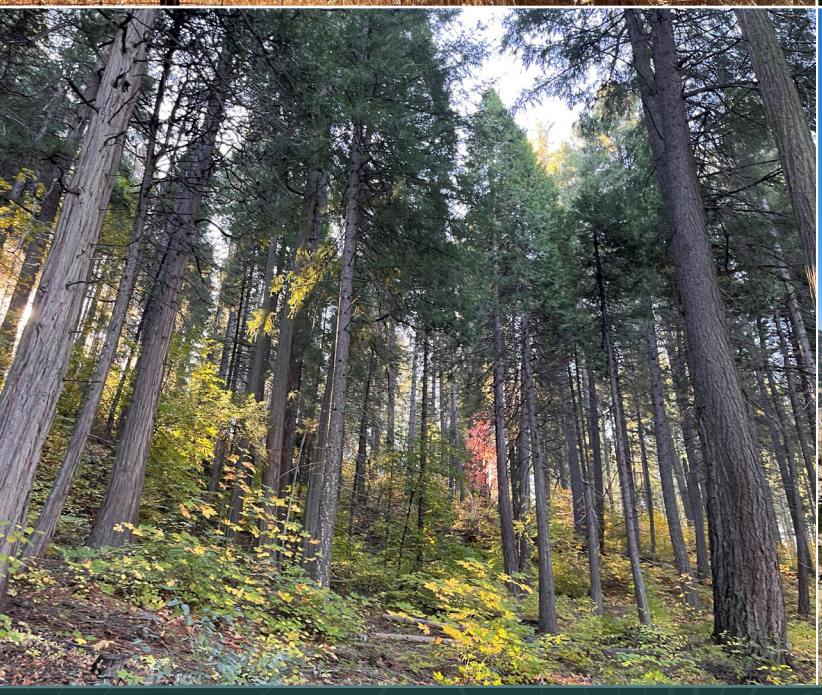
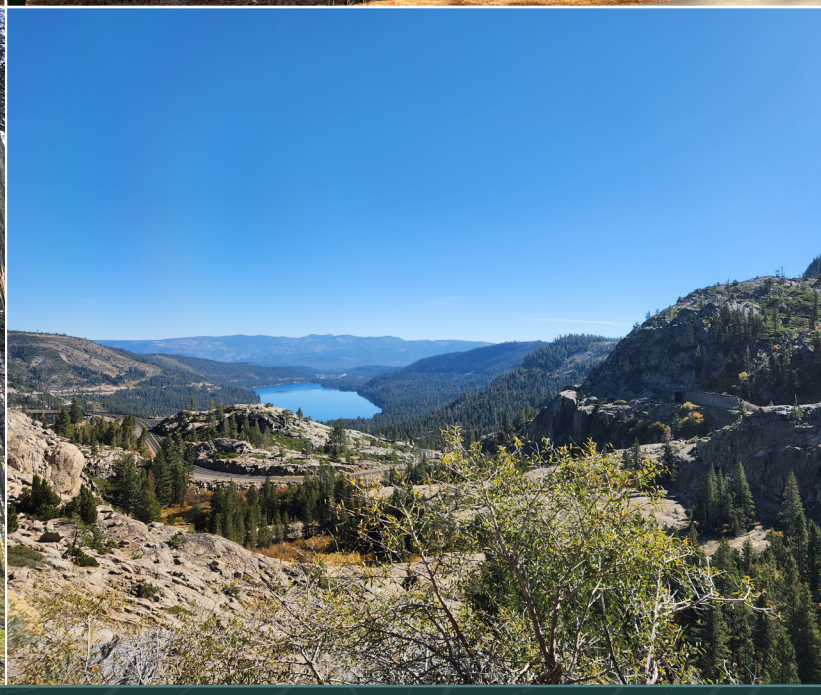
NEVADA COUNTY
CALIFORNIA

LAND MANAGEMENT PLAN



READY NEVADA COUNTY

PREPARED BY:
DUDEK

LAND MANAGEMENT PLAN

Nevada County

DECEMBER 2025

Prepared for:

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Navigating This Plan

The following Use Matrix is provided to guide the users of this plan in finding resources to guide vegetation management project implementation. It is organized by dominant vegetation (fuel) type and provides references to plan sections where one can find further information about vegetation descriptions, vegetation management principles, vegetation treatment techniques, and vegetation treatment types.

Fuel Type	Vegetation Summary	Principles of Vegetation Management	Effective Treatment Techniques in this Fuel Type	Treatment Types
Conifer Forest/ Woodlands	Section 2.2.3.1	Section 4.1.3	Biological (grazing) (Section 3.1.1) Manual (Section 3.1.2) Mechanical (Section 3.1.3) Prescribed Fire (Section 3.1.4) Chemical (Section 3.1.5)*	Wildland Urban Interface (Section 4.2.1) Fuel Breaks (Section 4.2.2) Ecological Restoration (Section 4.2.3)
Mixed Conifer	Section 2.2.3.2	Section 4.1.3	Biological (grazing) (Section 3.1.1) Manual (Section 3.1.2) Mechanical (Section 3.1.3) Prescribed Fire (Section 3.1.4) Chemical (Section 3.1.5)*	Wildland Urban Interface (Section 4.2.1) Fuel Breaks (Section 4.2.2) Ecological Restoration (Section 4.2.3)
Hardwood Forest/ Woodland	Section 2.2.3.3	Section 4.1.3	Biological (grazing) (Section 3.1.1) Manual (Section 3.1.2) Mechanical (Section 3.1.3) Prescribed Fire (Section 3.1.4) Chemical (Section 3.1.5)*	Wildland Urban Interface (Section 4.2.1) Fuel Breaks (Section 4.2.2) Ecological Restoration (Section 4.2.3)
Shrub	Section 2.2.3.4	Section 4.1.2	Biological (grazing) (Section 3.1.1)** Manual (Section 3.1.2) Mechanical (Section 3.1.3) Prescribed Fire (Section 3.1.4) Chemical (Section 3.1.5)*	Wildland Urban Interface (Section 4.2.1) Fuel Breaks (Section 4.2.2)
Herbaceous	Section 2.2.3.5	Section 4.1.1	Biological (grazing) (Section 3.1.1) Manual (Section 3.1.2) Mechanical (Section 3.1.3) Prescribed Fire (Section 3.1.4) Chemical (Section 3.1.5)*	Wildland Urban Interface (Section 4.2.1)

Notes: * Herbicide use should be done in concert with a treatment technique that reduces the volume of vegetation
** The effectiveness of biological techniques in shrub cover varies by time of year and the palatability of the plants present, consult a local grazing contractor.

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APPENDIX

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ANSI	American National Standards Institute
AQMD	Air Quality Management District
BLM	Bureau of Land Management
BMP	Best Management Practices
BTU	British Thermal Unit
CalVTP	California Vegetation Treatment Program
CAL FIRE	California Department of Forestry and Fire Protection
CCR	California Code of Regulations
CE	Categorical Exclusion
CEQA	California Environmental Quality Act
County	County of Nevada
CWPP	Community Wildfire Protection Plan
DBH	Diameter at Breast Height
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHSZ	Fire Hazard Severity Zones
FRAP	Fire and Resource Assessment Program
FZ	Forecast Zone
GIS	Geographic Information Systems
HFRA	Healthy Forests Restoration Act of 2003
HOA	Homeowners Association
HVRA	High Value Resources and Assets
LMP or Plan	Land Management Plan
LRA	Local Responsibility Area
MND	Mitigated Negative Declaration
NCRCD	Nevada County Resource Conservation District
NEPA	National Environmental Policy Act
NEU	Nevada-Yuba-Placer Unit
NOE	Notice of Exemption
OES	Nevada County Office of Emergency Services
Plan Area	Incorporated and Unincorporated Areas of Nevada County
PRC	California Public Resources Code
PSA	Project Specific Analysis
QWRA	Quantitative Wildfire Risk Assessment
RPF	Registered Professional Forester

Acronym/Abbreviation	Definition
RWQCB	Regional Water Quality Control Board
SRA	State Responsibility Area
SSI	Sierra Streams Institute
SYRCL	South Yuba River Citizens League
TAC	Technical Advisory Committee
TFPD	Truckee Fire Protection District
THP	Timber Harvest Plan
TNF	Tahoe National Forest
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
VHFHSZ	Very High Fire Hazard Severity Zone
VMP	Vegetation Management Plan
WRA	Wildfire Risk Assessment
WUI	Wildland Urban Interface
YWI	Yuba Watershed Institute

Common Terms Used in This Document

Fire Hazard: The physical conditions that create a likelihood of fire and expected fire behavior over a 30 to 50-year period without considering mitigation measures such as home hardening, recent wildfire, or fuel reduction efforts (CAL FIRE 2025a).

Fire Risk: The potential damage a fire can do to the area under existing conditions, accounting for any modifications such as fuel reduction projects, defensible space, and ignition resistant building construction (CAL FIRE 2025a).

Fire Severity: The degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time (NWCG 2025).

Treatment Technique: The specific methods used to achieve the particular goal of a fuel reduction project.

Treatment Type: The category of fuel reduction project based on the intended project goal.

Project: A planned fuel reduction project with a start and end date, and a well-defined goal. Projects are typically confined to a specific geographic area.

Wildland Urban Interface: The geographical area where human development, including structures and other infrastructure, meets or intermixes with undeveloped wildlands (NIST 2023).

Executive Summary

The County of Nevada (County) exhibits a complex fire environment that presents a significant risk to public and firefighter safety and the built and natural environment. The region has experienced numerous damaging wildfires, is influenced by local extreme wind and weather conditions (including high wind events), has steep and varied terrain, and includes a complex mosaic of vegetation types—all located within close proximity or intermixed with developed areas and human activity.

This Land Management Plan (LMP) is a component of the County's Roadmap to Resilience. The purpose of the Roadmap to Resilience is to outline a framework for reducing wildfire risk and increasing community resilience within the County. In addition to the LMP, the Roadmap to Resilience includes the following:

- A Community Wildfire Protection Plan (CWPP) to provide community-focused fire protection and risk mitigation strategies for at-risk communities
- A Local Hazard Mitigation Plan that addresses all hazards County-wide, including wildfire.
- An Evacuation Study that identifies, assesses, and tailors strategies for the five most evacuation-vulnerable areas in Nevada County, analyzes fire behavior and traffic dynamics for effective evacuation planning, and provides recommendations for roadway improvements and wildfire mitigation projects to enhance evacuation route safety and capacity.

Of the variables that comprise the fire environment (weather, terrain, and fuels [vegetation]), fuels are the only variable that can be managed. Research indicates that vegetation management can aid in wildfire resilience—the ability for the forested system and the surrounding community to resist and recover from wildfire without sustaining permanent loss. This LMP acknowledges that fire is an integral, necessary component of healthy forests, and that vegetation is a dynamic component of wildfire hazard, necessitating an adaptive management approach. The LMP functions to guide the implementation of vegetation management projects by outlining management types and fire risk reduction techniques and identifying a series of best management practices (BMPs) to be implemented during vegetation management activities to reduce or avoid impacts to natural resources.

This LMP has been prepared with direct input from Nevada County Office of Emergency Services (OES), Nevada County Resource Conservation District (NCRCD), and the LMP Technical Advisory Committee (TAC), which includes representatives from Truckee Fire Protection District (TFPD), Yuba Watershed Institute (YWI), United States Forest Service (USFS), California State Parks, Tahoe Donner Home Owner's Association (HOA), CAL FIRE, and Sierra Streams Institute (SSI). Development of this LMP demonstrates the County's commitment to reducing wildfire risk through collaborative and multi-beneficial risk reduction projects in the County Project Priority Areas.

Acknowledgments

This LMP was supported in part by a grant from the U.S. Department of Agriculture (USDA), Forest Service, Cooperative Fire Community Wildfire Defense Grant Program, under the authority of the Infrastructure Investment & Jobs Act.

Additionally, this Project was made possible by funding provided by a grant from the California Department of Forestry and Fire Protection as part of the California Climate Investments Program, through the California Fire Safe Council.

Nevada County is an equal opportunity provider.

1 Introduction

California forests evolved with fire and are fire-adapted but face a dramatic increase in the number and severity of wildfires. Eighteen of the 20 most destructive wildfires in the state's history have occurred since 2000, and 15 have occurred since 2015 (CAL FIRE 2024a). In recent years, California has seen its deadliest and most destructive fire season on record (2018) and its largest fire season on record, with 4% of the state's total land burning in a single year (2020) (CAL FIRE 2024b), roughly approaching estimates of pre-settlement burn area for the first time in centuries.

The County of Nevada (County) exhibits a complex wildfire environment that presents a significant risk to public and firefighter safety and the built and natural environment. The County has a history of large, damaging wildfires, including the 1988 49er Fire (36,343 total acres/148 homes destroyed) the 1994 Trauner Fire (536 total acres/34 structures destroyed), the 2001 Martis Fire, (14,127 total acres/4 structures destroyed), and the 2021 River Fire (2,619 acres/142 structures destroyed). Nearly 325,000 acres of the County (excluding federal land) are mapped as Very High Fire Hazard Severity Zones (VHFHSZs) (CAL FIRE 2024e, 2025b).

Of the variables that comprise the fire environment (weather, terrain, and fuels [vegetation]), fuels are the only variable that can be managed. Research indicates that proper planning, including vegetation management, can aid in wildfire resilience. The goal of vegetation management identified in this Land Management Plan (LMP) is to strategically treat vegetation to minimize the ignition potential and the likelihood of extreme fire behavior. This can be achieved by modifying the structure, composition, and spacing of retained vegetation within treatment areas. Conducted in strategic and prioritized locations, such management actions can reduce surface fuel loads, reduce ladder fuels, facilitate invasive species management, enhance fuel/fire breaks, reduce wildfire ignition potential, provide defensible space around structures and assets, enhance ingress and egress routes, and minimize potential wildfire impacts on communities, natural resources, and other values at risk.

The LMP outlines a framework for managing vegetation within the Plan Area (the County of Nevada, covering 623,213 acres within incorporated and unincorporated areas) and acknowledges that vegetation is a dynamic component of wildfire hazards, necessitating an adaptive management approach. The LMP framework focuses on vegetation management in areas where vegetation conditions pose a wildfire risk to communities, natural resources, and other values at risk. This LMP functions to guide the implementation of vegetation management projects by outlining management types and fire risk reduction techniques. Project Priority Areas are identified in the County's 2025 Community Wildfire Protection Plan (CWPP) and are areas within Nevada County where wildfire risk reduction activities should be a priority to both mitigate the wildfire risk and protect the values of the Nevada County community. In addition to vegetation management types and techniques, this LMP identifies a series of Best Management Practices (BMPs) to be implemented during vegetation management activities to reduce or avoid impacts to resources present in the Plan Area.

The fire hazard conditions present in the County necessitate a proactive hazard mitigation approach. This LMP recognizes that vegetation management is only one component of a broader, multi-faceted approach to addressing and reducing fire hazards in the County. The California Department of Forestry

and Fire Protection (CAL FIRE) and local fire and land management agencies are actively engaged in vegetation management activities, as well as other wildfire risk reduction efforts through plans and programs that focus on other aspects to fire risk reduction beyond vegetation management.

This LMP has been prepared by the Nevada County Office of Emergency Services (OES) with direct input from stakeholders, local wildfire experts, non-profit organizations, land managers, fire agencies, community members, and the LMP Technical Advisory Committee (TAC), which includes representatives from various county, state, and federal land management agencies. This LMP is a component of the County's Roadmap to Resilience and includes a toolbox of regionally specific and technically vetted best practices for wildfire mitigation treatments that can be deployed at multiple scales.

1.1 Purpose

Vegetation can be managed to minimize the potential for ignition, facilitate suppression activities, and reduce the likelihood of extreme fire behavior, as well as increase general forest and community ability to recover after fire. Extreme fire behavior is classified as behavior that far exceeds the threshold of control for known fire suppression tactics and strategies. Annual expenditures associated with wildfire suppression in California have been steadily growing over the past 20 years, totaling $47.7 million in 1997/1998 (fiscal year) up to $1.23 billion in 2021/2022 (CAL FIRE 2024c). Vegetation management has proven to be a cost-effective approach to reducing wildfire hazards. Per the Federal Emergency Management Agency (FEMA) every $1 spent on mitigation saves $6 on future recovery (FEMA 2018)

The purpose of this LMP is to provide a framework for strategically managing vegetative fuel loads in Project Priority Areas in Nevada County, as defined in the County's CWPP, such that wildfire risk is reduced and potential environmental impacts resulting from vegetation management activities are avoided or minimized. The LMP will be implemented by parties conducting vegetation management activities in the County. The LMP includes outreach in the form of a Technical Advisory Committee (TAC) (Section 1.4) that includes various agencies, land managers, landowners, and stakeholders. As needed, County OES will coordinate with landowners, agencies, and interested parties to implement projects under this LMP.

While this LMP is intended to be a stand-alone document, the information and recommendations presented herein will be used by County OES in evaluating vegetation management needs on an ongoing basis. This LMP is a critical component of the County's Roadmap to Resilience and the CWPP. The LMP serves to fulfill the Healthy Forests Restoration Act (HFRA) recommendation that the CWPP identify BMPs for reducing wildfire risk.

1.2 Plan Scope and Timeframe

The LMP scope includes vegetation management recommendations to reduce wildfire risk in the County. Vegetation management is a fundamental strategy for reducing wildfire risk and is one component of an overall risk mitigation strategy. This LMP recognizes that vegetative management and hazardous fuel reduction are not the only actions that can reduce wildfire risk and includes non-vegetation management approaches that can support wildfire risk reduction. Other critical components, identified in the 2025 CWPP, necessary to reduce wildfire risk include, but are not limited to, structural hardening through

building codes and standards; providing and maintaining suitable ingress and egress routes; community education; ensuring water availability; firefighter training; and establishment, maintenance, and inspection of defensible space on private properties. Vegetation management types and techniques consider environmental impacts, benefits, and opportunities (such as restoration of native vegetation communities or the ecological benefits of low and mixed-severity fire) associated with implementation.

This LMP provides management recommendations appropriate at the time of Plan completion but considers the dynamic nature of vegetation and wildfire recurrence as well as the region's historical fire return interval (time between fires). Implementation of vegetation management projects will also alter wildfire hazard conditions in some locations for a period following completion but will require ongoing maintenance to maintain desired conditions. Therefore, this LMP may be applicable for a relatively short period (1–2 years) in areas experiencing wildfires or where projects are conducted, and for a longer period in areas not experiencing such changes. County OES will routinely evaluate and update this LMP based on current vegetation conditions and wildfire occurrence, as discussed in Section 5.

1.3 Plan Goals and Objectives

The County has identified four primary goals to guide the preparation of this LMP, and subsequent vegetation management actions intended to reduce wildfire hazard and risk. The LMP goals provide a framework under which more specific management objectives were developed to achieve desired levels of wildfire hazard reduction, public and firefighter safety, and resource protection. The purpose of the objectives is to enable the County to make informed, adaptive decisions based on site-specific conditions present in project areas. The goals and objectives of the LMP are as follows:

Goals

- Reduce wildfire hazards and wildfire risk in the County.
- Reduce the likelihood of ignitions and extreme fire behavior to enhance public and firefighter safety.
- Implement practices to avoid or minimize impacts on natural resources.
- Improve public awareness about the increasing risk of wildfire.
- Improve public understanding and responsibilities of living in a fire-adapted and fire-prone landscape.

Objectives

- Reduce the likelihood of catastrophic wildfires by limiting ignition potential[1], reducing fuel loads, and modifying fuel arrangements in Project Priority Areas.
- Provide a framework for identifying and defining vegetation management projects that consider site-specific vegetation type, fuel hazard, treatment effectiveness, treatment location within a landscape/regional context, and ongoing maintenance needs.
- Develop management recommendations that enable the County to make informed, adaptive decisions on a project basis, considering the benefits of treatment and potential environmental effects.

[1] Limiting or minimizing ignition potential in the context of this LMP means managing fuels to reduce the likelihood that a new fire ignition spreads beyond its point of origin.

- Avoid, minimize, and/or reduce potential adverse effects of vegetation management on sensitive natural resources (e.g., biological, cultural, water, aesthetics, soils, slope stability, etc.).
- Increase the ability of fire agencies to engage with wildfire in the Plan Area to minimize wildfire impacts on the Plan Area's identified High Value Resources and Assets (HVRAs).
- Increase the ability of forests in the wildland urban interface (WUI) to recover from wildfire with limited post-fire management need.
- Encourage vegetation management project implementation across different land ownerships.
- Engage and educate public and private stakeholders on the increasing risks of wildfire and responsibilities when living in the WUI.

