for the DEIS focused analysis. The ability to present pre- and post-treatment estimates of key landscape condition metrics tied to the purpose and need of the project will be a critical contributing factor to the development of the SERAL 2.0 DEIS.

Key SERAL 2.0 landscape condition metrics are described in more detail in the following subsections.

Resilience Departure Index

Key Developers: Dr. Van Kane, Monika Moskal, and Dr. Jonathan Kane – University of Washington; Dr. Malcom North – Pacific Southwest Research Station.

The resilience departure index (ForSys input dataset Name = "Res_Depart") was produced by the Forest Resilience Lab, University of Washington (vkane@uw.edu).

The similarity is measured with "tree-approximate objects" (or "TAOs", which are canopy trees that were detected by lidar along with any subordinate trees that may be underneath them that cannot be detected individually by lidar) per hectare, mean clump size, and open space index. Values close to 0 indicate pixels that are very similar to average reference conditions. Positive values indicate pixels that are denser than the average reference site, and negative values indicate lower density.

This lidar-derived data layer was produced from the 2018-19 acquisition, by the Forest Resilience Lab at the University of Washington (vkane@uw.edu) for the Stanislaus National Forest. A composite index was developed by the UW lab that measures how similar or how departed current conditions at all locations across the forest are to climatically and topographically similar reference sites; locations where conditions resembled a restored fire regime (i.e., the area had experienced low/moderate severity fires at an expected return interval) and had no history of logging. To date, the resilience team at UW has found suitable climatic reference sites for much but not all of the Stanislaus NF. Some areas, particularly at the lower elevations with oak woodland and pine-oak woodland forest type do not currently have suitable reference sites.

Lidar data were used to generate the three primary metrics that collectively reflect the resiliency of the forest; TAO density (per hectare), mean TAO clump size, and an open space index [% area > 6m from nearest canopy]. A composite value that reflects the standard deviation from the mean for the three metrics, was assigned to every raster pixel across the landscape. Standard deviation values close to 0 indicate conditions within a pixel that are very similar to average reference site conditions. Positive values indicate conditions within a pixel that are denser than the average reference site, and negative values indicate lower density.

The data obtained from the University of Washington were processed with two additional steps. First, all values less than 1, not significantly different from the reference conditions, were set to zero; representing conditions less than 1 standard deviation from the mean in the positive direction (denser). All values that were less dense than the mean, were also set to zero. These values represent pixels that are not significantly denser and thereby not in need of treatment. All values greater than 1 were included; the further from 1, the greater the departure. These values were squared, in order to give greater significance for larger values (i.e., the farther from the mean the more departed the value). The second step was to aggregate the values of all pixels within a selection polygon and divide by the number of pixels in the selection polygon to obtain an average value for the selection polygon. This last step provided the single, aggregated values of all pixels within a selection polygon.

Selection polygons with the largest Res_depart values represent the selection polygons that are the most departed from the reference forest structure density condition; for planning purposes these selection polygons with the highest Res_depart values may benefit the most from forest management.

Wildfire Hazard and Risk Assessment

<u>*Key Developers*</u>: Will Downing and Jessica Haas, USFS Enterprise Program –

The quantitative framework for wildfire risk assessment was first introduced by Finney (2005). The framework measures fire effects on Highly Valued Resources and Assests (HVRAs) using the Net Value Change (NVC) concept. NVC captures both fire-related losses and benefits in relative terms on a percentage basis (e.g., -100% indicates complete loss and +100% indicates maximum benefit), allowing for a common currency to evaluate wildfire risk across market and non-market HVRAs. The product of NVC and fire likelihood results in an expected measure of NVC (eNVC), or risk. Continued development of the framework led to its formalization in USDA Forest Service General Technical Report RMRS-GTR-315: *A Wildfire Risk Assessment Framework for Land and Resource Management* (Scott et al. 2013), which provides additional guidance on weighting the importance of HVRAs for integrated risk assessment. The primary components required to apply the framework spatially include the simulation of wildfire hazard, identification and characterization of HVRAs, and quantification of risk. The following paragraphs provide a brief overview of each component.

Wildfire Hazard Modeling

Burn probability and wildfire intensity were modeled for the current landscape conditions with FSim – the large fire simulation system (Finney et al. 2011). FSim uses inputs on fuels, topography, climate, and historical ignition patterns to simulate large fire occurrence, spread, and suppression over many potential future fire seasons. The outputs include both characteristics of the individual fires, including ignition points and final extents, and raster surfaces aggregating the individual fire extent and intensity information into estimates of burn probability and the conditional probability of burning in each of six fire intensity levels (Finney et al. 2011; Scott et al. 2013).

Burn probability estimates are calculated as the number of iterations (i.e, fire seasons) that resulted in a given pixel burning divided by the total number of iterations. In short, burn probability represents where large fires are most likely to burn on the landscape. Estimates of the conditional probability of burning in each of six fire intensity levels can be combined to express conditional flame length, a simple measure of

expected fire intensity should a fire occur. Burn probability and wildfire intensity estimates were generated to represent the existing landscape condition, as well as the post-treatment (proposed action) landscape condition.