1.4 Plan Development Coordination

1.4.1 Project Team

The Project Team responsible for the development of this LMP includes the following:

- Alex-Keeble-Toll, Director of Emergency Services, Nevada County OES
- Alessandra Zambrano, County Wildfire Coordinator, Nevada County OES
- Alex Gertiz, Registered Professional Forester, Nevada County OES
- Nathan Alcorn, Program Director, Nevada County RCD

1.4.2 Technical Advisory Committee

1.4.2.1 Role

A Technical Advisory Committee (TAC) for the LMP was established to provide feedback on the LMP process. County OES selected TAC members, which include representatives from federal, state and local fire agencies, land management agencies, resource conservation districts, and research organizations. The TAC's purpose is to provide feedback on the LMP; identify local opportunities and constraints associated with vegetation management in the Plan Area; and discuss opportunities and challenges, project implementation experience, and opportunities for future collaboration.

1.4.2.2 Members

Table 1 identifies the members of the LMP TAC.

Table 1. Technical Advisory Committee Members

Members	Representation
Dillon Sheedy	Truckee Fire Protection District
Chris Friedel	Yuba Watershed Institute
Rita Clipperton	U.S. Forest Service
Richard Steffke	U.S. Forest Service

Table 1. Technical Advisory Committee Members

Members	Representation
John Groom	Tahoe Donner HOA
Ben Grewder	Tahoe Donner HOA
Lindsay Ryan	Tahoe Donner HOA
Steve Garcia	CAL FIRE NEU
Landon Haack	CAL FIRE NEU
Jeff Lauder	Sierra Streams Institute
Rich Adams	California State Parks
Robert Griffith	California State Parks

1.4.2.3 Meetings/Review Process

TAC meetings/reviews were held as identified below:

- March 12, 2025: Meeting held via Teams to introduce the LMP purpose and contents, discuss the Plan Area, and solicit preliminary information regarding planned vegetation management activities and wildfire risk reduction efforts in the Plan Area.
- September 9–24, 2025: TAC review of the Draft LMP.

Following the TAC review of the Draft LMP, proposed edits were reviewed and incorporated into the Final LMP as appropriate.

1.4.3 Stakeholders

Stakeholders in the County that may conduct vegetation management activities were engaged as part of LMP development and included the following:

- Caltrans
- Nevada County Agricultural Commissioner
- South Yuba Citizens League
- City of Nevada City
- City of Grass Valley
- Truckee Donner Land Trust
- Bear Yuba Land Trust
- Nevada County Recreation Department
- Nevada Irrigation District
- Truckee River Watershed Council
- Bureau of Land Management

- Sierra Pacific Industries
- Truckee Tahoe Airport District
- Pacific Gas and Electric (PG&E)

1.4.4 Land Management Plan Workshop

A workshop was held on September 13, 2024, to solicit input from stakeholders on vegetation treatment techniques. Feedback was collected from attendees regarding their experience with vegetation treatment in Nevada County and focused on the following information: ideal vegetation for treatment, ideal landscapes for treatment, vegetation constraints to treatment, landscape constraints to treatment, sensitive species constraints to treatment, tribal/cultural resources considerations, treatment timing (time of year), environmental review (CEQA/NEPA) considerations, budget ranges, and other considerations. Representatives from the following agencies/entities were in attendance at the workshop:

- U.S. Forest Service
- Truckee Fire Protection District
- California Fire Safe Council
- Sierra Streams Institute
- South Yuba River Citizens League (SYRCL)
- Nevada County Consolidated Fire District
- Truckee Tahoe Airport District
- Boreal Mountain
- National Forest Foundation
- California State Parks
- Town of Truckee
- Truckee Tahoe Airport District
- City of Nevada City

2 Plan Area Description

2.1 Location

For the Land Management Plan (LMP), the Plan Area encompasses all areas and all lands within Nevada County, totaling 623,213 acres (Figure 1 Plan Area Location). Given the significant variability in climate, fuels, weather, terrain, and communities across the County, the County was divided into four Forecast Zones (FZs) for the purposes of modeling wildfire hazard and risk as a component of the Wildfire Risk Assessment (WRA), which informed development of the Community Wildfire Protection Plan (CWPP). FZ boundary delineations were based on hazard but aligned with community boundaries to keep community values and identities intact. Analysis at the FZ level better captures fire weather influences and better informs planning decisions related to fire management. For continuity with the WRA and the CWPP, these FZs are discussed and referenced in this LMP. The four FZs for the County are identified and summarized in Table 2 and depicted in Figure 2, Forecast Zones. Additionally, the Project Priority Areas identified in the WRA and the CWPP are presented in Figure 3, Project Priority Areas.

Table 2. Forecast Zones

Forecast Zone	Total Acreage
Higgins/Penn Valley	143,715
Grass Valley/Nevada City	136,166
Tahoe National Forest Area	234,891
Truckee/Donner	108,438

Nevada County has an estimated population of 102,293 (County of Nevada 2024). The majority of residents live in the Grass Valley/Nevada City Forecast Zone (FZ), which contains the urban centers for western Nevada County. The incorporated areas of the City of Grass Valley, City of Nevada City, and Town of Truckee house 33% of the County's population, while the remaining 67% live in unincorporated areas (County of Nevada 2024). Numerous public agencies and private entities own land within the Plan Area, as presented in Figure 4, Land Ownership, and Table 3, Land Ownership in the Plan Area.

Table 3. Land Ownership in the Plan Area

Land Ownership	Total Acreage	Percentage
Private Ownership	376,033[2]	60%
United States Forest Service	196,820	32%
United States Bureau of Land Management	17,077	3%
Truckee Donner Land Trust	10,811	2%
Nevada Irrigation District	8,941	1%
California Department of Parks and Recreation	8,316	1%
California Department of Fish and Wildlife	4,034	1%
Bear Yuba Land Trust	2,018	<1%

[2] Includes industrial timberland, unreserved forest lands owned or managed for the production of wood (USDA FS 2025)

Table 3. Land Ownership in the Plan Area

Land Ownership	Total Acreage	Percentage
The Nature Conservancy	1,904	<1%
University of California	1,492	<1%
California Department of Forestry and Fire Protection	927	<1%
Truckee Tahoe Airport District	890	<1%
United States Army Corps of Engineers	587	<1%
California State Lands Commission	228	<1%
Nevada City, City of	180	<1%
Placer Land Trust	142	<1%
Truckee-Donner Recreation and Park District	119	<1%
Grass Valley, City of	114	<1%
Western Gateway Recreation and Park District	86	<1%
California Heritage: Indigenous Research Project	33	<1%
North Star Historic Conservancy	14	<1%
Nevada, County of	11	<1%
Grass Valley School District	9	<1%
South Sutter Water District	6	<1%
Other State	2	<1%
Yuba Water Agency	<1	<1%

Source: CAL FIRE 2024d.

Fire Hazard Severity Zones (FHSZ) are "geographical areas designated pursuant to California Public Resources Code (PRC), Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Areas (SRA) or as Local Responsibility Area (LRA) Very High Fire Hazard Severity Zone (VHFSZ) or non-VHFHSZ designated pursuant to California Government Code, Sections 51175 through 51189" (California Building Standards Commission 2016). SRA FHSZs in the Plan Area encompass 381,934 acres, including 303,771 acres classified as VHFHSZ. In 2024, CAL FIRE completed a statewide remapping update of FHSZs within the SRA and in 2025 CAL FIRE completed this mapping for FHSZs within the LRA. The acreage of FHSZs in the Plan Area is summarized in Table 4, FHSZ Distribution in the Plan Area.

Table 4. Fire Hazard Severity Zone Distribution in the Plan Area

Forecast Zone	FHSZ (acres)			
	Moderate (SRA)	High (SRA)	Very High (SRA)	Very High (LRA)
Higgins/Penn Valley	1,064 (<1%)	70,351 (49%)	68,823 (48%)	0
Grass Valley/Nevada City	353 (<1%)	714 (<1%)	110,273 (81%)	4,891 (4%)
Tahoe National Forest Area	743 (<1%)	2,974 (1%)	91,539 (39%)	0
Truckee/Donner	33 (<1%)	1,931 (2%)	33,136 (31%)	16,075 (15%)
Total	2,193	75,970	303,771	20,966

Source: CAL FIRE 2024e, 2025b.
Notes: FHSZ = Fire Hazard Severity Zone; SRA = State Responsibility Area; LRA = Local Responsibility Area.

Figure 1 - Plan Area Location

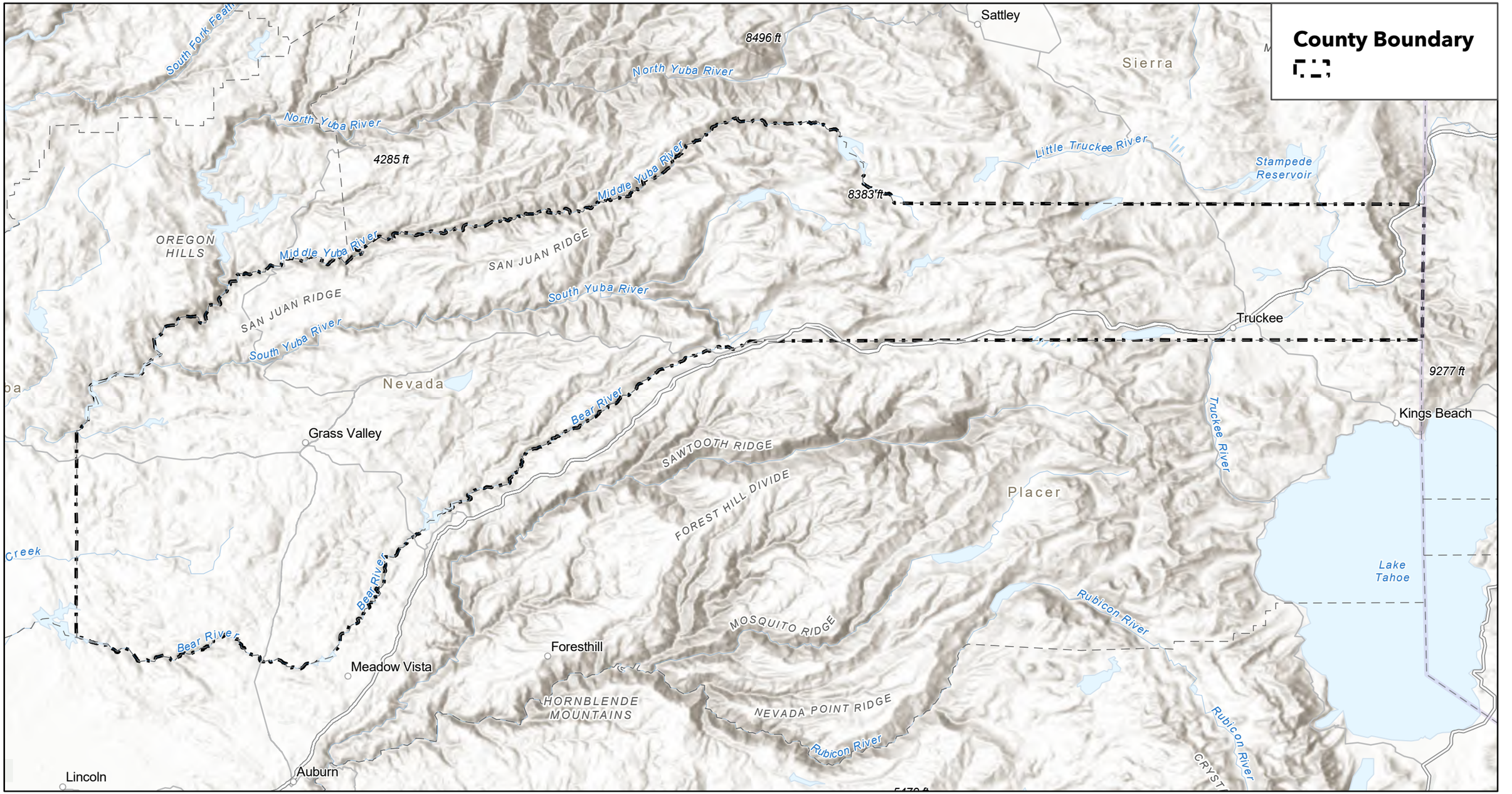

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Figure 2 - Forecast Zones

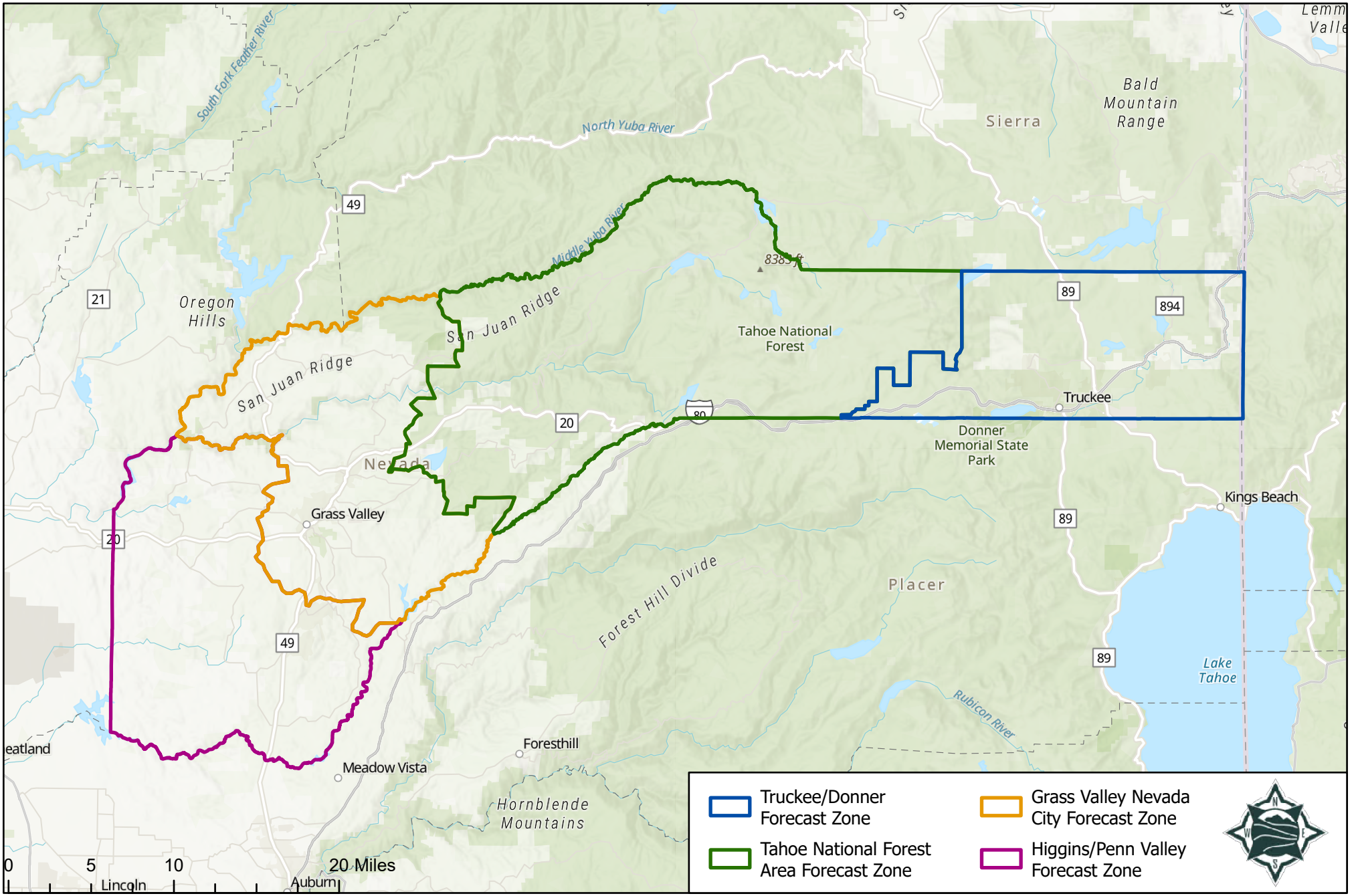

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Figure 3 - Nevada County Project Priority Areas

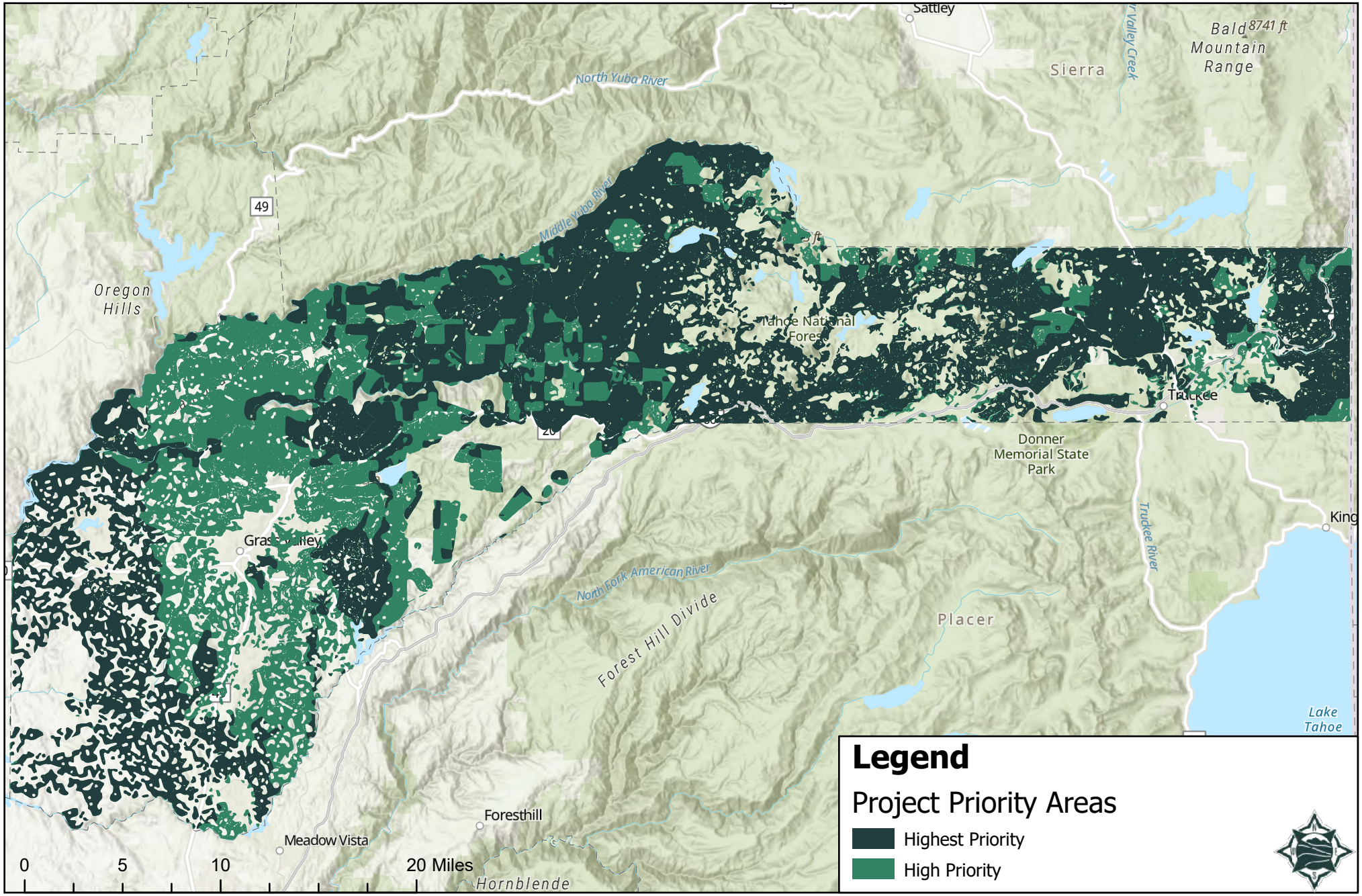

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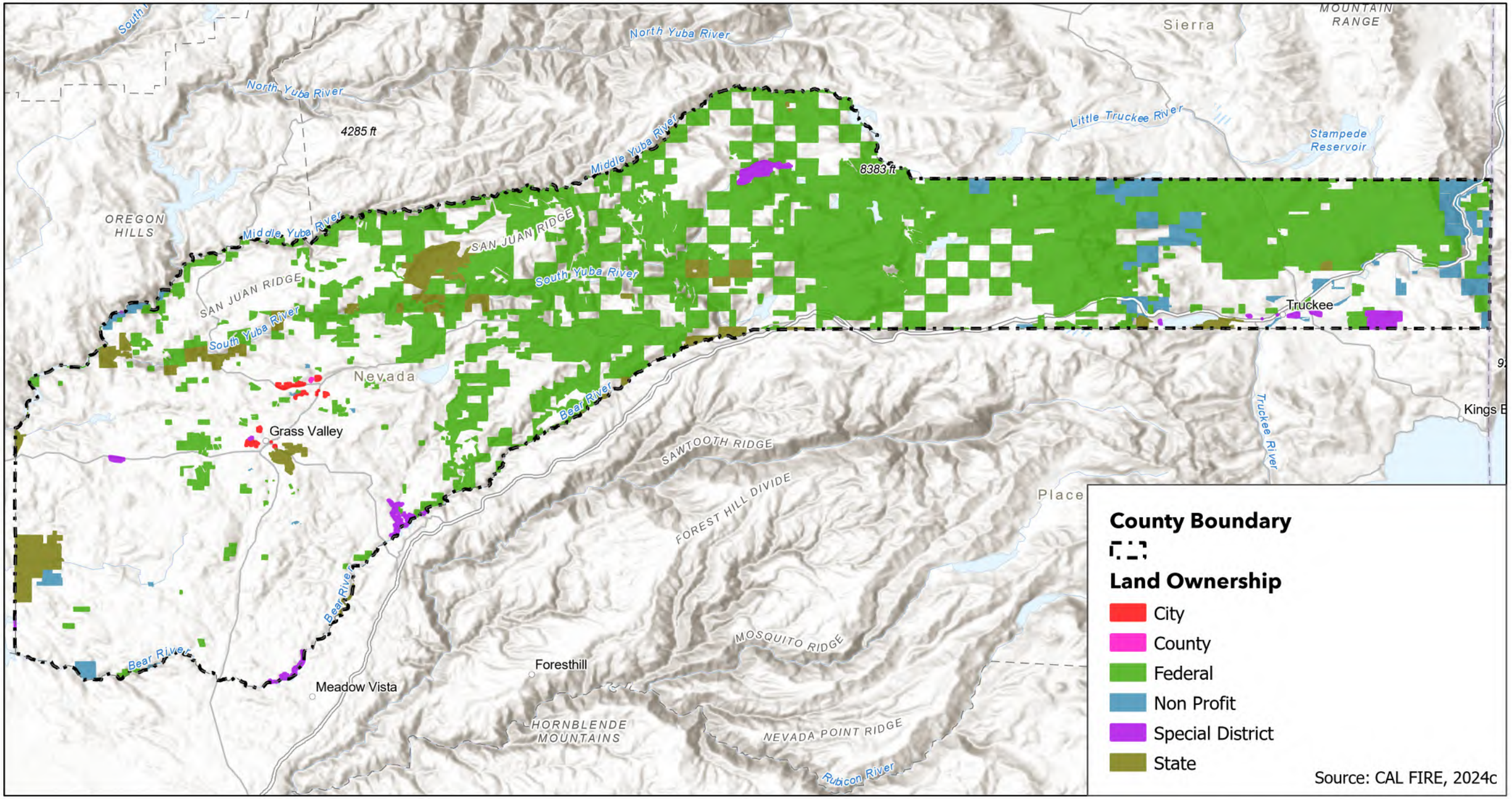
Figure 4 - Land Ownership



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2.2 General Description

2.2.1 Climate

Fire Behavior Triangle

The County is generally characterized by a Mediterranean climate with hot, dry summers followed by cool, wet winters. The western portion of the County is typically characterized by mild winters, with little snow (2022/2023 and 2023/2024 winter seasons were atypical, seeing more snowfall than typical years). Winters along the crest of the Sierra Nevada range and eastward are long and cold, with heavy snowfalls. Annual precipitation ranges from approximately 35 inches in the west to nearly 70 inches at the summits of the range. Peak summer temperatures in July average between 95°F and 100°F, and the winter temperatures in January average between 35°F and 55°F. The growing season (free from freezing temperatures) varies from more than 250 days in the western portions of the County (usually from mid-March to November), to as low as 25 days in the eastern portions (usually from mid-June to July) (County of Nevada 2017). Due to the County's diversity in elevation, which climbs up in elevation from 950 feet where the Yuba County and Nevada County lines meet to where Mount Lola sits in the Truckee area at 9,143 feet of elevation, microclimates and differences within the Forecast Zones (FZs) may exist (County of Nevada 1996). As such, conditions may be variable on a daily and seasonal basis throughout the County. Microclimatic conditions can greatly affect fire hazards and would be considered when determining vegetation treatments and implementation timing. Such conditions are often not captured in weather station datasets or recorded in easily referenced weather almanacs but are usually well known to residents, land managers, and local fire agency personnel. Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases (County of Nevada 2017).

Wind is one of the most significant factors influencing fire behavior. Higher wind speeds contribute to rapid wildfire spread and high-intensity fire behavior. Winds can be significant at times in Nevada County. Southwest winds in western Nevada County result in topographic wind alignment and are funneled through the river canyons. In eastern Nevada County, southwest winds pick up speed as they cross Donner Summit and can result in Red Flag Warning Days. A Red Flag Warning is issued by the National Weather Service when any combination of predefined criteria for extreme fire weather occurs. In Nevada County, this can be strong winds (greater than 25 miles per hour, high temperatures, low humidity levels (less than 20%), dry fuels, or the possibility of dry lightning strikes. North winds in Nevada County can occur during hot, dry conditions, which can lead to "red flag" days indicating extreme fire danger, especially in western Nevada County. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides (County of Nevada 2017). Predominant winds (in CAL FIRE's Nevada-Yuba-Placer Unit [NEU]

area, which encapsulates Nevada County) are southwest but commonly become north-to-northeast following weather systems. Fire weather conditions in the County generally become critical in late July through October. Note that this does vary across the County due to differences in climate, especially in eastern Nevada County. On average, a summer day is 85°F to 95°F with winds from the southwest at 0 mph to 7 mph and relative humidity of 20% to 25%. During these conditions, the ignition potential and likelihood of a fire growing into a significant event is high (CAL FIRE 2024f).

2.2.1.1 Climate Change Impacts to Fire Weather

As noted, California faces a dramatic increase in the number and severity of wildfires, with 15 of the most destructive fires occurring since 2015 (CAL FIRE 2024a). The state's major study on climate impacts, the Fourth Climate Assessment (OPR et al. 2019), projects that California's wildfire burn area is likely to increase by 77% by the end of the century. As identified in Governor Newsom's Strike Force report (State of California 2019), the growing risk of catastrophic wildfires has created an imperative for the state to act urgently and swiftly to expand fire prevention efforts. Current research has also identified that the frequency of autumn days with extreme fire weather has more than doubled in California since the early 1980s, a result of human-caused climate change. Such fire weather exhibits strong winds (e.g., north winds) and is coincident with unusually dry vegetation resulting from warm conditions over the summer months prior to the onset of autumn precipitation (Goss et al. 2020).

Climate change is expected to make landscapes more susceptible to extreme wildfires by altering temperatures (Hayhoe et al. 2004) and the availability and aridity of fuels (Abatzoglou and Williams 2016). Anthropogenic climate change has emerged as a driver of increased fire activity, a trend that is expected to continue (Abatzoglou and Williams 2016). All analyses completed for fire occurrence and severity into the future predict more frequent fires, a greater number of fires, and higher fire severity under climate change scenarios (Fried et al. 2004; Lenihan 2008; Westerling et al. 2011; Westerling 2018).

A changing climate, combined with anthropogenic factors, has already contributed to more frequent and severe wildfires in the western United States (Abatzoglou and Williams 2016; Mann et al. 2016; Westerling 2016; OEHHA 2022), with the number of human-caused fires being much higher in more populated regions of the state. Recently, the area burned by wildfires has increased consistent with increasing air temperatures (OEHHA 2022). Increased wildfire risk and severity are vulnerabilities that are anticipated throughout California (Westerling 2018; Krawchuk et al. 2009). Increased fire occurrence and severity under climate change would secondarily affect other areas of vulnerability, as noted below.

- Increased Fire Risk: Warmer air temperatures are expected to lengthen the fire season, drying out vegetation more quickly and increasing fire risk. Based on high- and low-emissions climate change scenarios, increases in the number of high-severity wildfires are anticipated (IPCC 2023, Westerling 2018). Multi-year severe drought is supported as a factor in increasing fire size and severity, as well as tree mortality (Crockett and Westerling 2018). On interannual and shorter time scales, climate variability affects the flammability of live and dead forest vegetation (Westerling 2016). The greatest increases in burned area are projected to be in forested areas, with annual average area burned in many parts of the Sierra Nevada doubling to quadrupling by end of century under the most extreme warming (Westerling 2018). Additionally, the frequency of extreme fire weather in the fall months has increased over the past 40 years, a trend which is expected to continue under climate change models (Goss et al. 2020).

- Greater Fuel Loads: Years with widespread fires are historically preceded by wet years, which influence greater vegetation growth, especially in the understory. Highly flammable species, which often populate disturbed areas quickly, may have a competitive advantage over other species, typically resulting in a higher, more flammable fuel load. Drought may result in increased tree mortality, which contributes to higher fuel loading and wildfire size and severity (Crockett and Westerling 2018). Increasing fire size and severity and tree mortality are linked to increasing temperatures and aridity (Crockett and Westerling 2018). Increased prevalence of dead or desiccated fuels resulting from drought effects is conducive to crown fires, which require ladder fuels to move from volatile grasses to the less volatile mid-level forest to the dry and volatile canopy cover (Crockett and Westerling 2018). Increased fuel aridity contributes to larger forest areas experiencing increased periods of high fire potential (Abatzoglou and Williams 2016).
- Ecological Impacts: Increased fire severity is expected to amplify and accelerate the ecological impacts of climatic change (Stephens et al. 2013, Prichard et al. 2021). Drought years may increase the vulnerability of tree populations to insects and disease (Young et al. 2017), and the lower occurrence of extended freezing periods in the winter would allow higher insect survivability. Climate-induced changes in fire behavior and frequency would influence species distribution, migration, and extinction (Flannigan et al. 2000, Moran 2020). Greater occurrence of fires increases the amount of carbon and particulates released into the atmosphere (Westerling and Bryant 2008). Shorter winters and earlier dry down periods may also dramatically shift plant community responses and ranges along an already competition-heavy elevation gradient of the Sierra Nevada (Moran 2020, Moran et al. 2021). Increasing drought severity may also decrease tree species ability to reproduce or defend against stress, leading to selection for genotypes excelling in one particular strategy and not resilient to all future stressors (Lauder et al. 2019).
- Social Impacts: Increased expenditures for fire suppression are anticipated, and the amount of burned property (in total area and monetary value) increases substantially under global climate models' high-emissions scenarios due to greater fire risk (Westerling and Bryant 2008; Levy 2018). This has been seen recently, where 2020 wildfires alone caused billions of dollars in damages (OEHHA 2022). In areas with the highest fire risk, wildfire insurance is estimated to see costs rise by 18% by 2055, and the number of properties insured is lowered (Westerling 2018). Wildland fire smoke exposure is a growing risk to public health (Domitrovich et al. 2017). Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects on regional business interests and local economies. This is especially true in Nevada County due to economic dependency on recreation tourism and the cultural values placed on natural resources in the community. The California Energy Commission, alongside UC Berkeley's Geospatial Innovation Facility, released Cal-Adapt in 2011 as a resource to highlight climate change research and future climate change projections for specific regions throughout the state (Cal Adapt, n.d.). Nevada County resides within the North Sierra Region, and climate projections for this region are provided below in Table 5.

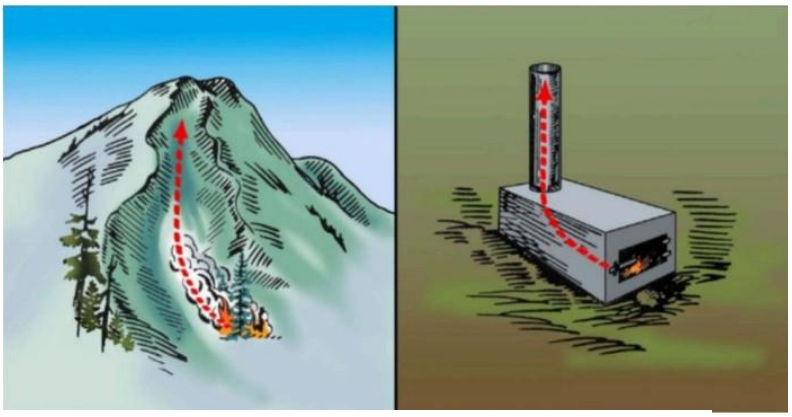
Table 5. Climate Change Projections for Nevada County

Effect	Ranges
Temperature Change, 1990–2100	January increase in average temperatures: 2.5 °F to 4°F by 2050 and 6°F to 7°F by 2100. The largest changes are observed in the southern part of the region. July increase in average temperatures: 4°F to 5°F by 2050 and 10°F by the end of the century, with the greatest change in the northern part of the region. (Modeled average temperatures; high emissions scenario)
Precipitation	Precipitation decline is projected throughout the region. The amount of decrease varies from 3 inches to 5 inches by 2050 and 6 inches to more than 10 inches by 2100, with larger rainfall reductions projected for the southern portions of the region. (CCSM3; high carbon emissions scenario)
Heat Waves	Heat waves are defined as 5 consecutive days over 83 °F to 97°F depending on location. By 2050, the number of heat waves per year is expected to increase by two. A dramatic increase in annual heat waves is expected by 2100, 8 to 10 more per year.
Snowpack	Snowpack levels are projected to decline dramatically in many portions of the region. In southern portions of the region, a decline of nearly 15 inches in snowpack levels—a more than 60% drop—is projected by 2090. (CCSM3; high carbon emissions scenario)
Wildfire	Wildfire risk is projected to increase in a range of 1.1 to 10.5 times throughout the region, with the highest risks expected in the northern and southern parts of the region. (GFDL climate model; high carbon emissions scenario)

Source: County of Nevada 2017.
Notes: CCSM3 = Community Climate System Model version 3; GFDL = Geophysical Fluid Dynamics Laboratory.

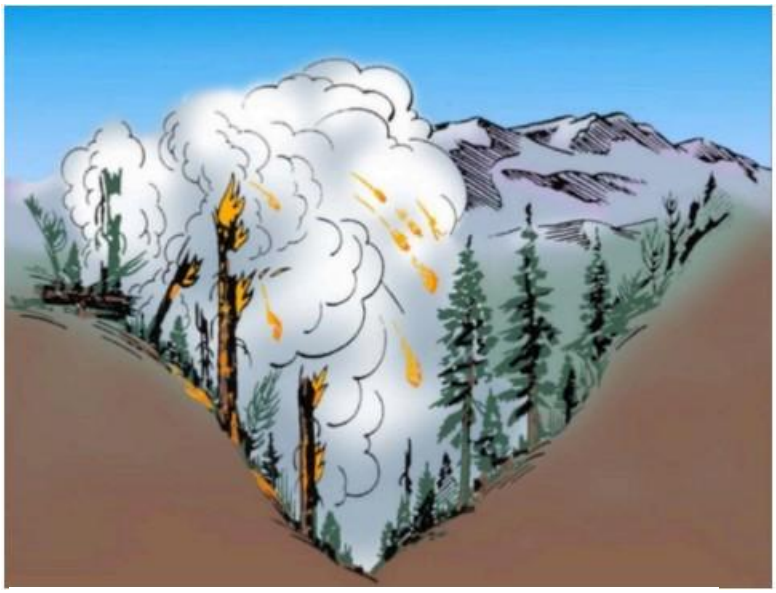
The effects of climate change in the Nevada County region have the potential to impact the occurrence and significance of the identified hazards.

2.2.2 Terrain



Chute and chimney effect (University of Alaska, n.d.)

The County is very topographically diverse and includes features such as mountain ranges, valleys, and canyons with significant differences in elevation, slope, and aspect. Each of these features affects fire behavior and alters how fire moves across the landscape. The County climbs from the Sacramento Valley at an elevation of 300 feet to the crest of the Sierra Nevada Mountains, at an elevation of 9,143 feet, the peak of Mount Lola (County of Nevada 1996). Topographical features of interest include Deer Creek Canyon, Wolf Creek, and Wolf Mountain in the Higgins/Penn Valley FZ; Deer Creek Canyon, South Yuba River Canyon, Bear River Canyon, Middle Yuba River, and Greenhorn Creek in the Grass Valley/Nevada City FZ; Deer Creek Canyon, South Yuba River Canyon, Bear River Canyon, Middle Yuba River, Steephollow Creek, and the Sierra Crest in the Tahoe National Forest (TNF) FZ; and Donner Summit, Sagehen, Carpenter Valley, Casey Canyon, and Truckee Canyon in the Truckee/Donner FZ, with the Middle Yuba Canyon and Bear River Canyon along the County's northern and southern borders, respectively.



Fire behavior in a steep canyon (University of Alaska, n.d.)

Terrain affects wildfire movement and spread. Flat areas typically result in slower fire spread, absent windy conditions. Topographic features such as saddles, chutes, canyons, and chimneys may cause unique air circulation conditions that can concentrate winds which can funnel or accelerate fire spread (i.e., land formations that collect and funnel heated air upward along a slope). Steep terrain typically results in faster upslope fire spread due to the pre-heating of uphill vegetation. Terrain may also buffer, shelter, or redirect winds away from some areas based on canyons or formations on the landscape. Saddles occurring at the top of drainages or ridgelines may facilitate the migration of wildfire from one canyon to the next. Various terrain features can also influence fire behavior, as summarized in Table 6.

Table 6. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Narrow Canyon	Surface winds follow the canyon direction, which may differ from the prevailing wind; wind eddies/strong upslope air movement is expected, which may cause erratic fire behavior; radiant heat transfer between slopes facilitates spotting/ignition on the opposite canyon side.
Wide Canyon	Prevailing wind direction is not significantly altered; aspect is a significant contributor to fire behavior. Wide canyons are not as susceptible to cross-canyon spotting except in high winds.
Box Canyon/ Chute	Air is drawn in from the canyon bottom, resulting in strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at the canyon bottom can rapidly move upslope due to chimney-like preheating of the higher-level fuels and upslope winds.
Ridge	Fires may change direction when reaching the ridge/canyon edge; strong airflows are likely at the ridge point; possibility for different wind directions on different sides of the ridge. Ridges experience more wind. Fires gain speed and intensity moving toward a ridge. Fires burning at a ridge can exhibit erratic behavior. Strong air flows can cause fire to whirl. Wind crossing a ridge usually has a leeward eddy where the wind rolls around and comes up the leeward side.
Saddle	Potential for rapid rates of fire spread; fires pushed through saddles faster during upslope runs. Winds can increase when blowing through saddles due to the funneling effect of the constricted pass. On the other side, winds will slow, but erratic winds potentially occur at the saddle due to eddies.

Sources: Teie 1994; NFPA 2011.

2.2.3 Vegetation and Fuels

Nevada County features a diverse range of vegetation communities due to its varied topography, elevation gradients, and climate. In lower-elevation regions of the County (western portion of the County), vegetation communities are dominated by oak woodlands and annual grasslands with scattered shrublands. As elevation increases, gray pine forests and shrublands become increasingly dominant. At roughly 2,500 feet above mean sea level, ponderosa pine forests become increasingly dominant, transitioning into mixed conifer forests at higher elevations. In the eastern portion of the County, aspen dominates hardwood woodlands, and east side pine type (dominated by Jeffrey pine [*Pinus jeffreyi*] and white fir [*Abies concolor*]) becomes dominant. Figure 5, Vegetation Communities, provides a visual display of these communities in Nevada County. Table 7 summarizes the acreage of vegetation communities in Nevada County and Table 8 summarizes vegetation communities by Forecast Zone.

Table 7. Vegetation Communities within Nevada County

Vegetation Community	Acres	Percent of County
Conifer Forest/Woodland	245,147	40%
Mixed Conifer/Hardwood	130,864	21%
Hardwood Forest/Woodland	102,739	16%
Shrub	52,988	9%
Herbaceous	36,856	6%
Barren/Other	24,557	4%
Urban/Developed	14,490	2%
Water	11,244	2%
Agricultural	4,331	<1%

Source: USFS 2019a, 2019b.

Table 8. Vegetation Communities within Nevada County, by Forecast Zone

Vegetation Community	Acres by Forecast Zone			
	Higgins/Penn Valley	Grass Valley/Nevada City	Tahoe National Forest	Truckee Donner
Conifer Forest/Woodland	1,202	32,913	143,969	67,063
Mixed Conifer/Hardwood	33,893	59,246	37,425	299
Hardwood Forest/Woodland	71,588	22,738	8,817	226
Shrub	2,866	5,708	18,523	25,872
Herbaceous	24,757	4,454	2,675	4,969
Barren/Other	364	2,499	18,333	3,361
Urban/Developed	4,596	6,465	316	3,112
Water	1,424	847	5,449	3,523
Agricultural	3,006	1,297	17	12

Source: USFS 2019a, 2019b.

All vegetation can burn; however, some plants exhibit characteristics that make them more flammable than others. Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and/or can support extreme fire behavior. Flammability can be defined as a combination of ignitability, combustibility, and sustainability, where ignitability is the ease of or the delay of ignition, combustibility is the rapidity with which a fire burns and sustainability is a measure of how well a fire will continue to burn with or without an external heat source (White and Zipperer 2010).