We ran FSim at 120-m resolution for 10,000 fire seasons across the full extent of the Stanislaus National Forest. Fuels, climate, and fire regimes vary substantially over this extent, so the landscape was divided into geographic areas for modeling with similar patterns of historical fire occurrence, called pyromes, to align with concurrent efforts to update the National FSim outputs (e.g., Short et al. 2020). For consistency, we used the National FSim inputs and model parameters for the selected pyromes (26, 27, 29) wherever possible, including information on historical ignitions, climate, the statistical relationship between climate and large fire occurrence, and the number of seasons to simulate. Landscape fuel conditions were characterized by LANDFIRE v2.2.0 updated to account for forest management activities and disturbances through June of 2023. We calibrated FSim by pyrome to a tolerance of +/-10% of the historical number and mean size of large fires observed over the period 2004-2018 by adjusting the total fire load and spread rates. The final 120-m burn probability and fire intensity outputs were mosaiced into seamless rasters with full coverage of the region and then downscaled to 30-m and gap-filled using a smoothing procedure.

Identification and Characterization of HVRAs

Highly Valued Resources and Assets (HVRAs) are fire-sensitive elements of the natural and built environment. Three characteristics must be determined for each HVRA identified: relative importance, spatial extent, and response to wildfire of varying intensity levels (i.e., degree of loss or benefit). “Highly valued” implies that HVRAs are an important subset of resources and assets present on the landscape, typically those that drive land, resource, and fire management decision making. Common examples include human assets, like buildings, critical infrastructure, and developed recreation sites, and natural resources, like merchantable timber, and rare or critical wildlife habitat. HVRAs are ranked in terms of relative importance for weighting their contribution to “integrated” or “total” risk metrics. The intent of relative importance weighting is to capture fire and land management objectives and priorities as well as social values (Scott et al. 2013; Thompson et al. 2013). HVRA identification and relative importance ranking were completed by Stanislaus National Forest leadership in 2020 and updated in 2023. R

Stanislaus National Forest resource specialists helped to inform identification, mapping, and effects analyses. In particular, resource specialists helped to define the tabular response functions used to relate fire intensity to HVRA response (Calkin et al. 2010; Scott et al. 2013). Response functions are typically based on expert judgement or some combination of expert judgement, published fire effects research, and fire effects modeling. Response functions represent the near-term effects on HVRAs, including both first-order (e.g., tree mortality) and second-order (e.g., habitat loss) fire effects but not distant future outcomes that are influenced by other processes (Scott et al. 2013).

Quantification of Risk

Final risk calculations were based on wildfire hazard, HVRA exposure, fire effects, and relative importance. Integrating these components results in is a measure of Expected Net Value Change (eNVC), which represents the likelihood and magnitude of expected losses and benefits from wildfire. The mission-oriented expected net value change (exp_nvc_m) is modified to include weightings for various Forest Service mission factors at two scales; the selection polygon and PODs. This process prioritizes/weights values upfront, based on forest leadership rankings of the individual values relative to each other. t also integrates modeled fire behavior across the fire season (accounting for differences between fires burning in early June and late August), how individual values respond to the variation in modeled fire behavior (differences in gains/losses across the season), and their spatial extent. The final “mission weighted” eNVC layer sums the individual values together (conditional net value change [cond_nvc]), and then multiplies it by burn probability to determine the expected net value change (exp_nvc).

The mission-weighted modified exp_nvc for both selection polygon (LMU_envc_m) and POD scale (POD_envc_m) values have been transformed by multiplying by -1 to ensure that when combined with other objectives in any given ForSys run, the values trend in the same direction. Therefore, positive values represent harmful resource outcomes while negative values represent beneficial resource outcomes. Preliminary POD treatment prioritization was made by ranking POD_envc_m, with the PODS with the greatest expected losses from wildfire suggesting highest priority (DEIS Map 6).

California Spotted Owl Departure Index

Key Developers: Dr. Peter Stine – Affiliate with the Pacific Southwest Research Station; Carlos Ramirez and Carol Clark – R5 Remote Sensing Lab; Sarah Sawyer – USDA Forest Service Region 5

The conservation, maintenance, and restoration of California spotted owl (CSO) habitat required specific attention throughout the Sierra Nevada. The California spotted owl departure index (ForSys input dataset = "CSOdprtF3W") was created to identify areas in CSO PACs that represent areas most in need of treatment to restore more favorable conditions for CSO (e.g., large trees, multi-layered canopies) *and* avoid or limit treatment in areas that were preferential for retention. The intent is to focus any potential treatment in areas that are most departed from desired owl habitat conditions, while avoiding areas that meet high-quality habitat standards (as defined by the CSO Strategy, USDA 2019). This metric was calculated to assign a "departure" value to every 30-meter pixel of forested habitat in CSO PAC selection polygons that represents existing conditions compared with a reference condition of forest density and patchiness, as defined by data in Ng et. al (2020). The values are on a scale from 0-1, the closer to 1 the more departed the value is. These departed-conditions are primarily made up of only small to medium sized trees – with no large trees greater than 30" DBH, and an excess proportion of dense tree clumps with too few openings. The logic behind this is dense stands of relatively small trees are most "departed" because the stand is vulnerable to high severity fire and is suppressing the growth of large trees that are most desirable for nesting sites.