Flammability is influenced by several factors, which can be classified into two groups: physical structure (e.g., branch size, leaf size, leaf shape, surface-to-volume ratio, and/or retention of dead material) and physiological elements (e.g., volatile oils, resins, and/or moisture content) (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Plants that are less flammable have low surface-to-volume ratios, high moisture contents, and minimal dead material or debris, while those that are more flammable

have high surface-to-volume ratios, exhibit low moisture contents, contain volatile oils, and have high levels of dead material or debris (Moritz and Svihra 1998; UCFPL 1997; UCCE 2016; White and Zipperer 2010). Plant condition and maintenance are also important factors in flammability. Some plants that have more flammable characteristics can become less flammable if well maintained and irrigated but can also be explosively flammable when poorly maintained or situated on south-facing slopes, in windy areas, or in poor soils (Moritz and Svihra 1998). In general, most vegetation within the Plan Area is not regularly irrigated or maintained and exists in natural or open space settings.

While this section focuses on vegetative fuels, this LMP recognizes that non-vegetative fuels can ignite and contribute to wildfire ignition and spread and can increase wildfire hazard and risk to resources. Non-vegetative fuels are any material that can ignite and carry fire, such as structures, vehicles, and debris. The recommendations presented in this LMP are intended to minimize the potential for ignition of such fuels and acknowledge that they can contribute to increased hazard in some areas.

2.2.3.1 Conifer Forest/Woodland

As provided in Tables 7 and 8, conifer forest and woodlands are the most commonly observed vegetation communities across the County, covering 39% of the County, or 245,147 acres. In lower areas in the County, conifer forests are comprised of mainly ponderosa pine (*Pinus ponderosa)* with a mix of other coniferous trees like Douglas fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*). The understory often includes shrubs like manzanita (*Arctostaphylos spp.)* and a variety of grasses. In higher elevations, forest conditions resemble mixed conifer, including a more diverse mix of species such as white fir (*Abies concolor)*, sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), incense cedar (*Calocedrus decurrens*), Douglas fir (*Pseudotsuga menziesii*), and red fir (*Abies magnifica*). The understory in mixed conifer varies greatly and may be dependent on a variety of factors including canopy cover, terrain, fire history, or historical and current forest management practices. Wildfire behavior in conifer vegetation communities is highly dependent on forest structure and fuel characteristics. Wildfire hazard is generally highest in stands with minimal crown separation and high accumulations of ladder fuels that can facilitate surface-to-crown fire transition. Other factors such as drought and forest pests and diseases can increase wildfire hazards due to reduced fuel moisture and the increased prevalence of dead and dying trees. Fire return interval in this forest type is approximately 5-90 years according to tree ring reconstructions (Van de Water and Safford 2011).

High elevation conifer forest.

Low elevation conifer forest.

2.2.3.2 Mixed Conifer/Hardwood

Mixed conifer/hardwood near Grass Valley.

Mixed conifer/hardwood communities are the second most abundant vegetation community occurring throughout Nevada County, covering 21% of the County, or 130,864 acres. This vegetation community is largely represented by oak and conifer species including canyon live oak (*Quercus chrysolepis*), interior live oak (*Quercus wislizenii*), California black oak (*Quercus kelloggii*), ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi)*, gray pine (*Pinus sabiniana*), incense cedar (*Calocedrus decurrens*), and Douglas-fir (*Pseudotsuga menziesii)*. Shrubs such as manzanita (*Arctostaphylos spp*.), poison oak (*Toxicodendron diversilobum*), coffeeberry (*Rhamnus californica*), and ceanothus (*Ceanothus spp*.) may also be present in these vegetation types, although poorly developed. Herbaceous vegetation is generally sparse but is often more prevalent in open canopy stands. The reduction of fire as an ecosystem process in these vegetation communities allows for an accumulation of fuels that had previously been consumed during regular, low-intensity fires through either indigenous burning or natural (often lightning ignited) fires, with a mean fire return interval of approximately 2-50 years (Van de Water and Safford 2011). These vegetation types are often highly productive and lead to a build-up of woody vegetation in the understory, including significant increases in dead and downed woody material and ladder fuels connecting ground vegetation to tree canopies. As a result, some stands are more susceptible to severe, crown-consuming wildfires.

Mixed conifer/hardwood near Nevada City.

Mixed conifer/hardwood in the Deer Creek Canyon.

2.2.3.3 Hardwood Forest/Woodland

Hardwood forest/woodlands are the third most abundant vegetation community occurring throughout Nevada County, covering 17% of the County, or 102,739 acres. This vegetation type is represented by oak woodlands with common species including California black oak (*Quercus kelloggii*), blue oak (*Quercus douglasii*), and interior live oak (*Quercus wislizenii*). Trees are scattered, although canopies may be closed on better quality sites. Shrubs may be present but are rarely extensive. The typical understory is composed of annual grasses and forbs. As such, wildfire behavior in blue oak woodland is typically dependent on the structure of understory vegetation. Wildfires may move quickly through these flashy surface fuels; however, fuel loads are low and do not typically promote high flame lengths.

Hardwood forest/woodland near Grass Valley.

Hardwood forest/woodland in Lake Wildwood.

Hardwood forest/woodland near Penn Valley.

2.2.3.4 Shrub

Manzanita shrub vegetation near Penn Valley.

Shrub vegetation comprises roughly 9% of the County, or 52,988 acres. Continuous shrublands are most common in lower elevations of the County, including species such as chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos spp*.), and ceanothus (*Ceanothus spp*.). Also referred to as chaparral, this vegetation community is subject to hazardous wildfire conditions. Shrublands accumulate woody material as they age and mature chaparral stands are more flammable compared to younger chaparral stands. Chaparral 30 years and older present a greater hazard due to the accumulation of dead material within shrub canopies. Some chaparral species such as chamise are highly flammable due to their dense, resinous foliage. The plant contains volatile oils that can easily ignite and burn intensely. Invasive Scotch Broom (*Cytisus scoparius*) is a highly dominant shrub in these lower elevations, from shrubland through mixed conifer/hardwood forests, and represents a significant increase in flammability, particularly in areas with highly decadent (including a high amount of dead and dry foliage) patches.

2.2.3.5 Herbaceous/Grassland

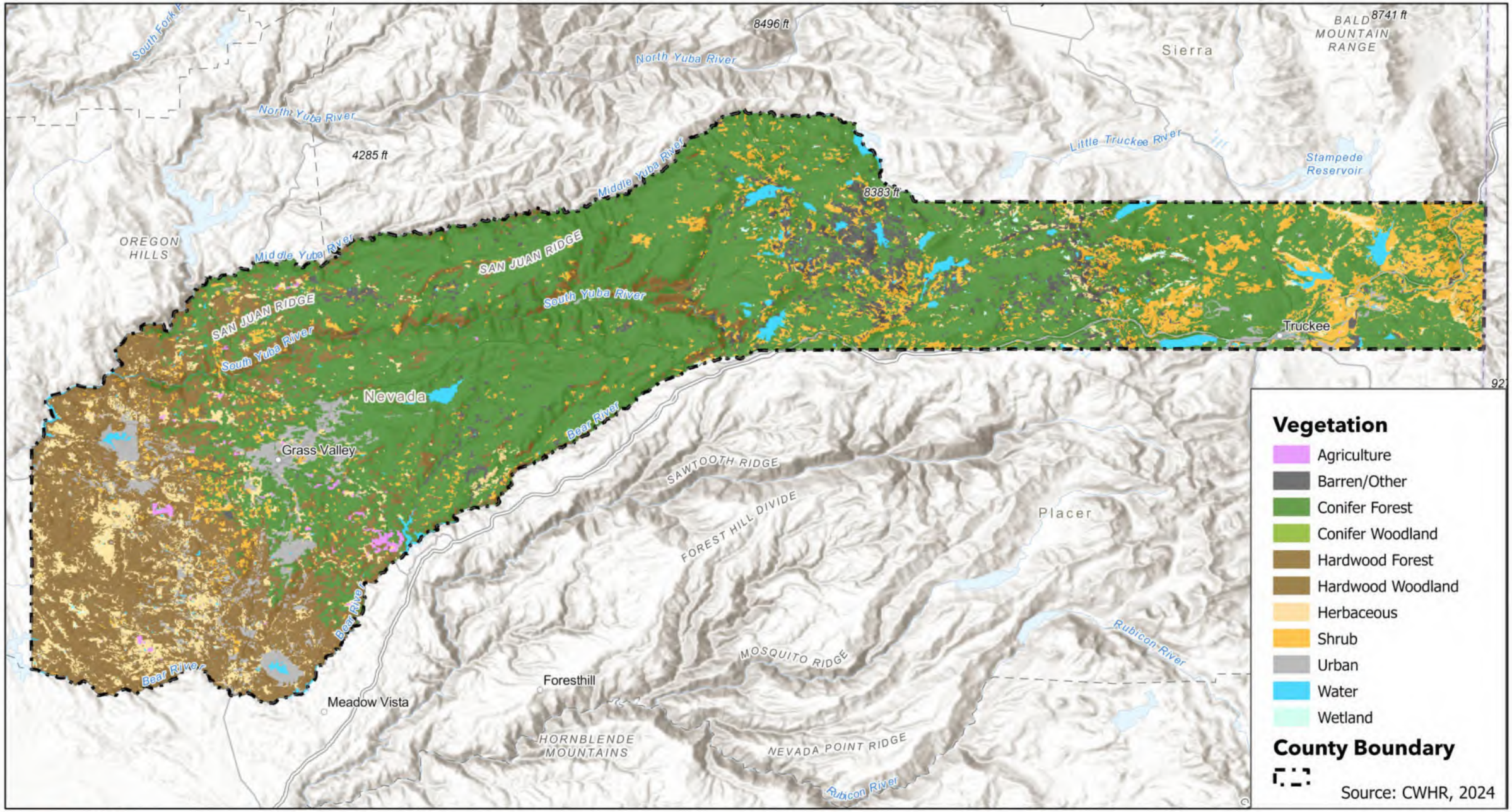
Herbaceous/grassland vegetation along the Deer Creek Canyon.

Herbaceous, or grassland vegetation covers 6% of the County, or 36,856 acres. Introduced annual grasses are the dominant species, including wild oats (*Avena fatua*), soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), red brome (*Bromus rubens*), wild barley (*Hordeum murinum*), and foxtail fescue (*Setaria spp.*). Grasses have a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to ignition temperature. They are also subject to early seasonal drying in late spring and early summer. Live fuel moisture content in grasses typically reaches its low point in early summer, and grasses begin to cure soon after. Due to these characteristics, grasses have the potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Their low overall fuel loads typically result in faster-moving fires with lower flame lengths and heat output. Untreated grasses can spread a fire into other adjacent surface fuel types (e.g., shrubs, small trees) or facilitate surface-to-crown fire transition where grasses exist beneath tree canopies.

Herbaceous/grassland vegetation near Penn Valley.

Herbaceous/grassland vegetation near Truckee.

Figure 5 - Vegetation Communities



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Forest pests, such as insects, fungi, other microbes, and vertebrates, are a natural component of California forests and plant communities. Populations of pests are dynamic and fluctuate in response to climatic and environmental changes such as drought, stand density, fire, and other site disturbances. Healthy, vigorous trees are typically able to withstand pest attacks when pest populations are at endemic levels. When stressors exist in forests (e.g., overstocking, shading, drought), tree vigor is reduced, and tree susceptibility to pest attacks and infestations increases. For example, there is evidence that sustained drought, regardless of severity, over multiple years, can reduce conifer resistance to native pests that historically would be kept at bay by cold winters. As trees exhaust resources to defend against drought, they are more likely to succumb to pests or disease, or vice versa (Lauder et al. 2019, Kolb et al. 2019, Fettig et al. 2022), as seen during the mass conifer die off tied to the 2012-2016 Sierra "mega-drought" (Young et al. 2017).

Bark beetle mortality in conifers.

Tree mortality creates both hazardous fuel conditions and threatens recreational resources through the increased likelihood of falling trees. Tree mortality is largely driven by prolonged periods of drought as trees become stressed and susceptible to forest pests and pathogens, or when trees are damaged from wildfires, though specific causes of tree death can vary (Das et al. 2016). Bark beetles naturally attack all trees available to them, often attacking the largest in a stand (Das et al. 2016), but are a particularly high stressor to drought-weakened trees and continue to be a large driver of tree mortality throughout the Sierra Nevada and in Nevada County (County of Nevada 2017). However, with the significant variation in forest types in Nevada County, ultimate causes of mortality vary, with Ponderosa pine populations in Nevada County seemingly not experiencing the same levels of mortality shown in southern Sierra Nevada populations, but higher elevation fir communities experiencing more die-off than other areas.

Areas experiencing an increase in tree mortality have been mapped by CAL FIRE within the California High Hazard Zones Tier 1 and Tier 2 datasets. The Tier 1 Hazard Zones identify areas designated by state and local governments as being in the greatest need of dead tree removal for the threats they pose to public safety. Nevada County includes 44,477 acres of Tier 1 Hazard Zones (CAL FIRE 2022a), with 38% of this acreage in the Grass Valley/Nevada City Forecast Zone and 35% of this acreage in the Tahoe National Forest Area Forecast Zone. Tier 2 Hazard Zones define tree mortality by watersheds that have significant tree mortality as well as significant community and natural resource assets (CAL FIRE 2022b). Nevada County includes 520,709 acres of Tier 2 Hazard Zones, with 38% of this acreage in the Tahoe National Forest Area Forecast Zone and 26% of this acreage in the Grass Valley/Nevada City Forecast Zone.

Annual surveys of forested areas in California are conducted through aerial mapping to detect tree mortality and tree damage. Statewide, elevated levels of tree mortality (more than 1% of forested area

affected) were recorded on more than 2.4 million acres, representing an estimated 28.8 million dead trees. Most of the trees killed were recorded as fir (*Abies spp*.), ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*). Mortality is attributed in part to the ongoing effects of long-term exceptional drought conditions (with sustained drought having a greater impact than severe drought with significant winter recovery) and subsequent successful bark and engraver beetle attacks that have resulted in an estimated 239 million trees killed since 2010 (USDA 2024a).

In the Tahoe National Forest, tree mortality increased from ~5 million dead trees across 260,000 acres in 2022 to an estimated 6.5 million dead trees across 330,000 acres in 2023. Mortality occurred at moderate to severe levels over many areas, but notably along central, high elevation areas of the Forest (USDA 2024a).

In Nevada County, tree mortality rates have increased between 2021 and 2023 with severe (30-50% mortality) mortality rates increasing from 2,527 acres to 16,699 acres and very severe (50%+ mortality) mortality rates increasing from 101 to 4,609 acres (USDA 2024b). These changes are seen primarily in red fir trees, with some mortality occurring in white fir and ponderosa pine trees. Tree pests are often adapted to specific target tree species. Causal agents for mortality in red and white firs include the fir engraver beetle and the western pine beetle (*Dendroctinus brevicomus*) or ponderosa beetle (*D. ponderosae*) for ponderosa pine. However, additional causes of mortality include a combination of drought, pest stress, and disease, often varying in their relative contribution to tree mortality (Das et al. 2016). Tree mortality areas are located primarily at upper elevations in the easter portion of the County, with concentrations near Boreal/Donner Lake, Soda Springs, Sand Ridge/Buzzard Roost/Lake Sterling, Fordyce Lake/Magonigal Road, Grouse Ridge, Meadow Lake, and Mount Lola (USDA 2024b).

2.2.4 Wildfire Types and Potential Fire Behavior

Several wildfire types exist, as summarized below.

Ground Fire: Fire that consumes the organic material beneath the surface litter ground, such as a peat fire (NWCG 2024).

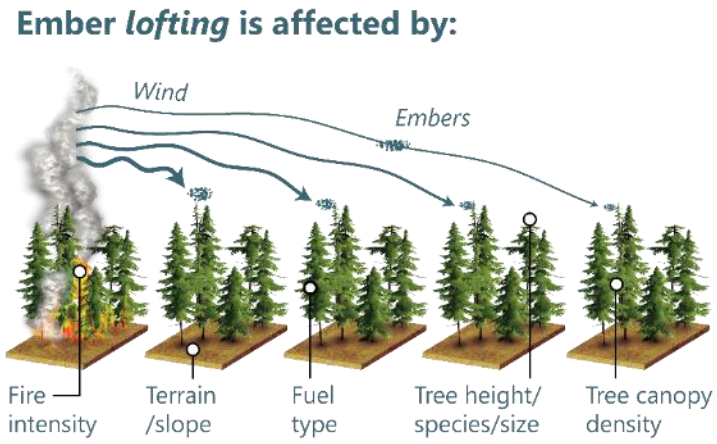
Surface Fire: Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation (NWCG 2024).

Crown Fire: A fire that advances from top to top of trees or shrubs more or less independent of a surface fire. Crown fires are sometimes classed as running or dependent to distinguish the degree of independence from the surface fire (NWCG 2025). There are three types of crown fires:

- *Passive Crown Fire*: A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fires encompass a wide range of crown fire behavior, from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching (Scott and Reinhardt 2001).
- *Active Crown Fire*: A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire (Scott and Reinhardt 2001).

- *Independent Crown Fire:* A crown fire that spreads without the aid of a supporting surface fire (Scott and Reinhardt 2001).

Another component of fire behavior is spotting—the transfer of firebrands (embers) ahead of a fire front—which can ignite smaller vegetation fires (NWCG 2025). These smaller fires can burn independently or merge with the primary fire. Spotting can also result in structural ignitions when transported embers reach a receptive fuel bed[3] (e.g., combustible roofing), especially in wind-driven fires. Structure fires, as well as vegetation-fueled fires, can generate firebrands. Additionally, landscape features like ridges can dramatically affect fire behavior by changing prevailing wind patterns, funneling air, and increasing wind speeds, thereby intensifying fire behavior.



Variables affecting ember lofting and travel distance

Each of the fire types mentioned above may occur within the Plan Area, depending on site-specific conditions. Fire behavior is how a wildland fire reacts to weather, fuels, and topography. The difficulty of controlling and suppressing a wildfire is typically determined by fire behavior characteristics, such as rate of spread, fireline intensity, torching, crowning, spotting, fire persistence, and resistance to control. Extreme fire behavior is that which precludes methods of direct control (e.g., flame lengths 8 feet and greater), behaves unpredictably and erratically, and typically involves high spread rates, crowning and spotting, the presence of fire whirls, and a strong convective column.

Fire behavior characteristics are an essential component in understanding fire risk. Flame length—the length of the flame of a spreading surface fire within the flaming front—is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). Although it is a subjective and nonscientific measure of fire behavior, it is imperative to fireline personnel when evaluating fireline intensity and is worth considering as a vital wildfire variable (Rothermel 1983). Fireline intensity is a measure of heat output from the flaming front and affects the potential for a surface fire to transition to a crown fire. Table 9 presents an interpretation of flame length and its relationship to fire suppression efforts.

[3] An area where existing vegetation or other combustible debris is in a condition that is ready and available to ignite when an ember lands upon it.

Table 9. Fire Behavior Interpretation

Flame Length	Fireline Intensity	Interpretation
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 feet to 8 feet	100–500 BTU/ft/s	Fires are too intense for a direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 feet to 11 feet	500–1,000 BTU/ft/s	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1,000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

Source: Roussopoulos and Johnson 1975.
Note: BTU/ft/s = British thermal units per foot per second.

2.2.5 Fire and Ignition History

Jones Fire (2020) in Nevada County.

Fire history is an important component of fire planning and can provide an understanding of a variety of factors related to fires, including frequency, type, behavior, most vulnerable community areas, and significant ignition sources, among others. One important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned in the area, and how a fire may spread. Fire history represented in this LMP uses the CAL FIRE, Fire and Resource Assessment Program (FRAP) database (CAL FIRE 2024g). FRAP summarizes fire perimeter data dating to the late 1800s[4]. While the database is extensive, it does not include some small fires, prescribed fires of certain sizes, and some that have less evidence of their final footprint. Prior to the FRAP database time period, there is extensive evidence of indigenous burning for 12,000 years or more in the region, and "natural" (lightning-ignited) fires as well, with fire return intervals in the region estimated to be between 2 and 90 years, with a median return interval of 9-25 years depending on vegetation type (Van de Water and Safford 2011), but there are significant gaps in return interval knowledge based on tree ring records, and fire may have occurred even more frequently without leaving

[4] Includes perimeters ⩾10 acres in timber, ⩾50 acres in brush, or ⩾300 acres in grass, and/or ⩾3 impacted residential or commercial structures, and/or caused ⩾1 fatality.

significant tree ring records. These historical fires that shaped the current forest landscape occurred primarily in the dry fall months and were extinguished by late fall and early winter rains.

There have been 231 recorded wildfires in Nevada County, with 65 fires burning 500 acres or more (CAL FIRE 2024g). The largest fire affecting the County was the 1960 Donner Ridge Fire, which burned 43,374 total acres (19,166 acres within Nevada County and 24,208 within Sierra County). The largest fire burning entirely within the County was the 1988 49er Fire (36,343 total acres). A list of notable wildfires burning within the County is provided below:

- Donner Ridge Fire (1960): Burned a total of 43,374 acres, resulting in 27 injuries and threatened Downtown Truckee burning within 2.5 miles of the Town (County of Nevada 2017)
- 49er Fire (1988): Burned 36,343 acres and destroyed 148 homes and 358 additional structures (County of Nevada 2017)
- Trauner Fire (1994): Burned 536 acres and destroyed 12 homes and 21 additional structures (County of Nevada 2017)
- Martis Fire (2001): Burned 14,126 acres and destroyed 2 homes and 3 vehicles (County of Nevada 2017)
- Yuba River Complex Fire (2008): A complex of 13 fires that burned a total of 3,590 acres, leading to multiple health issues reported from smoke exposure (County of Nevada 2017)
- Lowell Fire (2018): Burned 2,304 acres, resulting in 3 injuries and extensive evacuations (County of Nevada 2017)
- Jones Fire (2020): Burned 705 acres, resulting in 18 destroyed structures, 3 damaged structures, and 7 injuries (CAL FIRE 2022c)
- River Fire (2021): Burned 2,619 acres, resulting in 21 destroyed structures, 142 damaged structures, and 4 injuries (CAL FIRE 2022d)
- Rices Fire (2022): Burned 921 acres, resulting in 4 destroyed structures (CAL FIRE 2023c)

River Fire (2021) in Nevada County.

While the number of acres burned in California has substantially increased over the past 3 decades (Miller and Safford 2012), this trend has not necessarily occurred in Nevada County. As presented in Exhibit 1, the County has experienced a gradual decline in burned acres since a peak between 1941 and 1960. While the size of wildfires is influenced by many factors, including remoteness, emergency response capacity, and wildfire behavior, wildfire trends have resulted in large continuous tracts of forestland that have not experienced fire since the beginning of the historical fire record. Without fire as a natural disturbance or other fuel reduction efforts, vegetation continues to mature and accumulate, resulting in hazardous forest conditions in many areas of the County. However, specific regions of the County have experienced repeated wildfires, including the Fall Creek drainage east of the Washington

and Truckee Canyon in the far eastern portion of the County—both of which have burned more than three times according to the historical fire record (CAL FIRE 2024g).

Exhibit 1. Acres burned in Nevada County from 1908–2023 (CAL FIRE 2024g)

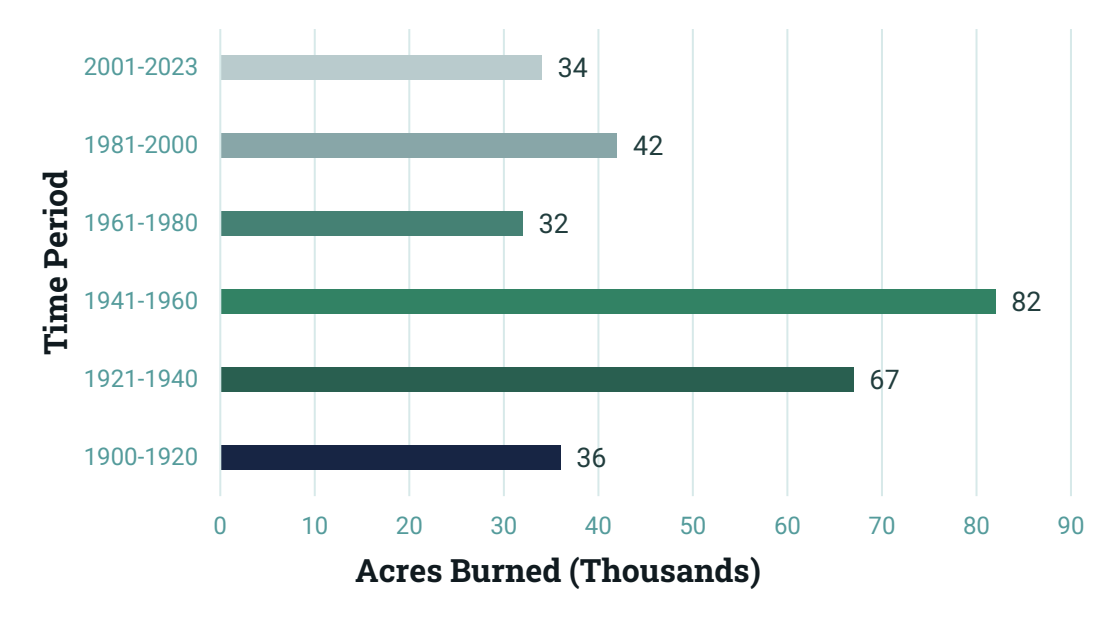
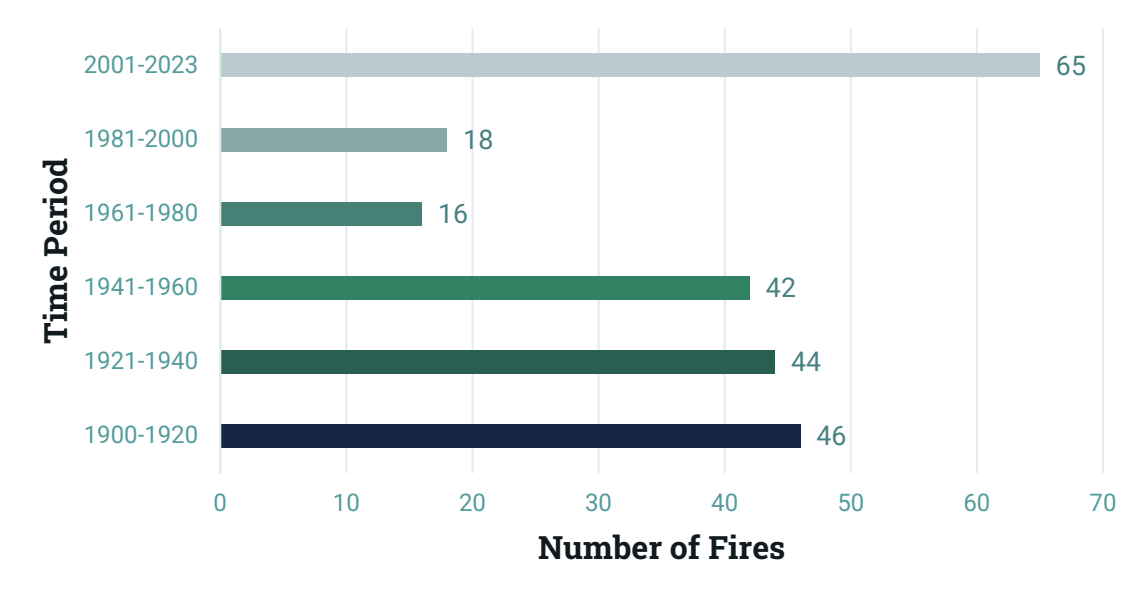


Exhibit 2. Wildfire frequency in Nevada County from 1908–2023 (CAL FIRE 2024g)



Nevada County residents are often exposed to wildfire smoke during summer and early fall months from wildfires burning within the County or from wildfires burning in other regions of the state (County of Nevada 2017). It is not uncommon for air quality to well exceed air quality standards for fine particulate matter (PM2.5) concentration, the leading pollutant within wildfire smoke. For example, during the summers of 2013 and 2014, heavy smoke from wildfires in Northern California, including Nevada County, increased PM 2.5 levels 100 times greater than air quality standards (County of Nevada 2017). Wildfire smoke leads to health concerns, can negatively impact local economies, and can adversely affect vulnerable populations.

2.2.5.1 Fire Cause

An analysis of the cause of the 231 fires that have burned in the County reveals that most are unknown/unidentified or miscellaneous (67%)[5]. Those with identified causes include lightning (8%), debris burning (5%), equipment use (4%), arson (4%), smoking (3%), campfires (3%), vehicles (2%), powerlines (2%), railroads (1%) and escaped prescribed burns (1%) (CAL FIRE 2024h).

2.2.5.2 Ignitions

Wildfire ignitions in the County are typically concentrated along major highways, including Highways 20, 49, 20, and 174, as well as Interstate 80. Concentrations are also seen in more urbanized areas, notably in or near Lake of the Pines, Lake Wildwood, Penn Valley, Rough and Ready, Alta Sierra, Grass Valley, Nevada City, North San Juan, Cedar Ridge/Peardale, Scotts Flat, Truckee and near Prosser Creek and Boca Reservoirs. For ignitions in the County, the vast majority are classified as being of unknown or undetermined origin. For those with identifiable sources, the majority (67%) are human caused and the remainder (33%) are naturally caused (CAL FIRE 2024h).

2.3 Forecast Zones

2.3.1 Overview

To account for variability across the County's fire environment, this LMP evaluates the Plan Area according to four Forecast Zones (FZs) established through development of the WRA and carried forward into the structure of the CWPP. A description of the fire environment and vegetation for each FZ is presented in the following sections.

[5] Fire cause is determined by an investigation, and sufficient evidence discovered during the investigation to assign the fire cause to arson, debris and open burning, equipment, misuse of fire by a minor, natural, power generation/transmission/distribution, railroad operations and maintenance, recreation and ceremony, smoking, vehicle, or undetermined. Fires where the cause is identified as unknown/unidentified or miscellaneous (or other) are fires that were either investigated and there was insufficient evidence to determine a cause or were not investigated. Unknown/unidentified, miscellaneous, and other are not necessarily indicators of an unlisted cause rather a lack of evidence.

Table 10. Area Size of Forecast Zones Within Nevada County

Forecast Zone	Acres	Percent of County
Higgins/Penn Valley	143,715	23%
Grass Valley/Nevada City	136,166	22%
Tahoe National Forest	234,891	38%
Truckee Donner	108,438	17%

Source: USFS 2019a, 2019b.

2.3.2 Higgins/Penn Valley

The Higgins/Penn Valley Forecast Zone (FZ) covers 143,715 acres, making it the second-largest FZ. It is bound on the west by Yuba County, on the east by the Grass Valley/Nevada City FZ, on the north by the South Yuba River, and on the south by the Bear River and Placer County. The FZ is below the 2,000-foot elevation line.

Higgins/Penn Valley Forecast Zone.

2.3.2.1 Terrain

The terrain in the Higgins/Penn Valley FZ is relatively gently sloped when compared to the terrain of the other FZs within Nevada County. Most of the FZ has slopes ranging from 0% to 46% slopes The areas that contain slopes at 46% to 70% and above are the areas approaching the South Yuba River, which crosses the northernmost part of the Higgins/Penn Valley FZ border, and then San Juan Ridge, which is north of the South Yuba River and located just outside of the northernmost Higgins/Penn Valley FZ border. The Bear River follows the southern border of the FZ. Dry Creek runs through the middle portion of the FZ, while Deer Creek runs west and east of Lake Wildwood. These rivers serve as drainages within the FZ.

2.3.2.2 Vegetation and Fuels

The predominant vegetation community in the Higgins/Penn Valley FZ is hardwood woodland/forest and this is where the majority of the County's Oak Woodlands are located. Common oak species are canyon live oak (*Quercus chrysolepis*), interior live oak (*Quercus wislizenii*), and California black oak (*Quercus kelloggii*). A total of 24% of the vegetation within the FZ are Mixed Conifer/Hardwood. Common conifer species include ponderosa pine (*Pinus ponderosa*) and gray pine (*Pinus sabiniana*). Other common hardwood species include white alder (*Alnus rhombifolia*), Fremont cottonwood (*Populus fremontii*), California buckeye (*Aesculus californica*), and willow (Salix spp.). Grass/Herbaceous vegetation makes up 17% of the vegetation which is higher than any other FZ. Table 11 displays all vegetation communities and their acreages.

Table 11. Higgins/Penn Valley Forecast Zone Vegetation Communities

Vegetation Community	Total Acreage	Percent
Hardwood Forest/Woodland	71,588	50%
Mixed Conifer/Hardwood	33,893	24%
Herbaceous	24,757	17%
Urban	4,596	3%
Shrub	2,886	2%
Agricultural	3,006	2%
Water	1,424	1%
Conifer Forest/Woodland	1,202	1%
Barren/Other	364	<1%

Source: USFS 2019a, 2019b.

2.3.2.3 Climate

The temperature in the Higgins/Penn Valley Forecast Zone (FZ) is influenced by being at relatively lower elevation in comparison to the other FZs in Nevada County. Warmer temperatures are more likely, as is consequential early season drying of vegetation. Temperatures in this area during the summer months and early fall (June through September) range from 66°F to 91°F. Average winter temperatures, from November through March, average below 60°F. Rainfall is minimal in the summer months of June through September, if any, ranging from 0.0 inches to 0.4 inches. Average monthly precipitation, from October through May, ranges from 0.50 inches to 5.6 inches. The dominant wind direction is typically from the south February through September, and from September through February, the wind direction is most often from the east. The average hourly wind speed in this FZ averages around 6 mph throughout the year (Weather Spark 2024a).

2.3.2.4 Recent Fire History

From 1950 through 2022, the Higgins/Penn Valley FZ has experienced 47 fires according to the fire history record. These fires burned approximately 42,477 acres within the FZ, with the north and northwest portion of the FZ accounting for most of this acreage due to the 1988 49er Fire, which burned 36,343 total acres. Most of this fire occurred in the Higgins/Penn Valley FZ, with some of the acreage in the Grass Valley/Nevada City FZ. The next largest fires that have occurred in this FZ are the 2021 River Fire (1,294 acres in the FZ), the 1961 Bilderback Fire (921 acres in the FZ), and the 1953 Camp Beale #5 Fire (881 acres in the FZ). The most recent fires that have occurred in this FZ of notable size are the 2021 River Fire (1,294 acres in the FZ), 2020 Jones Fire (698 acres in the FZ), and the 2017 Lobo Fire (820 acres in the FZ). While the average fire return interval within the Higgins/Penn Valley FZ was calculated to be approximately every 2 years, 19 of these 47 fires occurred within the past 10 years. Table 12 summarizes the Higgins/Penn Valley FZ fire history per decade, with recorded history dating back to 1950.

Table 12. Higgins/Penn Valley Forecast Zone Fire History by Decade

Years	Total Acreage in FZ	Number of Fires
<1980	5,991	12
1980–1990	31,987	4
1991–2000	542	2
2001–2010	669	9
2011–2020	1,871	14
2021–2023	1,418	6
Total:	42,478	47

Source: CAL FIRE 2024g.
Note: FZ = Forecast Zone

2.3.3 Grass Valley/Nevada City

The Grass Valley/Nevada City Forecast Zone (FZ) covers 136,166 acres, making it the third-largest FZ. It is bound on the west by the Higgins/Penn Valley FZ, on the east by the Tahoe National Forest (TNF) Area FZ, on the north by the South Yuba River, and the south by the Bear River.

Grass Valley/Nevada City Forecast Zone.

2.3.3.1 Terrain

The terrain in the Grass Valley/Nevada City FZ is extremely diverse. Much of the FZ contains areas with slopes ranging from 0% to 46% degrees; areas containing slopes at 46% to 70% and above can be found within the multiple river drainages located in the FZ. The Middle Yuba River runs along the northern border of the FZ, along the northernmost portion of the San Juan Ridge, while the South Yuba River runs below the San Juan Ridge. The Deer Creek River runs through the center of FZ through the City of Nevada City. The Bear River is located along the southeastern border of the FZ. These rivers serve as drainages within the FZ. The Rollins Reservoir is also located along the southern border of the FZ.

2.3.3.2 Vegetation and Fuels

The predominant vegetation community in the Grass Valley/Nevada City FZ is mixed conifer/hardwood, followed by conifer forest/woodland, hardwood forest/woodland, and then urban, shrub and herbaceous. The western and southern portions of San Juan Ridge are where the hardwood forest/woodland communities are most concentrated, but they are also interspersed throughout the FZ. Common species include canyon live oak (*Quercus chrysolepis*), interior live oak (*Quercus wislizenii*), California black oak (*Quercus kelloggii*), madrone (*Arbutus menziesii*), white alder (*Alnus*

rhombifolia), bigleaf maple (*Acer macrophyllum*), willow (*Salix* spp.), ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi)*, gray pine (*Pinus sabiniana*), incense cedar (*Calocedrus decurrens*), and Douglas-fir (*Pseudotsuga menziesii)*, manzanita (*Arctostaphylos* spp.), poison oak (*Toxicodendron diversilobum*), coffeeberry (*Rhamnus californica*), and ceanothus (*Ceanothus* spp.) The Grass Valley/Nevada City FZ contains the most urban areas out of the four FZs of Nevada County. Table 13 displays all vegetation communities and their acreages.

Table 13. Grass Valley/Nevada City Forecast Zone Vegetation Communities

Vegetation Community	Total Acreage	Percent
Mixed Conifer/Hardwood	59,246	44%
Conifer Forest/Woodland	32,913	24%
Hardwood Forest/Woodland	22,738	17%
Urban	6,465	5%
Shrub	5,708	4%
Herbaceous	4,454	3%
Barren/Other	2,499	2%
Agricultural	1297	1%
Water	847	1%

Source: USFS 2019a, 2019b.

2.3.3.3 Climate

Temperature, climate, and winds are influenced by the diversity of terrain throughout the Grass Valley/Nevada City Forecast Zone (FZ). The Grass Valley and Nevada City areas tend to experience temperatures between 68°F and 86°F during the summer months, from June through September. Typical winter temperatures from November through March average below 59°F. Rainfall is minimal in the summer months, from June through September, averaging about 0.1 inches. Average monthly precipitation, from October through May, ranges from 0.50 inches to 6.0 inches. The dominant wind direction is from the south February through September, and from September through February, the wind direction is most often from the east. The average hourly wind speed in this FZ averages around 6 mph throughout the year (Weather Spark 2024b).

2.3.3.4 Recent Fire History

From 1909 through 2022, the Grass Valley/Nevada City FZ has experienced 57 fires. These fires burned approximately 39,649 acres within the FZ, with the northern areas along San Juan Ridge and the southeastern portion of the FZ accounting for most of this acreage. The largest fires that have occurred in this FZ are the 1988 49er Fire (36,343 acres total, but most of this fire burned within the Higgins/Penn Valley FZ—3,709 acres burned within the Grass Valley/Nevada City FZ), an unnamed fire in 1924 (27,081 acres total; 3,673 acres in the FZ), an unnamed fire in 1917 (26,767 acres total; 6,241 acres in the FZ), and the 1960 NSJ Fire (23,951 acres total; 5,835 acres in the FZ). The most recent fires that have occurred in this FZ of notable size are the 2009 Yuba Fire (9,061 acres total; 830 acres in the FZ), the 2015 Lowell Fire (2,304 acres total; 2,295 acres in the FZ), the 2021 River Fire (2,619 acres total; 413 acres in the FZ), and the 2022 Rices Fire (921 total acres and all in this FZ). The average fire return interval within the

Grass Valley/Nevada City FZ was calculated to be approximately every 2 years. However, 13 of these 57 fires occurred within the past 10 years. Table 14 summarizes the Grass Valley/Nevada City FZ fire history per decade, with recorded history dating back to 1909.

Table 14. Grass Valley/Nevada City Forecast Zone Fire History by Period

Years	Total Acreage	Number of Fires
<1980	30,195	33
1980–1990	3,734	2
1991–2000	336	2
2001–2010	929	5
2011–2020	3,030	11
2021–2023	1,424	4
Total:	39,648	57

Source: CAL FIRE 2024g.

2.3.4 Tahoe National Forest

The Tahoe National Forest (TNF) Area Forecast Zone (FZ) covers 234,891 acres, making it the largest FZ. It is bound on the west by the Grass Valley/Nevada City FZ, on the east by the Truckee/Donner, on the north by the South Yuba River, and on the south by the Bear River and Placer County. The FZ boundary roughly follows the TNF boundary.

Tahoe National Forest Area Forecast Zone.

2.3.4.1 Terrain

The terrain in the TNF Area FZ is the most variable among the other Nevada County FZs. The west to middle portion of the FZ contains the steepest sloped areas, specifically along the rivers and canyons present through the middle portion (slopes reaching 60% to 70% gradient). The San Juan Ridge continues east from the Grass Valley/Nevada City FZ until it meets the canyons and ridges that extend north from where the South Yuba River flows. Canyons and ridges are prevalent along the South Yuba River and Canyon Creek until they respectively empty out into Lake Spaulding and Bowman Lake. The Middle Yuba River, which runs above the San Juan Ridge, defines the northern border from the end of the Grass Valley/Nevada City FZ. The Middle Yuba River follows the northern border to Jackson Meadows Reservoir and follows the Middle Yuba River south of this reservoir until it intersects with the panhandle of Nevada County going east to Truckee. The slopes along these canyons, ridges, and rivers vary in the 46% to 70% and above range. Steep slopes are present throughout the FZ. Many bodies of water are located within the middle and eastern portion of this FZ, and many creeks run through this FZ.