To calculate owl departure, a series of queries was performed summarizing the area of CWHR type, size, density and tree clumps per polygon depending on the topographic position of the selection polygon following the referenced topographic conditions thresholds measured and summarized by Ng et. al. (2020); the valley bottoms threshold is 0.47, the mid-slopes threshold is 0.41, and the ridges threshold is 0.32.

For any given selection polygon located within a CSO PAC the departure value was calculated based on these different threshold values. The example outlined below is for valley bottoms. For the other two topographic positions substitute the appropriate threshold value.:

1. Identify all the pixels in: PPN, SMC, RFR, DFR, MHC, MHW, WFR, RDW, in the size/density classes 4D, 4M, 4P, and 4S and 3D, 3M, 3P, and 3S. Then exclude all pixels with trees larger than 30 inches. Add these up and this is the starting value of departure.
2. Identify all the pixels in the following categories: PPN, SMC, RFR, DFR, MHC, MHW, WFR, RDW, that are in the size/density classes 5D or 6, or SMC, RFR, DFR, WFR 5M. Also include any tree clumps with trees greater than 30" DBH. Sum these.
3. If this sum from step 2 is greater than 47% of the selection polygon add the number of pixels that exceed the 47% threshold.
4. Sum steps 1 and 3 and calculate the percentage of the selection polygon that contain this sum.

This final value represents the proportion of the selection polygon that could be considered for habitat management using appropriate silvicultural methods for application inside PACs. The amount that could be managed is a choice that managers can stipulate in any given ForSys run.

The applied use of this metric enables the SERAL 2.0 team to focus treatment area selection in PACs to areas of a lower quality habitat — areas containing small trees in dense stands with few openings — in order to most effectively reduce the threat of high severity fire and promote faster recruitment of large trees, while ensuring portions of CSO PACs already containing higher quality habitat — large, old, closed-canopy structure — were left untreated or maintained.

Forest Type

Key Developers: Shengli Huang, Carolos Ramirez, Marcus McElhaney, Kirk Evans – "F3 Team" – R5 Remote Sensing Lab

Forest type ("Forest_Typ") represents the dominant forest type – pine dominated, mixed conifer-pine dominated, mixed conifer dominated, hardwood, shrub, herbaceous, non-vegetated, or other. Calculation of forest type ("Forest_Typ") values consisted of two main steps. The first step used lidar derived canopy cover values and F3 modeled basal area surfaces to determine relative species proportions at the selection polygon scale. The species information was then cross-walked into one of the forest type classes. A second step used plantations data to improve the forest type values in selection polygons known to substantially intersect plantations.

The initial forest type calculation started by looking at canopy cover for the selection polygons. All selection polygons with a canopy cover values less than 10% are considered not tree-dominated and rely upon the National Landcover Database (NLCD) to inform forest types between shrub, herbaceous, and non-vegetated cover. If the canopy cover is greater than or equal to 10%, then the dominant lifeform (conifer or hardwood) of the selection polygon is determined using F3 modelled basal area by species (Huang et al. 2018, Burrill et al. 2018). This was done by summing the basal area of all hardwood species types and all conifer species types; if the sum hardwood basal area was greater than or equal to the sum conifer basal area then the selection polygon was considered to be hardwood dominated and the forest type was set to hardwood. If the selection polygon was determined to be conifer dominated, then the relative conifer species proportions are calculated for all conifer types. These values are equal to the species basal area divided by the sum conifer basal area. Each conifer species type, as well as several conifer species combinations, was associated with one of the three designated conifer forest types. If a relative conifer species (or species combination) proportion was greater than 75%, then the selection polygon was assigned to that species' associated forest type. If no species proportions meet this threshold, then several more conifer species combinations were tested at lower thresholds.

The second forest type modeling step began by making a 30-meter resolution raster mask of plantation locations. The mask was then used to calculate the proportion of each selection polygon that is covered by plantation features. If the selection polygon is more than 50% covered by plantation features, it is considered plantation dominated and its forest type was defined as 'Pine dominated.'

Value for "Forest_Typ" in the ForSys input dataset are: Pine dominated, Mixed conifer/pine, Mixed conifer/fir, Red Fir, Hardwood, Shrub, Herbaceous, Nonveg, Other

California Wildlife Habitat Relationship

(WHRdensLDR, WHRsizeF3cwhr, Alt1WHRsz, Alt1WHRdn)

Key Developers: Shengli Huang, Carolos Ramirez, Marcus McElhaney, Kirk Evans – "F3 Team" – R5 Remote Sensing Lab

The California wildlife habitat relationship (CWHR) size was calculated by the zonal mean of all 30-meter F3 (Huang et al. 2018, Burrill et al. 2018) derived DBH raster cells contained within each ForSys selection polygon. This mean DBH value was then binned into the Wildlife Habitat Relationships (WHR) tree size categories. The WHR standards for tree size fall into five categories based on DBH; seedling size class 1 (DBH is less than 1"), sapling size class 2 (DBH 1" to 6"), pole tree size class 3 (DBH 6" to

11”), small tree size class 4 (DBH 11” to 24”), medium to large tree size class 5 (DBH > 24”). There is also size class 6 which references multi-layered trees with size class 5 over smaller trees of size class 3 or 4.

Canopy cover values derived from a Lidar metric that reports the fraction of returns greater than 3m in height were binned according to the California Wildlife Habitat Relationships (CWHR) canopy closure categories*: sparse canopy (S) 10-24%, open canopy (P) 25-39%, moderate canopy (M) 40-59%, and dense canopy(D) 60-100%.

*NOTE: There is an acknowledged difference between canopy closure and canopy cover; canopy closure is a measure of the percentage of the sky hemisphere obscured by vegetation over a point, as opposed to canopy cover, the measure of canopy porosity averaged over a stand. The CWHR canopy crown closure percent categories have been used to classify the calculated Forest Canopy Cover data.

Silvicultural Prescriptions

(Silv_AM1, Silv_NC, ALT1prescript)

Key Developers: Jacob Baker – Stanislaus National Forest; Ramiro Rojas – Region 5 Regional Assistant Silviculturist/ Sierra National Forest; Joe Sherlock – Region 5 Regional Silviculturist; Lucas Wilkinson – Stanislaus National Forest

The Forest built silviculture kcp files that represented the silviculture prescriptions that would be used to implement the proposed actions in different locations. There are 11 different prescriptions (Table E.03-1) that apply within the project area.

Silvicultural prescriptions vary primarily by forest vegetation type, land allocations, and the management direction of the proposed project-specific forest plan amendments. Each ForSys selection polygon was assigned whichever silviculture prescription aligns with the specific combination of forest type, land allocation, and management direction that applies within the ForSys selection polygon.

Table E.03-1. Silviculture Prescription Descriptions.

Silviculture Prescription ID	Silviculture Prescription Description
Alt1_FMF_THIN30PCC.kcp:	Fuelbreaks with designation of thinning to a canopy target (30%) and limit of 30 inches DBH
Alt1_MC_GF_[150/200].kcp:	Mixed conifer forest with General Forest designation and a target stand density index (SDI) of 150 or 200
Alt1_MC_PAC_20.kcp:	Mixed conifer forest with CSO Protected Activity Centers designation and a limit of 20 inches DBH
Alt1_MC_Territory_[150/200].kcp:	Mixed conifer forest with CSO Territory designation and a target SDI 150 or 200
Alt1_PP_GF_100.kcp:	Pine with General Forest designation and a target SDI of 100
Alt1_biomass_thin_25tpa.kcp	intended to simulate removal of ladder fuels leaving overstory trees intact with a target of 25 trees per acre
Alt1_biomass_thin_100tpa.kcp:	intended to simulate density management in conifer stands of small trees with a target of 100 trees per acre
Alt1_mastication.kcp:	intended for WUI defense, roadsides, fuelbreaks, and slopes greater than 35% with a limit of mastication of trees <10” DBH to 100 trees per acre
Noncommercial mech:	designated for Noncommercial Mechanical treatments
Rx fire:	designated for prescription fire treatments
No treatment:	Non-Forest Service held lands designated for no treatments

Economic Metrics

Key Developer: Dr. John Hogland – Rocky Mountain Research Station, Research Forester

Dr. John Hogland (Rocky Mountain Research Station, Research Forester) spatially quantified multiple economic variables associated with implementing various vegetation management actions being proposed by the SERAL 2.0 project. Of particular interest to the team was creating spatially explicit estimates of potential revenues and removed volume given different treatment scenarios.

The economic attributes generated were based on the 16 silviculture prescriptions identified by the forest. Four different metrics were developed to inform costs and benefits across the project area and to enable a comparative analysis of the ability to provide wood product among alternatives (Hogland and Anderson 2014, Huang et. al 2018). Each selection polygon has a value for 1) total cost for treatments, 2) delivered market value from treatments, 3) net-value from treatments, and 4) total volume removed from a treatment. Values are calculated by identifying the CCF volume raster associated with the silvicultural prescription for the selection polygon.