2.3.4.2 Vegetation and Fuels

The composition of vegetation communities throughout the TNF Area FZ vary. The FZ vegetation communities consist predominantly of conifer and mixed conifer forests. Common species include ponderosa pine (*Pinus ponderosa),* Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), incense cedar (*Calocedrus decurrens*), mountain hemlock (*Tsuga mertensiana*), white fir (*Abies concolor*), and red fir (*Abies magnifica*). The hardwood forest communities are situated primarily in the western half of the FZ along the ridges and river valleys, with most of those communities following the South Yuba River and Canyon Creek. Other hardwood species include madrone (*Arbutus menziesii*), canyon live oak (*Quercus chrysolepis*), California black oak (*Quercus kelloggii*), bigleaf maple (*Acer macrophyllum*), willow (*Salix spp.*), black cottonwood (*Populus trichocarpa*), white alder (*Alnus rhombifolia*), and mountain alder (*Alnus incana*). Shrub communities are present throughout the FZ but are more prevalent in the eastern half of the FZ and concentrated in the middle of the FZ. Barren/other land coverage is almost equal to that of the shrub communities, as is comprised of granite outcrops. Wetlands and meadows are accounted for in the herbaceous community type. Table 15 displays all vegetation communities and their acreages.

Table 15. Tahoe National Forest Area Forecast Zone Vegetation Communities

Vegetation Community	Total Acreage	Percent
Conifer Forest/Woodland	143,969	61%
Mixed Conifer/Hardwood	37,425	16%
Shrub	18,523	8%
Barren/Other	18,333	8%
Hardwood Forest/Woodland	8,187	3%
Water	5,449	2%
Herbaceous	2,675	1%
Urban	316	<1%
Agricultural	17	<1%

Source: USFS 2019a, 2019b.

2.3.4.3 Climate

Large elevation differences across the Tahoe National Forest (TNF) Area Forecast Zone (FZ) result in diverse weather (the FZ ranges in elevation from approximately 2,600’ in the west to approximately 8,900’ in the east). Due to overlapping similarities in terrain, the western region of the FZ is likely to experience weather similar to the Grass Valley/Nevada City FZ. In higher elevations throughout the TNF Area FZ, fire season may be delayed due to snowfall and more significant precipitation. Data collected from the Bowman Dam weather station, which is situated by Bowman Lake in the middle of the FZ, shows that temperatures during the summer months, from June through September, range from 51°F to 103°F, and that average winter temperatures, from November through March, average from 31°F to 62°F (NOAA 2024). Precipitation is minimal in the summer months, from June through September, though more than in other FZs (often in the form of thunderstorms), averaging about 0.58 inches. Average monthly precipitation, from October through May, ranges from 0.50 inches to 8.0 inches (NOAA 2024). The White Cloud RAWS station, located in the easternmost portion of the first third of the FZ, records a dominant

wind direction from the southeast, with most winds in the area in the 1 mph to 8 mph range and averaging 3 mph (WRCC 2024).

2.3.4.4 Recent Fire History

From 1908 through 2023, the TNF Area FZ has experienced 95 fires. These fires burned approximately 55,845 acres within the FZ, with most of the wildfire acreage having occurred in the western portion of the FZ. The largest fires that have occurred in this FZ are the 1910 Fall Fire (2,416 acres), an unnamed fire in 1919 (4,277 acres), an unnamed fire in 1935 (5,245 acres), and an unnamed fire in 1946 (10,567 acres). The most recent fires that have occurred in this FZ of notable size are an unnamed fire in 2002 (1,476 acres), an unnamed fire in 2008 (943 acres), an unnamed fire in 2016 (2,105 acres), and an unnamed fire in 2022 (946 acres). The average fire return interval within the TNF Area FZ was calculated to be approximately every year, though it should be noted that, out of the 95 fires that have been recorded in this FZ, 76 of those fires, as well as the most acreage burned by period (49,822 acres), occurred before 1980. In comparison to the two FZs previously mentioned (Higgins/Penn Valley FZ and Grass Valley/Nevada City FZ), the TNF Area FZ has not experienced many wildfires within its boundary from 2011 to 2023. The Truckee/Donner FZ has also experienced a similar level of little recent wildfire history within the same year range. Table 16 summarizes the TNF Area FZ fire history per decade, with recorded history dating back to 1908.

Table 16. Tahoe National Forest Area Forecast Zone Fire History by Period

Years	Total Acreage	Number of Fires
<1980	49,822	76
1980–1990	1,331	5
1991–2000	553	3
2001–2010	4,036	7
2011–2020	47	2
2021–2023	57	2
Total:	55,846	95

Source: CAL FIRE 2024g.

2.3.5 Truckee Donner

The Truckee/Donner Forecast Zone (FZ) covers 108,438 acres, making it the smallest FZ. It is bound on the west by the Tahoe National Forest (TNF) Area FZ, on the east by California-Nevada state line, on the north by Sierra County, and to the south by Placer County.

2.3.5.1 Terrain

Truckee/Donner Forecast Zone.

The terrain in the Truckee/Donner FZ contains the most continuous areas of relatively flat terrain, with slopes at 0% to 8%, compared to the other FZs in Nevada County. While this flat terrain is also present throughout different areas of the FZ, it is notable that flat terrain has some overlap with where the wetland vegetation communities are located in the western portion of the FZ and where the northernmost herbaceous communities are next to Boca Reservoir and Prosser Creek Reservoir. Gently sloped areas are also prevalent throughout the FZ, ranging from 8% to 26%, and some areas have 26% to 46% slopes. Slopes that are 46% to 70% are concentrated in the western portion of the FZ, above and below the wetland vegetation communities, and in the easternmost part of the FZ from north to south along the Boca Ridge and within the Humbolt-Toiyabe National Forest area. The highest concentration of > 35-degree slopes are those located along the north-to-south areas along the Boca Ridge. Martis Creek Lake and Dry Lake are located east of Truckee, while Donner Lake resides between Donner and Truckee. Prosser Creek Reservoir is approximately 4 miles northeast of Truckee, and Boca Reservoir is 7 miles northeast of Truckee and approximately 3 miles northeast of Prosser Creek Reservoir.

2.3.5.2 Vegetation and Fuels

The dominant vegetation community in the Truckee/Donner FZ is conifer forest/woodland, followed by shrub communities. Common conifer species include ponderosa pine (*Pinus ponderosa),* white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*Pinus jeffreyi*), lodgepole pine (*Pinus contorta*), incense cedar (*Calocedrus decurrens*), and red fir (*Abies magnifica*). Associated hardwood species include willow (*Salix* spp.), quaking aspen (*Populus tremuloides*), and black cottonwood (*Populus trichocarpa*). Shrub communities are concentrated in the area above Donner Lake, Interstate 80, east of the Truckee area in the area north of Interstate 80 and around Prosser Creek Reservoir, and in the eastern portion of the FZ east of Boca Reservoir and along Boca Ridge. Herbaceous, water, barren/other, and urban land covers are relatively similar in acreage, but their presence combined is less than half of the area covered by shrub communities. Wetlands and meadows are accounted for in the herbaceous community type. Table 17 displays all vegetation communities and their acreages.

Table 17. Truckee/Donner Forecast Zone Vegetation Communities

Vegetation Community	Total Acreage	Percent
Conifer Forest/Woodland	67,063	62%
Shrub	25,872	24%
Herbaceous	4,969	5%
Water	3,523	3%
Barren/Other	3,361	3%
Urban	3,112	3%
Mixed Conifer/Hardwood	299	<1%
Hardwood Forest/Woodland	226	<1%
Agricultural	12	<1%

Source: USFS 2019a, 2019b.

2.3.5.3 Climate

During the summer months, from June through September, the Truckee/Donner Forecast Zone (FZ) experiences high temperatures ranging from 73°F to 82°F. Average winter temperatures, from November through March, average below 48°F. Rainfall is minimal in the summer months, from June through September, averaging about 0.25 inches. Precipitation occurs more frequently from October through May, averaging 4.60 inches. Snow makes up a significant portion of the precipitation from November through April, and into May. Accumulated snowfall is typically present on the ground beginning in November and extending through to May (WRCC 2025). The dominant wind direction is typically from the west from March through October, and from October through March, the wind direction is most often from the south. The average hourly wind speed in this FZ averages around 6 mph throughout the year (Weather Spark 2024c).

The climate of the Truckee/Donner FZ is influenced by being located at a higher elevation. These factors, especially regarding summer temperatures and winter precipitation, can influence potential fire behavior by influencing the availability of the snowpack and peak runoff at higher elevations, which affects the length of the plant's green stage, its consequential availability to burn, and thus potential fire behavior (SWCA 2024).

2.3.5.4 Recent Fire History

Most wildfire acreage in the Truckee/Donner FZ appears to be concentrated toward the eastern edge of the FZ boundary (east of the Boca Hill and Boca Reservoir area) and in the middle of the FZ where Highway 89 crosses the north FZ boundary moving southwest. Similarly, most wildfire acreage appears to have burned before 1980. The largest fires recorded in this area are the 1960 Donner Ridge Fire, which burned 19,165 acres in the eastern portion of the FZ, and two unnamed fires from 1959, which burned 8,806 acres combined in the middle portion of the FZ. The 2001 Martis Fire burned a total of 14,127 acres in the southeast corner of the FZ. From 2011 to 2023, less than 100 acres of wildfire area is recorded in this FZ. Similar to the TNF Area FZ, the Truckee/Donner FZ has not experienced much wildfire in the 2011 to 2023 range. Those numbers for Truckee/Donner FZ fire history per decade are reflected in Table 18, with recorded history dating back to 1908. Not accounted for in Table 18 are small fires not documented

by CAL FIRE. For example, 44 small fires burned between 2021 and 2023, as identified in the Truckee Fire Protection District CWPP (SWCA 2024).

Table 18. Truckee/Donner FZ Fire History by Period

Years	Total Acreage	Number of Fires
<1980	46,693	36
1980–1990	295	1
1991–2000	1,389	4
2001–2010	6,009	7
2011–2020	82	1
2021–2023	12	1
Total:	54,480	50

Source: CAL FIRE 2024g.

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3 Fire Risk Reduction Techniques

3.1 Vegetation Management Techniques

Vegetation management techniques describe the methods used to achieve the WUI, fuel break, or ecological restoration goals. Techniques differ from types in that technique describes the specific equipment and practices that will be used but don't describe the goals of the project.

Vegetation management for fire hazard mitigation is the practice of thinning, pruning, removing, or otherwise altering vegetation in order to reduce the potential for ignitions and modify fire behavior. Different vegetation management techniques can be utilized, depending on vegetation type, location, condition, configuration, and environmental sensitivity. Given the dynamic nature of vegetation, a single treatment technique or management prescription may not be appropriate for one site over time. Therefore, an adaptive approach that allows for the selection of appropriate management techniques is needed to achieve management goals. Selection of vegetation management techniques, or combinations thereof, will be determined by site-specific conditions. In general, vegetation management techniques can be classified into five categories:

- Biological
- Manual
- Mechanical
- Prescribed Fire
- Chemical

The following sections present a discussion of each of the vegetation management techniques that may be implemented in the Plan Area. Key components of an effective vegetation management project include pre-project preparation (including any necessary environmental review) and layout; selection of qualified and trained contractors; appropriate training of crews, crew supervisors, and equipment operators; scheduling; and supervision to carry out vegetation management treatments and any associated BMPs.

3.1.1 Biological Techniques

3.1.1.1 Grazing

Grazing is a method of using livestock to reduce fine fuel loading of live herbaceous growth, shrubs, and new growth of trees. Livestock, such as cattle, goats, or sheep, browse on grasses, forbs, shrubs, and fresh growth of young trees, thereby reducing the overall fine fuel load of the treatment site.

Goat grazing at Lake Wildwood.

Grazing is effective in managing fine fuels[6] and preventing the expansion of brush into grasslands. Livestock have different grazing habits, and not all livestock are ideally suited for grazing treatments. Most livestock, with the exception of goats, do not consume live or dead, tough, woody plant material in significant quantities as this material is generally unpalatable. Additionally, livestock does not effectively create fuel breaks but is well-suited to maintain new annual growth within them (NCRCD 2025).

To achieve management goals, grazing typically begins in late spring, when growth of annual grasses has slowed, and continues through summer in order to reduce fine fuels prior to the onset of peak fire season. Development of site-specific grazing treatment plans would include goals and implementation actions to ensure that the timing of grazing treatment meets identified goals and minimizes potential negative effects. Knowledge of fuel characteristics and species foraging habits is important for developing grazing plans (Taylor n.d.). Grazing treatment plans would identify the optimal stocking rate and grazing duration, typically measured in pounds per acre of residual dry matter. Optimal residual dry matter levels would be determined by overall management objectives, such as suppression of weeds, fuel load reduction, or minimizing erosion potential. As a fuel reduction technique, grazing may not need to be conducted each year if the intent is to control shrubs or maintain understory fuels; however, if the intent is to reduce grass or other flashy fuels, grazing would be conducted at least annually.

Grazing can be relatively inexpensive and effective and may generate revenue, such as when beef or dairy cattle are contracted to graze large areas. Grazing does have management needs that are not associated with the other described treatment techniques, including controlling livestock movements, establishing water supplies, setting up safe overnight locations, and preventing overgrazing that are critical for successful implementation. Using professional herders or portable fences may be an alternative to fixed fencing where the treatment is temporary. Additional controls may also be needed for protecting retained plants, riparian zones, and sensitive resource areas, and to minimize erosion potential. Prescribed fire and targeted grazing can work as complementary techniques to reduce fuel loads (Taylor n.d.).

3.1.1.2 Grazing Management

Although the concept of grazing is the same regardless of which type of animal is used, how each animal type conducts its grazing varies significantly. As a result, some animals are not suited for grazing treatments in all areas. Animal selection would be determined by fuel management goals. As noted, development of site-specific grazing treatment plans would be completed considering site-specific conditions, management goals, and operational constraints. The plan would specify management objectives and standards, animal stocking rates and use levels, grazing season (turn-out and turn-in dates), and monitoring requirements and performance criteria. Stocking rates are determined by a range analysis, which calculates the number of animals required for a given period to attain the desired use level, which generally ranges from 600 to 1,000 pounds per acre of residual dry matter, depending on site-specific conditions.

Timely movement of livestock to the next treatment area or other available pastures once identified goals have been met is important to minimize potential adverse effects, including soil compaction, overgrazing, and resource damage. Timing of grazing is also critical for animal health as well as effective fuel-load reduction (Taylor n.d.). Fencing is an important component of grazing management efforts to prohibit

[6] Small, easily ignitable, and rapidly consumed vegetation like grasses, leaves, and twigs

livestock from leaving the identified treatment area or gaining access to riparian zones, wetlands, or other sensitive resource areas. Shepherds/herders with guard dogs are also important to keep grazing animals within identified treatment areas and to keep predators away. Finally, water sources are necessary for livestock and need to be provided if insufficient water is available at the treatment site. The following summarizes specific considerations for different grazing animals:

- Goats: Goats have the ability to efficiently access steep slopes. Unlike other livestock, goats prefer browsing on woody vegetation (e.g., tree leaves, twigs, vines, and shrubs) and will consume material up to 6 feet above the ground. This grazing pattern makes goats desirable for fuel reduction treatments to effectively create and maintain vertical separation between surface vegetation and the lower limbs of overstory trees (NRCS 2005). Additionally, substantial quantities of invasive seeds can effectively be removed by using time-controlled, short-duration, high-intensity grazing in early spring (Menke 1992). However, goats will indiscriminately damage most plants, so their use in areas with desired shrub and tree retention would be minimized as goats can girdle shrubs and trees by browsing on bark. Alternatively, portable electric fences can effectively control goat herds and guide the outcome of grazing efforts.
- Sheep: With proper management, sheep dramatically reduce grass densities and may suppress annual grasses. Similar to goats, sheep can efficiently access steep slopes. Sheep have an intermediate diet, with no preference for grasses, forbs, or shrubs, and commonly consume large amounts of green grass during rapid growth stages but avoid dry mature grass (SRCD n.d.). In addition to diet, making them versatile for grazing, sheep can be used with other species such as cattle or goats for diversity fuel treatment (SRCD n.d.). Substantial amounts of invasive seeds, such as yellow star thistle, can effectively be removed from the landscape by using time-controlled, short-duration, high-intensity grazing in early spring (SRCD n.d.). However, since sheep predation by animals such as coyotes is common, anti-predation techniques should be considered. Portable electric fences can be effectively used to control sheep flocks and help prevent animal predation, in addition to shepherds/herders with guard dogs.

Sheep grazing, with fencing and guard dogs. Image courtesy of Nevada County Resource Conservation District.

- Cattle: Management of cattle herd population density is necessary to limit impacts related to soil compaction and erosion, plant cover retention, water quality, and animal waste concentrations. However, the terrain steepness significantly influences cattle distribution, which tend to prefer level to gently rolling hills (SRCD n.d.). To avoid unnecessary impacts, cattle may be better suited to larger expanses for fuels treatment rather than small, confined areas. Cattle are considered grazers with a diet dominated by grasses and grass-like plants such as forbs (SRCD n.d.). Invasive plant species, such as yellow star thistle and medusahead, can be effectively removed from the landscape by using time-controlled, short-duration, high-intensity grazing in early spring for yellow star thistle and late spring for medusahead (SRCD n.d.). Water availability and water supply need to be considered to ensure cattle do not cause environmental damage to watercourses or impact water quality. Grazing for invasive species management must be carefully monitored to ensure timing prevents regrowth. Fencing or cattle guards would ensure cattle do not escape and unintentionally graze not prescriptive areas or interfere with adjacent land uses.

3.1.1.3 Best Management Practices for Grazing

The following BMPs would be implemented, where feasible, when using grazing as a vegetation treatment. Measures addressing the BMPs below should be incorporated into grazing plans. Additional BMPs are provided in Section 4.3. Nevada County Resource Conservation District also published in 2025 "Best Management Practices for Targeted Grazing in the Sierra Nevada Foothills." Livestock Fuel Management - Nevada County Resource Conservation District.

- Identify and assess streams, watercourses, and sensitive biological and cultural resources in potential grazing areas prior to turn-out and install exclusionary fencing where necessary.
- Routinely monitor grazing activities in riparian areas to minimize the potential for stream bank damage, soil compaction, and soil deposition into streams and watercourses.
- Identify thresholds that would trigger a cessation of grazing activity prior to grazing in riparian areas.
- Avoid grazing on unstable slopes or implement measures minimizing impacts to slope stability (e.g., reducing herd size to retain vegetation, avoiding grazing where saturated soil conditions exist).
- Consider the timing and level of grazing practices to promote plant recruitment (e.g., timing prior to undesired seed set of annual grasses to promote perennial species establishment).
- Minimize the spread of invasive plants and pathogens by using quarantine periods, holding areas, clean stock water, and personnel, equipment, and vehicle sanitation.
- Consultation with Certified Range Managers (CRM) when rangeland practices are being applied on forested landscapes or as appropriate.
- Provide an alternate water source such as portable troughs, mobile water trailers, or stock tanks.

3.1.1.4 Limitations to Consider

The following limitations should be considered when using grazing as a vegetation management technique:

- Animals browsing woody plants high in tannins, terpenes, and other phytochemicals demand additional nutrients for detoxification during digestion. This additional nutrition to aid in digestion may need to come from outside sources, such as alfalfa pellets, corn and cottonseed meal.
- Timing of grazing relative to the palatability of vegetation can be a challenge to the success of targeted grazing. For example, the palatability of cheatgrass and medusahead varies depending on the season and moisture conditions.
- Duration, or how long it takes grazers to reduce vegetation to desired levels depends on the palatability of the vegetation. Grazers will consume preferred vegetation first and will not consume less palatable vegetation until preferred vegetation is gone.
- Grazing will only decrease surface fuels, while other fuels will remain intact.

3.1.1.5 Grazing Treatment Resources

Below are direct links to key resources containing information on the use of grazing as a targeted treatment. The materials referenced below informed the grazing practices summarized in the preceding section and provide information for implementing effective, site-specific grazing strategies.

- Grazing | UC ANR Fire Network
- Best Management Practices - NCRCD
- Board of Forestry and Fire Protection:
  - Prescribed Herbivory for Vegetation Treatment Projects
- Livestock Grazing Management Resources | BOFGrazing Management (Code 528) Conservation Practice Standard | Natural Resources Conservation Service
- Livestock Fuel Management - Nevada County Resource Conservation District

3.1.2 Manual Techniques

Manual techniques involve pruning, cutting, or removing trees or other forest vegetation by hand or manual equipment. Manual treatments involve removing dead wood, piling material, lop and scatter, pile and chip, and spreading chips/mulch. Lopping and scattering is the process of breaking down vegetative material into smaller pieces, usually with a chainsaw, and scattering (as opposed to concentrating) the material across the treatment area. Manual treatment is most effective in small treatment areas, areas with difficult access where using heavy equipment is infeasible, or near waterways where other treatment techniques are not recommended. Manual treatment also allows for selective management or targeted vegetation removal and is typically used in conjunction with other techniques. Proper hand crew training and

Hand crews treating downed material with chainsaws.

supervision is necessary to reduce danger to workers using sharp tools on steep and/or unstable terrain, or where other environmental hazards exist. Hand tools include, but are not limited to, chain saws, shovels, Pulaski hoes, McLeod fire tools, line trimmers, weed wrenches, pruning shears, and loppers. Personal protection equipment typically includes long pants and long-sleeved shirts, gloves, safety goggles, hard hats, chaps, and sturdy boots.