Volume: Volume is the combined sawlog and biomass volume removed from the landscape, minus leakage, given a specified treatment and is measured in CCF. Volume estimates from F3 (Huang et al. 2018, Burrill et al. 2018) were broken down into sawlog and biomass components for the analysis because there are measurable differences between the two.

Timber harvest operations which remove biomass and sawlogs typically require a minimum product in order to mobilize equipment, operators, and staff to implement the treatment. Currently, volumes averaging greater than 7 CCF per acre best represent the common minimum product needed to ensure implementation of forest thinning requiring biomass and sawlog removal occurs.

Cost: The cost, in dollars, of the proposed forest thinning to move material from the forest to the relevant sawmill or biomass processing facilities. It is a combination of multiple factors that include: (1) the travel time to move woody materials from a landing to a facility along a road network, 2) the travel time to move woody materials from the forest to landings for in forest processing, and 3) various machine rates and operation costs given harvesting, processing, and hauling systems. Road maintenance or reconstruction needs were not considered in the modeling to estimate costs. Costs would be elevated proportionally with road maintenance or reconstruction needs.

Delivered Market Value: Delivered market value is the market value of the product removed. In this context, the delivered market value refers to the total dollar amount paid for woody biomass and sawtimber products. It is derived by the amount of removed volume measured in CCF with the proposed forest thinning prescription applied and the market price. Market values vary by species of tree and are variable. Market values for this analysis were based on the estimated values as of May 2023. DMVs were calculated for each raster by silviculture prescription assigned to that particular raster across the project area.

Net-Value: The net-value is the difference between the delivered market value and the cost to implement the proposed forest thinning. Post-treatment modeled estimates of net-value are presented as total gains or losses in dollars.

Stand Density Index

(post__D83_NoMGT, Alt1d83)

Key Developers: Shengli Huang, Carolos Ramirez, Marcus McElhaney, Kirk Evans – "F3 Team" – R5 Remote Sensing Lab

Stand density index (SDI) is a measure of stand density and competition, which is based on the number of trees per unit area (i.e., trees per acre) and the size of those trees (the quadratic mean diameter, or QMD,

which is the diameter at breast height of the tree of mean basal area). SDI was calculated by the zonal mean of all 30-meter F3 derived (Huang et al. 2018, Burrill et al. 2018) SDI raster cells contained within each ForSys selection polygon.

Basal Area

Key Developers: Shengli Huang, Carolos Ramirez, Marcus McElhaney, Kirk Evans – "F3 Team" – R5 Remote Sensing Lab

Basal area is another common measure of stand density and also an important indicator of forest health. It is determined from the sum of cross-sectional areas of all stems in a stand measured at breast height and expressed in unit of land area (square feet per acre, for example). Basal area was calculated by the zonal mean of all 30-meter F3 derived (Huang et al. 2018, Burrill et al. 2018) Basal Area raster cells contained within each ForSys selection polygon.

E.04 The Final Input Dataset

All of the efforts to develop the landscape condition metrics described above collectively resulted in the final ForSys input dataset. This ForSys input dataset is used in each ForSys scenario run to make selections of landscape units within a study area.

The ForSys input dataset attributes are used for setting: (1) scenario objectives; (2) constraints; (3) thresholds; and (4) availability masks. Collectively, these parameters define a given management scenario.

The SERAL 2.0 ForSys input dataset was received on September 11, 2023.

Final SERAL 2.0 ForSys Input Dataset is available as a geodatabase feature class (zipped) on the project website. See "SERAL2_ScopingData.gdb/SERAL2_ProposedAction_LandscapeMetrics".

E.05 Running ForSys

The ForSys scenario planning tool allows Forest managers to examine combinations of objectives, constraints, thresholds, and availability masks to evaluate trade-offs among a range of treatment area scenarios. Each ForSys scenario run produces both spatial and tabular outputs for Forest managers and planning teams to explore. For SERAL 2.0, staff on the Stanislaus National Forest used ForSys-R to examine scenarios to represent the proposed action.

ForSys enabled the SERAL 2.0 team to examine tradeoffs between different modeled scenarios supported by and made possible by scientifically defensible data developed by qualified and experienced individuals and teams from universities, research stations, and the R5 Mapping and Remote Sensing group.

With the project purpose and need well developed, the SERAL 2.0 team was able to use ForSys to rapidly synthesize key information to locate and select proposed treatment areas within the project area.

Objectives

An objective is a metric, usually related to an ecological or social goal, that is used to prioritize selection of treatment units. ForSys can select units based on multiple objectives and can run multiple scenarios that vary the objective weights so that tradeoffs can be examined. Objectives are standardized as the percent contribution to the problem (PCP) with respect to the total in the study area allowing metrics with varying scales to be used. Any metric included in the ForSys input dataset could be used as an objective depending on the project's goals, management intent, or collaborative interests.