3.1.2.1 Best Management Practices for Manual Techniques

The following BMPs would be implemented, where feasible, when using manual vegetation treatment techniques. In all circumstances, tools and equipment would be utilized only for their intended use. Additional BMPs are provided in Section 4.3.

- Ensure equipment operators and project personnel have appropriate personal protective equipment and are properly trained in equipment use.
- Ensure that appropriate fire safety measures are implemented.
- Provide necessary signage alerting the public to active operations for safety purposes.
- Ensure that vehicles and equipment arrive at the treatment area clean and weed-free.
- Prune trees according to International Society of Arborist and American National Standards Institute (ANSI) A300 standards (ANSI 2017).
- Protect retained trees and vegetation from tool and equipment damage.
- Sanitize tools between project areas to prevent the spread of pathogens.
- Service and fuel tools only in areas that prevent grease, oil, fuel, or other hazardous materials from passing into streams or retained vegetation.
- Remove and properly dispose of all refuse, litter, trash, and non-vegetative debris resulting from vegetation treatment operations or associated activity.
- Strive to ensure that cut pieces lay as flat and close to the ground as possible when lopping and scattering. Pieces that remain elevated have a much slower rate of decomposition and will contribute to fuel loading.
- Cut invasive plant material should be disposed of off-site and not chipped or spread onto the treatment site.

3.1.2.2 Limitations to Consider

The following limitations should be considered when using manual techniques for vegetation management:

- Manual treatment is labor-intensive and can become expensive due to the need for a high amount of skilled labor.
- Without continual maintenance, returns start to diminish over time.
- Lop and scatter techniques rearrange fuel loads but do not reduce fuel loads.

3.1.2.3 Manual Treatment Resources

Listed below are direct links to resources that provide information and guidance on the use of manual techniques for vegetation treatment.

- Manual | UC ANR Fire Network
- Page 45 of NCRCD's Forest Management Handbook for Small-Parcel Landowners in the Sierra Nevada and Southern Cascade Range
- Page 6 of the CAL FIRE Fuels Reduction Guide - Final 2021

3.1.3 Mechanical Techniques

Mechanical practices include all methods employing motorized heavy equipment to remove or alter vegetation. Mechanical practices rearrange vegetation structures, compact or chip material, and move material to landings, staging areas, or burn piles. Mechanical equipment typically uses rubber tires or tracks, although skids and cables are also used. In some instances, two or more pieces of equipment will work in concert to achieve a management standard. Mechanical equipment includes, but is not limited to, masticators, tractors, skid-steers, chippers, mowers, grinders, crushers, and skidders.

Tracked chipper processing cut material.

Mechanical equipment constraints include steep slopes; dense tree cover prohibiting travel; saturated soils; proximity of adjacent structures or infrastructure; size of equipment and required set-up and operational space; and dry, high fire hazard weather conditions where equipment use could result in ignition. Mechanical equipment may damage retained vegetation. Mechanical treatments would consider terrain, access, vegetation type, and standards to effectively treat vegetation and minimize impacts. Supervision and specialized training are required. Mechanical treatments are often done in conjunction with other techniques, particularly manual treatments (prior to mechanical treatment) and prescribed fire (following mechanical treatment).

3.1.3.1 Best Management Practices for Mechanical Techniques

The following BMPs would be implemented, where feasible, when using mechanical vegetation treatments. In all circumstances, equipment would be utilized only for its intended use. Additional BMPs are provided in Section 4.3.

- Use low ground-pressure equipment, to the extent feasible.
- Ensure equipment operators and project personnel are properly trained in equipment use.
- Use spotters and guides to direct equipment.
- Stage heavy equipment in previously disturbed areas to the extent feasible.
- Ensure appropriate fire safety measures are implemented.
- Provide necessary signage and patrols alerting the public to active operations and area closures for safety purposes.
- Ensure vehicles and equipment arrive at and leave the treatment area free of soil, weeds, and seeds.
- Control fugitive dust resulting from equipment use by watering disturbed areas.
- Protect retained trees and vegetation from potential damage by using tree protection devices, training equipment operators, and designing projects to reduce potential impacts.
- Leave tree and shrub stumps intact where soil stability is a concern. Where feasible, use existing roads, trails, skid trails, and predesignated routes for equipment travel.
- Limit the size and quantity of equipment to meet the identified vegetation treatment standard.

Mechanical equipment felling trees.

Spotters guiding equipment.

- Avoid alteration of the land through the use of heavy machinery to the extent feasible. If such alteration occurs, regrade or recontour as needed any areas subject to soil disturbance from heavy equipment, including dragging or skidding of trees or other material. Install soil stabilization structures and devices as needed (discussed further in Section 4.3).
- Avoid heavy equipment on unstable slopes, documented slope instability areas, and slopes with gradients exceeding 30%.
- Service and fuel heavy equipment only in areas that will prevent grease, oil, fuel, or other hazardous materials from passing into streams or riparian vegetation.
- Remove and properly dispose of all refuse, litter, trash, and non-vegetative debris resulting from vegetation treatment operations or associated activity.
- Ensure hazardous materials spill kits are available on all heavy equipment.
- Clean all equipment of invasive seed and debris as completely as possible to limit the spread of invasive species.

- Fell trees away from streams, sensitive biological resources areas, and retained trees to the fullest extent possible and with consideration to topography, lean of trees, utility lines, local obstructions, and safety factors. Employ cabling, sectional removal, or other felling techniques, where feasible, to minimize impacts to streams, sensitive biological resource areas, and retained trees.

3.1.3.2 Limitations to Consider

The following limitations should be considered when using mechanical techniques for vegetation management:

- May temporarily increase 1-hour and 10-hour surface fuels by breaking up larger fuels into smaller fuels.
- Heavy equipment is limited by access, requiring work to be done near roads. Staging areas are also often required.
- Manual treatment is generally needed to remove trees too large for the equipment and to prune retained trees.
- Use of mechanical treatment techniques may be limited during periods of high fire danger due to the increased ignition risk.
- Mechanical treatment may be limited during periods of wet weather due to erosion and soil compaction concerns.
- Disturbance-favoring species may increase or resprout following mechanical treatment and may need reentry sooner or follow-up with herbicide or prescribed fire.

3.1.3.3 Mechanical Treatment Resources

The following resources detail recommended approaches for applying mechanical vegetation treatments and offer further guidance to support their effective use in the field.

- Mechanical | UC ANR Fire Network
- Mechanical Treatment | US Forest Service
- The Role of Mechanical Treatments in Reducing Risks of Catastrophic Wildfire in California | California SAF
- Pages 7-10 of the CAL FIRE Fuels Reduction Guide - Final 2021
- Page 45 of NCRCD's Forest Management Handbook for Small-Parcel Landowners in the Sierra Nevada and Southern Cascade Range
- Grazing Land Mechanical Treatment (Ac.) (548) Conservation Practice Standard | Natural Resources Conservation Service

3.1.4 Prescribed Fire

Prescribed burn near Round Mountain (NCRCD).

Prescribed fire reduces fuel volume through combustion and is permitted under specific regulations when conditions permit adequate combustion and fire control. Prescribed fires are planned activities using low to moderate intensity fire and defined goals. Prescribed fire is performed in conjunction with specific land management objectives such as reducing fuel loads, increasing overall forest or habitat health, and/or protecting communities from wildfire (USDA 2018). Prescribed fire can accomplish land management objectives to control undesirable vegetation, prepare sites for harvesting/seeding, control plant pathogens and pests, improve wildlife habitat, improve plant production or quality, remove debris, restore ecological sites, and maintain native plans diversity and composition. Further, prescribed fire can reintroduce and mimic the processes that Sierra Nevada Forest vegetation is adapted to, including nutrient cycling and species turnover. Prescribed fire can occur in small, designated areas or over larger expanses. Two types of prescribed fire, pile burning and broadcast burning, are often implemented in conjunction with manual and mechanical treatment methods as a means of treating vegetative debris, or to enhance effectiveness in advance of an herbicide treatment.

Prescribed burning can be cost effective to quickly reduce large volumes of remaining woody material after other fuel treatments. Alternatively, tractors or hand crews can create piles on flat or gently sloping ground that can be burned during wet conditions (pile burn), although the piles fuel volume can produce localized heat, which may impact adjacent retained vegetation.

Note that prescribed fire is not an appropriate vegetation treatment activity for every project or area. Prior to the development of a project considering prescribed fire, fire professionals would need to thoroughly evaluate the treatment area. It would then be determined if prescribed fire is a viable option with consideration to vegetation type, treatment goals, sensitive receptors, smoke management, and natural resources. In some cases, and in some areas, prescribed fire may not be possible to implement. If an area is determined to be suitable for prescribed fire, prior to any burning taking place, extensive planning would have to occur, including the development of a burn plan. Should environmental conditions deviate from the burn plan, the prescribed fire would not take place. Any projects using prescribed fire would require extensive evaluation and monitoring prior to, during, and after implementation.

3.1.4.1 Pile Burning

Pile burning.

Pile burning is common and often applied in forest settings. Small pile burning is typically conducted at or near the treatment area. Pile burning involves stacking hand or machine-cut vegetation into piles and allowing the material time to dry out. Piles minimize the inclusion of dirt, debris, and stumps. The material is piled soon after cutting with the butt end of branches and limbs toward the outside of the pile so that branches overlap and form a series of dense layers. The top of the pile is covered with a small sheet of heavy paper (e.g., butcher paper) to keep the pile interior dry. One or two limbs are placed atop the paper to keep it in place. The dry interior portion of the pile is ignited at the appropriate time using a drip torch, weed burner, or other igniting tool. Alternatively, tractors or hand crews can create piles of material on flat or gently sloping ground that can be burned during wet conditions (pile burn), although the volume of fuel in the piles can produce localized heat, which may impact adjacent retained vegetation or scorch soil microbial communities, which may be ideal if an additional goal is to reset the vegetation in an area, but should be considered when determining pile placement and size. Piles burns are lit when weather conditions allow, such as in winter and spring, and confined to the footprint of the pile. Burns are divided over multiple days to allow for a halt of burning activities if conditions fall out of prescription (USDA 2018).

Air-curtain burner.

Using an air curtain burner is an alternative to pile burning. Air curtain burners allow for more complete combustion of wood waste and were developed to reduce the particulate matter, or smoke, which results from burning. Using a technology called an "air curtain," (a high velocity curtain of air that prevents smoke from escaping) smoke particles are trapped and reburned, resulting in a cleaner, nearly smokeless burn (less particulate matter) with emissions consisting mostly of water vapor and biogenic carbon dioxide (CAL FIRE 2021). Where feasible, an air curtain burner is used to dispose of wood waste and may be available as a shared resource between land management agencies. Air curtain burners require a large area to stage and move material to be burned.

3.1.4.2 Broadcast Burning

Broadcast burn area post-fire.

Broadcast burns are usually completed in larger areas where cost-effective fuel treatment to control noxious weeds and treat remaining surface fuels in areas treated by other techniques or to reduce surface and/or ladder fuels beneath tree canopies (understory burning) is used. Broadcast burning can be used to create a mosaic pattern of vegetation and allow for regeneration of desired plants (USDA 2018), as well as to introduce the beneficial impacts of mixed-severity fire on regional vegetation. Broadcast burning can break up vegetation continuity to promote ecosystem diversity or reduce fuel loading. Treatment boundaries using roads, trails, or other non-burnable features reduce the need to create additional firebreaks. This approach reduces labor costs and preparation time while minimizing soil disturbance and erosion potential. Prescribed burns can be used in all vegetation types, where conditions allow for effective control (USDA 2018). During the permit season, broadcast burns must be conducted by trained fire protection personnel. Broadcast burns of smaller sizes (< 1 acre) may be conducted by landowners during the open burn season barring any specific location restrictions. Using personnel and equipment from neighboring fire districts provides the added benefit of joint training under prescribed conditions. Timing is critical due to variances in weather conditions and the necessity to minimize plant and animal impacts. Fuel moisture content must be determined to assess if the treatment area is safe to burn. There are typically more available burn days in the spring and early summer months when atmospheric conditions are conducive to smoke dilution and dispersion, but ideal broadcast burns occur in the fall, when conditions permit, due to this being the fire season that Sierra Nevada vegetative communities are adapted to.

3.1.4.3 Prescribed Fire Planning

All prescribed burning requires planning, regardless of the size of the area being burned or the complexity of the proposed burn. Complexity in regard to prescribed fire planning refers to operational and administrative effort to safely burn a unit with minimal risk of escape or damage to life or property. A low-complexity prescribed fire is a small burn area with gentle topography, low fuel loads, good access, minimal environmental impact concerns, and done under favorable weather conditions. Conversely, a high complexity burn is a burn area with more challenging fuel and terrain conditions, done under less than favorable weather conditions, with vulnerable assets nearby, and requires significant operational

support (e.g., fire suppression crews, smoke monitoring, etc.). Low complexity prescribed fire can be successfully done by a private property owner, provided they adequately prepare for the burn. High complexity prescribed fire should incorporate the development, and approval of a prescription burn plan, which can be created by the local fire protection district or a certified burn boss considering vegetation management requirements, local weather conditions, and available fire management resources. Utilizing prescribed fire as a management tool must consider the following:

- Burn Plan/Prescription: A site-specific prescription and burn plan is developed that establishes goals and procedures for the prescribed burn and considers unique site characteristics. The prescription identifies geographic burn units, burn area limits, control line locations, acceptable fuel moisture ranges and weather conditions, and required personnel and equipment, and evaluates potential impacts to natural resources to meet compliance with the California Environmental Quality Act (CEQA). This may be prepared in coordination with CAL FIRE and led by a qualified certified burn boss.
- Smoke Management Plan: The California Air Resources Board and the Northern Sierra Air Quality Management District (AQMD) require a smoke management plan detailing the location of sensitive receptors and implementation of measures to maximize smoke dilution and minimize smoke production. Burn projects less than 10 acres in size or that will emit less than 1 ton of emissions may only need to obtain an air pollution permit. Burn projects exceeding 10 acres or producing more than 1 ton of emissions require a Smoke Management Plan and approval prior to any burn activities.
- Pre-broadcast Burn Site Preparation: Depending on the goals of the burn, manual or mechanical treatments are typically conducted prior to burn initiation to remove and treat larger material (trees, shrubs, slash). The burn boss will work with the project manager to design a prescription that meets project goals for fuel removal and burn severity/intensity, up to and including high severity fire in some pockets of fuel. Treatment of larger material reduces size and spatial arrangement and removes ladder fuels that may allow for crown fire transition. Site preparation includes establishing fire control lines if they do not already exist and reducing fuel loads near firelines to reduce the risk of fire crossing the fireline. These fire lines are typically constructed using bulldozers or hand-scraping tools; occasionally, they are “burned in” with a strip of fire under conditions limiting fire spread.
- Burn Notification: Notifying surrounding communities, local fire departments, media, and AQMD is an essential component to avoid misinterpretation of the prescribed burn as a wildfire. Notifications are repeated on the day of the prescribed burn. Printed materials or interpretive signs are posted at the site and distributed to neighboring communities explaining the reason for the prescribed burn, the type of burn being conducted, and the intended result. Prescribed fires may generate significant public safety concerns over the chance of fire escape. Smoke, ash, and particulate matter may raise additional public concerns many miles downwind from the actual burn site.
- Post Burn Follow-up and Evaluation: Following burn completion, burn crews or fire personnel will remain on site or revisit the burn area to evaluate prescribed fire impacts, mop-up or extinguish burning vegetation, monitor smoke, and to determine if additional treatments or further control BMPs are necessary. Burn plots are monitored and evaluated for invasive species establishment and long-term effectiveness in achieving the project goals.

3.1.4.4 Best Management Practices for Prescribed Fire

The following BMPs would be implemented, where feasible, when utilizing prescribed fire. In all circumstances, equipment would be utilized only for its intended use. Additional BMPs are provided in Section 4.3.

Planning/Before the Prescribed Burn

- Review and adopt a CAL FIRE or local fire protection district prescribed fire go/no-go checklist.
- Monitor weather conditions prior to the scheduled burn date. Review weather predictions for the day of the prescribed burn and the days following the burn for adverse weather conditions (e.g. high winds, heat waves, fire weather warnings).
- Locate and prepare control lines. If using public roads, notify local authorities about the proposed burn.
- Visit the burn area and observe local fuel conditions, including fuel moisture, hazardous trees, and ladder fuels.
- Verify with local fire protection agencies and land management agencies the required permits and notifications.

Day of the Prescribed Burn

- Ensure equipment operators and project personnel are properly trained.
- Check current and predicted weather conditions. Obtain a spot weather forecast from the National Weather Service if observable weather conditions don't match predicted conditions.
- Confirm control lines are strategically located and adequately sized for the anticipated fire behavior.
- Ensure appropriate fire safety measures are implemented, including adequate holding forces.
- Provide notifications to neighboring property owners and local fire protection agencies.
- Provide necessary signage and patrols alerting the public to active operations and area closures for safety purposes.
- Protect retained trees and vegetation from damage by pre-treating adjacent fuels.
- Prior to burning, measure on-site weather conditions several days before the planned burn and monitor weather forecasts for several days after the planned burn.
- Prior to and during burning, nearby communities should be notified to ensure they are aware of prescribed fire activities and potential smoke.

After the Prescribed Burn

- Monitor the burn area for hot spots, unburned islands, and fire-weakened trees near control lines.
- Evaluate whether treatment objectives were accomplished
- Extinguish hot spots and significant smoke sources if necessary.
- Check weather conditions for the days following the burn operation to identify adverse conditions coming.

3.1.4.5 Limitations to Consider

The following limitations should be considered when using prescribed fire for vegetation management:

- Private landowners not utilizing a certified burn boss should limit prescribed fire projects to 1 acre in size or less.
- Limited availability of California state-certified burn bosses.
- Liability and insurance concerns over damages that may occur if prescribed fire escapes, and the suppression costs if fire escapes.
- Weather windows when prescribed fire conditions are met can be very limited.
- Prescribed fire may temporarily reduce local air quality.
- Precise and consistent fire effects are difficult to accomplish, and there will be variability in fuel reduction and vegetation consumption across the treatment.
- Communities may have low tolerance for smoke and may be resistant to prescribed fire activities.

3.1.4.6 Prescribed Fire Treatment Resources

Below are links to resources that outline best practices for applying prescribed fire as a targeted treatment, providing additional technical guidance to support the site-specific implementation of the methods described in this section.

- Fire as a Tool | UC ANR Fire Network About Prescribed Burning - Nevada County Resource Conservation District
  - Prescribed Fire Education Programs - Nevada County Resource Conservation District
  - RX Fire Community - Nevada County Resource Conservation District
  - Prescribed Burn Site Visit - Nevada County Resource Conservation District
- Prescribed Fire | US Forest Service
  - National Prescribed Fire Resource Mobilization Strategy (June 2023)
- Prescribed Fires In California | Benefits & FAQs | CAL FIRE
- Pages 13-15 of the CAL FIRE Fuels Reduction Guide - Final 2021
- California Forest Practice Rules 2025 page 108: CALIFORNIA

3.1.5 Chemical Techniques

Chemical applications use herbicides to kill vegetation or prevent growth and are typically used in combination with other fuel reduction treatments. Herbicides do not remove vegetation from treatment areas; therefore, dead plant material remains without further treatments (except in cases where pre-emergent herbicides are used to control annual plants). Herbicide application is typically performed by hand and may include sponging, spraying, or dusting chemicals onto undesirable vegetation. Hand application provides flexibility and is ideally suited for small treatment areas and areas where it is desirable to control specific plant species. Roadside herbicide application may employ a boom affixed to or towed behind a vehicle.

Herbicide application requires specific storage, training, and licensing to ensure safe use. Application of restricted-use pesticides requires a Certified Applicator. For general-use pesticides, a licensed professional is required to write the pesticide recommendation. Herbicide applications follow a prescription prepared by a licensed pest control advisor. Personal protective equipment is essential to limit personnel exposure to chemicals. All personal protection equipment requirements as identified by the product label and/or state law must be followed.

3.1.5.1 Herbicides

Herbicide applications may be used independently or as a secondary vegetation treatment following manual or mechanical removal to control sprouts and regeneration. Herbicide treatments typically result in high kill rates and can prevent plants from setting seed. Over time, targeted plants are eliminated as their "seed bank" is eventually exhausted, although this process can take many years. Herbicides, in combination with hand/mechanical removal, are the most widely used and effective techniques for controlling vegetation.

Herbicides are broadly classified into two basic types: pre-emergent and post-emergent. Pre-emergent herbicides are sprayed directly onto the ground and prevent plants from germinating and/or growing. They have the potential to impact seedlings of desired species and often have longer persistence times in the environment. Post-emergent herbicides are applied directly on plants or during early growth phases, killing them before they mature and set seed. With proper equipment and training, herbicides can be applied selectively, minimizing impacts on desired species. However, with intermixed desired/undesired vegetation, potential impact to desired vegetation increases.