For the SERAL 2.0 proposed action, the mission-oriented expected net value change (LMU_eNVC_m) and the resilience departure index (res_depart) were selected as objectives because they best represented

the overall purpose and need of the SERAL 2.0 project — to increase landscape resilience to natural disturbances by restoring resilient forest conditions as guided by the NRV. These two landscape condition metrics were used as simultaneous objectives with weights from 0 to 5 in increments of 1. Applying these two metrics as objectives enabled ForSys runs to select units where predicted fire effects were most negative and forest structure was most departed from reference conditions.

The use of additional objective metrics was explored including flame length probabilities and fire transmission potential. However, runs with these additional metrics selected a very similar set of ForSys selection units as runs using only two objectives. It was determined that the mission-oriented expected net value change and resilience departure metrics well addressed the project purpose and need and adding additional metrics introduced unnecessary complexity.

Constraints

A constraint represents a limit on a given parameter within a planning area. Examples of possible constraints include total area treated, a budget, or a target harvest volume. In the SERAL effort we pursued the use of different constraints to both meet the purpose and need of the project and to enable critical aspects of the proposed action to be incorporated into the treatment area selection process.

Area treated was used as a constraint at two spatial scales. Forest thinning treatment area was constrained at the project scale based on the restoration need informed by comparing existing forest structure to average pre-settlement landscape condition (NRV Assessment, Appendix B, Table B.01-4). For each seral stage occurring in excess according to the NRV assessment, total area of forest thinning units selected was limited to the structural restoration needs identified. The proposed action included an additional constraint to limit mechanical treatments within CSO PACs to a maximum of 100 acres within each PAC.

Thresholds

Treatment thresholds are conditions that must be met for a ForSys selection unit to be considered for treatment. In the SERAL 2.0 effort, we pursued the use of different thresholds to increase the scrutiny during the treatment area selection process to meet the purpose and needs of the project, apply a more fine-tuned screening for areas selected for treatment within California spotted owl PACs, and to ensure units selected met certain operational criteria.

For the SERAL 2.0 proposed action, a threshold was applied within California spotted owl PACs requiring the value of the California spotted owl departure index (“CSOdprtF3W”) be greater than 0.5 to help ensure that treatments targeted the habitats most departed from reference conditions.

Additional thresholds were also applied to identify forest thinning and mechanical fuel reduction treatment areas. For forest thinning, a threshold was used to target treatment area selection to ForSys selection units to areas with conifers in WHR 3,4,5 M and D and to ensure that selected units included areas with forest conditions that could be treated. For example, where the logging system was identified as skyline or helicopter due to access and slope limitations, a threshold was used to only allow units to be selected when the estimated average sawlog volume removed was equal to or greater than 7 CCF/acre. No additional thresholds were applied to restrict selection of tractor treatment areas.

For mechanical fuels reduction, a threshold was used to target treatment area selection to ForSys selection units with slopes less than or equal to 45% with conifers in WHR 1,2 all densities and WHR 3,4 in densities S&P and to areas with hardwoods and shrubs where they were located within 250 feet of a road.

Availability Masks

Availability masks enable managers to exclude selection polygons from a given ForSys run if they wish to avoid it being selected. For example, an availability mask can allow all private land to be excluded in a ForSys scenario. Any combination of multiple metrics included in the ForSys input dataset can be used as an availability mask. When using ForSys-R, any number of attributes may be applied as an availability mask to exclude selection polygons during a ForSys-R run.

For SERAL 2.0 areas designated as not available for treatment included California spotted owl and American Goshawk nest stands, private lands, Experimental Forests, areas with ongoing or recently completed timber harvest contracts, and designated Roadless and Near Natural land allocations.

SERAL 2.0 Proposed Action ForSys-R Runs

Table E.03-2 and Table E.03-3 below presents the parameters which defined the ForSys scenario runs that identified the proposed treatment areas of the proposed action.

Table E.03-2. ForSys scenarios used to select forest thinning treatment areas for the proposed action.

Scenario	Objectives / Priorities	Thresholds	Constraints	Availability Masks (Areas not Available)
1. Forest Thinning	(Res_Depart)	(CSOdprtF3W) > 0.5 within CSO PACs	NRV restoration need by veg type (acreage cap)	CSO and AGO Nest Stand
				CSO Territory ID: TUO0146; TUO0061; and TUO00151
	(lmu_eNVC_m)	CWHR 3,4,5 M&D	Max. 100 acres / CSO PAC	AGO PAC outside of WUI
	Slope Position* (TopoPos)			GGO PAC
		1) On <45% slopes**: Tot vol. >= 7CCF/acre or within CSO PAC 2) On >45% slopes: Sawlog volume >= 7 CCF/acre		Private Land
				Experimental Forest
				Recent and Ongoing Thinning Contracts
				Roadless and Near Natural
				Wild and Scenic

*Selection priority given to SW exposure and Ridges vs NE Exposure and Valley Bottoms **less than 30% of unit classified as >45% by Lidar derived slope layer (gt45_slope < 0.3)

Table E.03-3. ForSys scenarios used to select mechanical fuel reduction areas for the proposed action.

Scenario	Objectives / Priorities	Thresholds	Constraints	Availability Masks
2. Fuel Reduction	(Res_Depart)	CSOdprtF3W > 0.5 within CSO PACs	Max. 100 acres / CSO PAC total (Forest thinning + Mech fuel reduction may not exceed 100); **set each PAC availability to only acres remaining <=100.	CSO 10-acre Nest Stand and Goshawk 18-acre Nest Stand
	(lmu_eNVC_m)	Conifers in CWHR 1,2 all densities and CWHR 3,4 S&P		AGO PAC outside WUI
		Conifers CWHR 3,4,5 M&D where Tot vol. / acres <7 CCF		Recent and Ongoing Thinning Contracts
		Slope ≤ 45%**		GGO PAC
		Hardwood, shrub, or other vegetation within WUI or within 250 feet of road		Fuelbreaks
				Private Land
				Experimental Forest

APPENDIX F: CUMULATIVE EFFECTS

Table F.01-1. List of reasonably foreseeable actions considered for cumulative effects.

Project Names	Planned Implementation	Type of Action	Acres
Private Timber Harvest	1-2 years (2024-2026)	Clearcut	854
		Fuelbreak/Defensible Space	223
		Commercial Thin	70
		Road Right of Way	2
		Selection	87
		Aspen/Meadow/Wet Area Restoration	7
Gooseberry Ecological Restoration	2024-2026	Commercial Thin	615
		Pile and Burn	181
		Precommercial Thin	318
Rim Fire Reforestation	2025-2026	Precommercial Thin	809
Rock Creek HFRA	2024-2027	Commercial Thin	1,472
Twomile Ecological Restoration	2024-2026	Commercial Thin	835
		Precommercial Thin	544
		Pile Burning	64
		Salvage Cut	263
Cold Springs HFRA	2024	Thinning for Hazardous Fuels Reduction	365
Hazard Tree Management	2025 - 2035	Hazard Tree Removal	35,916

APPENDIX G: GLOSSARY

Biomass: Generally, refers to non-merchantable material (i.e., not sawtimber); may include live trees (generally less than 10 in. DBH) or dead trees or brush.

Broadcast Burning: Prescribed burning activity where fire is applied generally to most or all of an area within well-defined boundaries for reduction of fuel hazard, as a resource management treatment, or both (NWCG Glossary).

Active Crown Fire: During an active crown fire, fire advances from crown to crown in the tops of trees or shrubs. Active crown fires generally produce high severity effects and are considered 'stand replacing' because they top-kill and / or consume most of the dominant overstory vegetation. Active crown fire is linked to surface fire, perpetuated by a combination of surface and canopy fuels.

Conditional Crown Fire: Conditional crown fires move though the crowns of trees but are not linked to surface fire. Conditional crown fires initiate in an adjacent stand and spread through canopy fuels alone. Conditional crown fires burn in areas where canopy base heights are too high for crown fire to initiate within the stand, but there is sufficient horizontal continuity of canopy fuels to carry a crown fire.

CWHR: The California Wildlife Habitat Relationship (CWHR) is a wildlife information system and predictive model for California's regularly-occurring birds, mammals, reptiles and amphibians and is considered "a state-of-the-art information system for California's wildlife."

DBH: diameter at breast height, refers to the tree diameter measured at 4.5 feet (1.37 meters) above the ground.

Dry Mixed Conifer: As used in Safford and Stevens (2017), "dry mixed-conifer" generally refers to mixed conifer forests with a dominance by yellow pine and an annual precipitation mostly <40 inches

Fire Type: Fire types are characterized into four categories: active crown fire, conditional crown fire, passive crown fire, and surface fire.

Fuelbreak: A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled (NWCG Glossary).

Fuels: Any combustible material, such as found in wildlands, that is made up from dead or alive vegetation.

HVRA: Highly valued resources and assets (HVRAs) are simply the things we care about. HVRAs can be both qualitative (e.g., visual quality) or quantitative (e.g., tons of carbon). There are a multitude of HVRAs for national forests, and the choice of a single or multiple HVRAs depends on the project objectives and needs. Some resources have only modest value and may not be analyzed so that efforts can be focused on the more highly valued resources and assets. At the national scale Calkin et al. (2010) categorized HVRAs into: critical habitat, recreation infrastructure, energy infrastructure, air quality, and municipal watersheds. In an assessment of the Lewis and Clark National Forest Thompson et at. (2013) categorized HVRAs into: green trees, wildlife habitat, infrastructure, watersheds and wildland urban interface. The precise HVRAs used in a fuels or vegetation project depends on the issues at hand as identified in the purpose and need.

Home Range Core Area (HRCA): As described in USDA Forest Service 2004, Home Range Core Areas (HRCAs) are established surrounding each territorial spotted owl activity center. The core area amounts to 20 percent of the area described by the sum of the average breeding pair home range plus one standard error which is 1,000 acres for the Stanislaus National Forest. The acreage in the 300-acre PAC counts toward the total home range core area.

Jackpot Burning: a type of prescribed burn that focuses on consuming a sporadic pattern of built up fuels (natural, human, or machine piled), as part of an understory burn.

Ladder fuels: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning (NWCG 2020b).

Mulching-type Mastication: Method of mastication where shredded material is mechanically incorporated into the surface of the soil with the masticating head. Rotating drum type heads are typically used, mounted horizontally. In contrast to 'traditional' mastication which leaves shredded material on the soil surface.

Natural Range of Variation (NRV): The "variation of ecological characteristics and processes over scales of time and space appropriate for a given management application. The NRV concept focuses on a subset of past ecological knowledge developed for use by resource managers incorporating a past perspective into management and conservation decisions. The pre-European-influenced reference period is considered to include the full range of variation produced by dominant natural disturbance regimes such as fire and flooding and should also include short-term variation and cycles in climate" (USDA Forest Service 2019).

Moist Mixed Conifer: As used in Safford and Stevens (2017), "most mixed-conifer" generally refers to mixed conifer forests with a greater fir presence and annual precipitation mostly >40 inches; moist mixed-conifer stands are also more common at higher elevations.

Protected Activity Center (PAC): An active or suspected California spotted owl nest stand based on territorial owl behavior (USDA 2019). The PAC is a USFS land allocation designed to protect and maintain high-quality CSO nesting and roosting habitat around active sites (Verner et al. 1992). PACs have been found to generally accommodate spotted owl nesting and roosting activities (Berigan et al. 2012).

Pile burning: Piling slash resulting from logging or fuel management activities and subsequently burning the individual piles.

POD: Potential wildland fire Operational Delineation (PODs) are polygons whose boundary features are relevant to fire control operations (e.g., roads, ridgetops, and water bodies). PODs are created by local fire experts with the help of analytical tools that highlight landscape features with control potential and provide information on their likely effectiveness. See Dunn et al. 2020.

Quadratic Mean Diameter (QMD): The diameter at breast height of the tree of average basal area. In forestry, quadratic mean diameter or QMD is a measure of central tendency which is considered more appropriate than arithmetic mean for characterizing the group of trees which have been measured.

Sawtimber: refers to live or dead trees that meet commercial sawlog specifications

Seral Stage: A developmental phase, or successional class, of a forest stand, with characteristic structure and plant species composition. Seral stages are generally classified as Early, Mid-, or Late-Seral (Figure D-1).

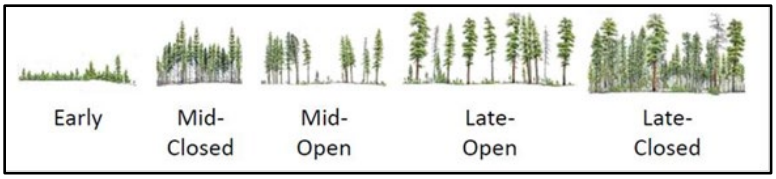

Figure D-1. Example classification of different seral stages in a Sierra Nevada mixed conifer forest (Images from Haugo et al. 2015; originally by Robert Van Pelt).

Surface Fire: Surface fires burn in surface and understory fuels only. Such fires consume surface fuels such as litter, duff, dead/down woody fuels, and herbaceous or shrubby fuels that are cured enough to be 'available' (or flammable) as fuel. Surface fire can be beneficial or detrimental in forested ecosystems, depending on the fuel loading and the conditions under which the fire burns.

Territory: As described in USDA Forest Service 2019, territorial owls, including pairs (with young), defend a core geographic use area consistently used for nesting, roosting, and foraging, containing essential habitat for survival and reproduction (Bingham and Noon 1997, Blakesley et al. 2005, Gutiérrez et al. 1995, Rosenberg and McKelvey 1999, Swindle et al. 1999, Williams et al. 2011).. Scientists in the central Sierra Nevada have defined the core area as a radius equal to half the mean-nearest-neighbor distance between the centers of adjacent owl sites (USDA Forest Service 2019). This equates to a distance of 1.1 kilometers (0.7 miles) and an area of 400 hectares (1,000 acres) (Jones et al. 2017, Seamans and Gutiérrez 2007, Tempel et al. 2014a). The 1,000 acres includes the associated PAC.

Threshold of Concern (TOC): The level of watershed disturbance which, if exceeded, could create adverse watershed or water quality effects, in spite of application of best management practices and project design criteria.

Understory burn or Underburn: A fire that consumes surface fuels but not the overstory canopy; prescribed burning under a forest canopy (NWCG 2020b).

Yellow Pine: refers to ponderosa pine (*Pinus ponderosa*) and Jeffrey pine (*Pinus jeffreyi*).