Plants vary in response to herbicides and depends on the plants life cycle stage when the herbicide is applied. Application during the "bolting" phase (when flowering stalks are being produced) may have greater kill rates than the same chemical applied during the rosette or the flowering stage. To control annual plants, the goal should always be to apply herbicide when the target plant is as small as possible. Some herbicides are specific to plant groups (e.g., Fusilade affects only grasses), while others can kill nearly all kinds of plants. Some are not permitted in California. Systemic herbicides (herbicides that kill the entire plant) are usually more effective in controlling highly flammable/rapidly spreading species through translocation into root tissue such as annual weeds. Contact herbicides (herbicides that kill the plant tissue they come in contact with) are more effective at controlling unwanted plant growth in a certain area (e.g., over a roadway).

Applications should be timed to minimize drift on desirable vegetation. A wide range of herbicides are available for various treatments. Herbicide labels and safety data sheets list susceptible target plant species and provide directions for use and handling. Herbicides must be applied in accordance with state and federal law.

3.1.5.1.1 Organic Herbicides

Organic herbicides may have active ingredients including acetic acid, citric acid, citrus oil, clove oil, and eugenol. They may be a safer option than traditional herbicides due to their quick breakdown in the environment compared to inorganic herbicides. High concentrations of organic herbicides may pose an

acute risk. Organic herbicides are non-selective and will kill or suppress all plant growth and may be combined with other vegetation management techniques.

3.1.5.2 Herbicide Application Methods

3.1.5.2.1 Foliar Spray

Foliar spray herbicide application involves spraying a diluted herbicide solution directly onto the leaves of target plants, allowing the chemical to be absorbed through the foliage and translocated throughout the plant. This method is commonly used for controlling broadleaf weeds, grasses, and woody plants, especially in areas where selective treatment is needed. It is most effective when plants are actively growing and have sufficient leaf surface for absorption. Applicators must carefully manage spray drift and timing to minimize impacts on non-target vegetation.

3.1.5.2.2 Cut and Daub

Cut and daub treatment is used for woody vegetation, invasives, such as Ailanthus; and shrubs such as Scotch broom to control regrowth and kill portions remaining belowground. An appropriate systemic herbicide is applied directly to the cambium layer of the freshly cut stumps or stems. Additional methods include drill and fill, where holes are drilled into the tree trunks and herbicide is injected, or the glove method, where an herbicide-soaked glove is applied directly to plant foliage or freshly cut stumps. This herbicide method must occur immediately after cutting to ensure plant uptake. If enough time elapses to allow the cut surface of the severed plant to dry out, a fresh cut would be made prior to herbicide application. If the fresh cut dries before herbicide application, a new cut should be made.

3.1.5.2.3 Hack and Squirt

Hack and squirt is a targeted herbicide application method used primarily for controlling unwanted woody vegetation. It involves making small cuts or "hacks" into the bark of a tree using a hatchet or similar tool and then squirting a measured amount of herbicide directly into each cut. This technique allows the chemical to be absorbed into the tree’s vascular system, effectively killing it while minimizing impact on surrounding vegetation.

3.1.5.2.4 Root Injection

Root injection is a precise herbicide application method used to control invasive or undesirable trees and shrubs by delivering herbicide directly into the root zone. This technique involves injecting a measured dose of herbicide into the soil near the base of the plant, targeting the root system for systemic uptake. It minimizes off-target impacts and can be useful in sensitive environments where foliar or broadcast applications could harm nearby vegetation or water sources.

3.1.5.3 Best Management Practices for Chemical Techniques

The following BMPs would be implemented, where feasible, when applying herbicide. In all circumstances, equipment would be used only for its intended use. Additional BMPs are provided in Section 4.3.

- Use herbicides as part of an integrated pest management program for achieving desired management or maintenance standards.
- Consult a state-licensed pest control advisor and/or the Nevada County Agricultural Commissioner to identify appropriate site-specific herbicide applications that meet vegetation management standards.
- Consider the timing of herbicide applications to minimize impacts to retained vegetation and nearby resources (for maximum). Application immediately prior to rainfall may reduce effectiveness.
- Use only herbicides and surfactants approved by the U.S. Environmental Protection Agency and registered with the California Department of Pesticide Regulation.
- Apply herbicide consistently with Federal Insecticide, Fungicide, and Rodenticide Act label instructions, and use conditions issued by the U.S. Environmental Protection Agency and California Department of Pesticide Regulation.
- Use the lowest recommended herbicide rate to achieve vegetation management objectives and desired control.
- Use a dye to identify treated areas and monitor overall application.
- Do not apply herbicides to submerged plants.
- Follow safe procedures for transporting, mixing, loading, and proper disposal of herbicides.
- Minimize the use of foliar (spray) applications, prioritizing localized or direct applications.

3.1.5.4 Limitations to Consider

The following limitations should be considered when using herbicides for vegetation management:

- Herbicides may impact wildlife. For example, amphibians may be vulnerable to glyphosate exposure (Durkin 2011).
- Herbicides may cause soil contamination, harm to beneficial insects, damage non-target plants, development of resistance in plants, and long-term ecological effects.
- Herbicides will not remove existing fuels, but will only stop the growth of fuels by killing live plants.
- Live ground fuels will convert to dead ground fuels.
- Depending on the selected herbicide and application method, there may be a limited window of time when the application will be most effective.
- Communities and landowners may be resistant to herbicide use.

3.1.5.5 Chemical Treatment Resources

Found below are key resources that outline best practices for the use of chemical treatments in vegetation management and provide supplemental guidance for applying these methods effectively.

- Herbicide | UC ANR Fire Network
- USDA's Forest_vegetation_Mgt.pdf
- Page 46 of NCRCD's Forest Management Handbook for Small-Parcel Landowners in the Sierra Nevada and Southern Cascade Range

- Cal SAF's Herbicide Use on Forestland (Download "Herbicide Use for Forest Management" for full position statement)
- Safe and effective herbicide use – California Invasive Plant Council
- Vegetation Control - Nevada Irrigation District

3.2 Additional Fire Risk Reduction Strategies

The following techniques may minimize ignition potential, reduce risks to Plan Area assets and resources, or alter vegetation conditions.

- Post-Fire Vegetation Management: Treatment in burned areas to promote forest canopy re-growth. Work may include removal or treatment of dead/dying trees, brush, and exotic or invasive weeds or other vegetation.
- Reforestation/Tree Planting: Planting trees or shrubs to achieve management goals may include restoration of degraded areas, wind flow alteration, ember defense, and increased ground surface shading. Tree planting, however, should always be conducted considering future climate, site-specific conditions, genetics, and local adaptation, and whether or not natural vs planted regeneration is preferred for a given location.
- Invasive Species Removal: Removal and treatment of invasive plants that displace native species and/or increase fire hazards via high fuel loading rates or increased ignitability and flammability.
- Fire Road Maintenance: Minor grading or natural material resurfacing to ensure fire agency apparatus can drive on existing fire access roads.
- Ignition and Spread Prevention: Modifications including flashy fuel treatment, restoration, ignition-resistant mat installation, and use restrictions (e.g., no parking).
- Structural Hardening: Efforts to reduce structure ignition via radiant heat, direct flame impingement, or ember intrusion (e.g., installation of dual pane windows, replacement of combustible roof materials, installation of ember-resistant attic vents).
- Community Outreach: Public education and engagement to raise wildfire risk awareness, fire ecology, and what it means to live in the wildland urban interface (e.g. WUI landowner forest stewardship responsibilities), and encourage wildfire risk reduction efforts (e.g., maintenance of defensible space, participation in chipper programs).
- Utility Hardening/Undergrounding: Moving overhead powerlines below ground, or retrofitting overhead power line networks to minimize arcing, conductor contact, etc.
- Patrols: Patrolling fire hazard areas to deter, detect, and report fire starts.
- Inspection/Monitoring: Conducting defensible space or structural hardening inspections or monitoring open space areas for trespass or fire activity.
- Chipper Program: Providing chippers to incentivize fuel reduction and defensible space maintenance work on residential properties.
- Infrastructure: Equipment purchase, installation, permitting, and maintenance intended to alert the communities about wildfires (e.g., fire detection cameras), or provide data to fire managers (e.g., remote automated weather stations).

3.3 Treatment Costs

As noted, a workshop was held on September 13, 2024, to solicit feedback from attendees on vegetation treatment techniques. During the workshop, treatment costs were discussed and budget ranges identified. Cost ranges were provided based on actual treatment cost, project bids, and cost proposals received by the participating stakeholders. In addition, feedback was provided regarding hidden costs associated with vegetation management that should be considered during project planning and budgeting effort. The following summarizes the feedback received and is organized by the vegetation management technique. It should be noted that the costs provided are reflective of September 2024 and that there is variability across the County, with the western portion of the County typically having lower relative costs than the eastern portion of the County. Cost information is provided in this LMP as a way to compare relative costs between techniques, acknowledging that costs will change over time.

- Biological Techniques
  - Budget Range: $400 - $2,000 per acre
  - Hidden Costs:
    - Livestock escape and trespass.
    - Public nuisance complaints.
    - Supplemental feed and water.
    - Animal welfare and site monitoring.
    - Pasture setup and mobilization of livestock.
- Manual Techniques
  - Budget Range: $2,000 - $15,000 per acre
  - Hidden Costs:
    - Inadequate outcomes requiring re-treatment.
    - Low-bid contractors underperforming.
    - Secondary treatments like pile burning or chipping.
    - Traffic control and equipment mobilization.
    - Seasonal fire restrictions.
- Mechanical Techniques
  - Budget Range: $1,000 - $8,000 per acre
  - Hidden Costs:
    - Ground disturbance and erosion control.
    - Equipment breakdowns and fueling logistics.
    - Public resistance to visible disturbance.
    - Access challenges in remote areas.
    - Seasonal fire restrictions.
    - Potential for high re-treatment costs if high invasion potential exists

- Prescribed Fire
  - Budget Range: $300 - $1,500 per acre
  - Hidden Costs:
    - Burn prep and control line construction.
    - Resource damage from burns out of prescription.
    - Mobilization and cancellation costs.
    - Public perception and outreach.
    - Lodging and transport for fire crews.
- Chemical Techniques
  - Budget Range: <$500 per acre
  - Hidden Costs:
    - Chemical spills and water contamination (rare with licensed operators).
    - Public education and outreach.
    - Administrative and liability concerns.

In addition to the costs associated with the actual treatment work, all vegetation management projects may be subject to costs associated with biological and cultural resource surveys and the preparation of environmental review documents.

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4 Vegetation Treatment Types

4.1 Principles of Vegetation Management to Reduce Fire Hazard

Forest management project in Truckee.

Vegetation management and maintenance standards are intended to reduce fire hazards by rearranging and maintaining the spatial distribution of fuels. As noted by Reinhardt et al. (2008), all vegetation will burn, given the right conditions. Additionally, low-severity fire, when occurring safely, is a natural fuel reduction tool. Therefore, fuel treatments should minimize the potential for ignitions, crown fires, and extreme fire behavior by reducing fuel loads and altering the structure, composition, and spacing (horizontal and vertical) of retained vegetation, and allow low-severity fire to burn should an area receive an uncontrolled wildfire. To achieve this, a combination of vegetation treatment types and techniques is necessary and dependent on vegetation type, structure, and condition.

Given the dynamic nature of vegetation, vegetation management is an ongoing, cyclical process; a single management prescription may not be effective in perpetuity and is, in essence an attempt to mimic what fire would do to the system if it were not in the wildland urban interface. Initial treatments may differ from management prescriptions intended for maintenance. Therefore, management and maintenance standards have been categorized by dominant vegetation community or land cover type (grassland/herbaceous, brush/scrub, tree/woodland/forest, and other combustible materials). Certain vegetation community/land cover types (e.g., wetlands, urbanized areas) do not present wildfire hazards due to high moisture levels or noncombustible conditions; management standards have not been developed for these vegetation communities.

This “dynamic approach” allows for vegetation management based on project needs as conditions change. Management and maintenance standards modify fuel arrangements to reduce the potential for ignitions, rapid-fire spread, crown fires, and extreme fire behavior. These standards reduce fuel loads, eliminate ladder fuels, disrupt the horizontal continuity of vegetation, minimize ignition potential, and prioritize retention of fire-resistant plants.

In grass-dominated vegetation types, management reduces vegetation height (e.g., mowing, grazing), resulting in shorter and more compact surface fuel layers that are less ignitable and less likely to sustain fire spread. Implemented beneath shrub or tree canopies, such treatments also minimize potential for surface-to-crown fire transition. Management is also intended to maintain low fuel volumes in the land areas between shrub- and tree-dominated vegetation types.

In shrub-dominated vegetation types, management reduces surface fuel loading and flame lengths and slows fire spread by increasing the horizontal spacing between retained shrubs. In areas beneath trees, management increases the vertical spacing between shrub and tree canopies to reduce the potential for surface-to-crown fire transition. Removal or treatment (e.g., chipping) of dead material from shrub-dominated types also reduces dead fuel loads, helps achieve spacing standards, and helps minimize the growth of highly ignitable grass/herbaceous vegetation.

In tree-dominated vegetation types, management increases the horizontal spacing between retained trees to reduce the potential for crown fire spread. It removes ladder fuels by increasing the vertical spacing between surface fuels (small trees, shrubs, grasses) and tree canopies to reduce the potential for surface-to-crown fire transition. Creating more fire-resilient tree stands involves a three-part process of reducing surface fuels, reducing ladder fuels (i.e., fuel that can facilitate fire spread from ground fuels into tree crowns), and reducing tree crown density through crown thinning (USFS 2013). As noted by Nunamaker et al. (2007), surface and ladder fuels would have the highest priority for management to reduce fire intensity, rate of spread, and crown fire potential. Active crown fires are initiated with torching but are ultimately sustained by the density of the overstory crowns. A reduction in potential surface fire behavior plus an increase in canopy base height minimizes torching potential (Agee and Skinner 2005).

Managed vs. unmanaged tree-dominated vegetation.

4.1.1 Herbaceous/Grassland

This section outlines management and maintenance recommendations for grasses; other light, flashy fuels; and surface fuels capable of igniting and carrying fire. Herbaceous/grassland fuels cover 6% of the County and are composed primarily of annual and perennial grassland types but may also include ruderal or disturbed areas where grasses have been established.

The following management recommendations have been identified for herbaceous/grass fuels in treatment areas:

- Cut grasses, weeds, and thistles such that heights do not exceed four (4) inches. Avoid disturbing mineral soil to minimize erosion.
- Cut native grasses after flowering/setting seed to discourage invasion of non-natives, and cut non-natives before flowering/setting seed where possible.
- Cut grass may be left on the ground surface to protect the soil as long as it does not exceed six (6) inches in depth.

- Dead or dying surface fuels (ground cover, vines) or other surface vegetation should be removed or chipped and spread on site.
- All dead twigs, branches, or limbs from overstory shrubs and/or trees should be removed or treated (e.g., chipped) and spread as a ground cover (mulch) on site.
- Spread all mulch or chipped material to a depth not to exceed four (4) inches.
- All material removed from treatment areas should be properly disposed of per County standards.

4.1.2 Shrub

This section outlines management and maintenance recommendations for brush vegetation. Brush fuels cover approximately 9% of the County. Continuous shrublands are most common in lower elevations of the County, including species such as chamise, manzanita, and ceanothus (commonly referred to as chaparral). Brush vegetation is characterized by relatively open to dense woody shrub cover and may include some scattered trees or clusters of trees. Brush fuels may be found within other dominant vegetation types (e.g., forests, woodlands) and may be treated to the recommendations outlined in this section.

Spaced and thinned shrub fuel.

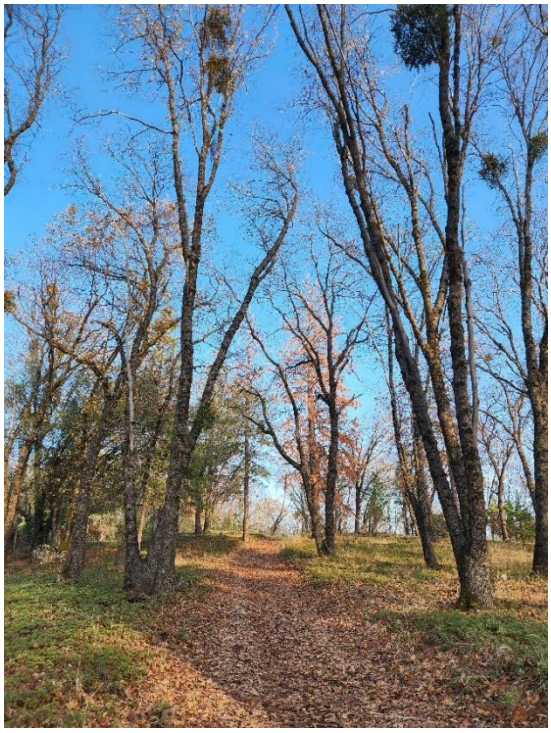
The following management recommendations have been identified for brush fuels in treatment areas:

- Remove all dead shrubs.
- Large continuous areas of shrub cover should be thinned. Individual shrub crowns should be horizontally separated from adjacent shrubs, shrub groupings, or trees. Retained groupings of shrubs should be sized based on the anticipated fire behavior, the presence of tree canopy near retained shrubs, and the adjacent fuels. Horizontal separation distances between shrubs/shrub groupings are dependent on slope gradient as follows:
  - Flat or mild slope (less than 20%): Two times the height of the shrub.
    - Mild to moderate slope (20-40%): Four times the height of the shrub
    - Moderate to steep slope (greater than 40%): Six times the height of the shrub
- Where brush is located within tree driplines, vertical separation between the top of the shrub and the lowest tree branch should be at least three (3) times the height of the shrub crown or 6 feet, whichever is greater.
- Prioritize removal of non-fire-resistant and invasive/noxious plants to achieve spacing standards.
- To minimize soil erosion potential, removed shrubs should be cut at or near the ground surface and root systems left intact.

- All vegetative material from brush removal or thinning should be removed or treated (e.g., chipped, pile burned) and spread on site.
- Spread all mulch or chipped material to a depth not to exceed four (4) inches.
- All biomass material removed from treatment areas should be properly disposed of per County standards.
- When brush removal is necessary to achieve the spacing standards outlined above, prioritize removal of non-fire-resistant plants over fire-resistant plants.

4.1.3 Tree/Woodland/Forest

This section outlines management and maintenance recommendations for tree-dominated vegetation types. Tree/woodland/forest fuels cover approximately 77% of the Plan Area and are composed of oak woodlands, hardwood/conifer, and mixed conifer types, though other forest types are present. Tree-dominated vegetation in the Plan Area varies from relatively open tree stands to dense stands with relatively closed canopy cover. Trees or small clusters of trees may be found within other vegetation types and would be treated to the recommendations outlined in this section. The overall intent of the management and maintenance recommendations for tree/woodland/forest fuels is to reduce densities by thinning stands, promote retained tree trunk diameter growth, promote retained tree health by reducing competition, retain ground surface shading through canopy retention, retain fire-resistant species, and reduce ladder fuels. and provide horizontal separation to minimize the potential for crown-to-crown fire spread.



Managed oak woodland.

The following management recommendations have been identified for tree/woodland/forest fuels in treatment areas:

- Target removal/treatment of dead trees near infrastructure or pathways, or areas of high density of dead fuel, while retaining habitat snags at a density to be determined by a consulting forester.
- Prune portions of tree crowns along to maintain 10 feet of horizontal clearance from the edge of the roadway and 15 feet of vertical clearance above the road surface.
- WUI projects should base tree/woodland/forest treatment goals on individual tree spacing. Individual tree crowns should be horizontally separated from adjacent tree crowns. Horizontal separation distances between tree crowns are dependent on slope gradient as follows:
  - Flat or mild slope (less than 20%): 10 feet.
  - Mild to moderate slope (20-40%): 20 feet.
  - Moderate to steep slope (greater than 40%): 30 feet.

- Fuel Break and Ecological Restoration projects treatment goals on pre and post treatment basal area[7], which is the cross-sectional area of trees at breast height.
  - On Site I lands[8] at least one hundred twenty-five (125) square feet per acre of basal area should be retained.
  - On Site II and III lands at least seventy-five (75) square feet per acre of basal area should be retained.
  - On Site IV and V lands at least fifty (50) square feet per acre of basal area should be retained.
- Where brush is located within tree driplines, vertical separation between the top of the shrub and the lowest tree branch should be at least three (3) times the height of the shrub crown or 6 feet, whichever is greater (CAL FIRE 2025c). Local fire agency requirements may differ, projects within a local fire agency jurisdiction (Grass Valley, Truckee, Nevada City) should check with the local agency for specific requirements.
- Prioritize removal of non fire-resistant and invasive/noxious plants[9] to achieve CAL FIRE or local fire agency defensible space tree and shrub spacing standards.
- To minimize soil erosion potential, stumps from removed trees should be left intact, with stumps cut as flat and low as possible not exceeding 6 inches (as measured from the uphill side).
- All vegetative material from tree removal or thinning should be removed or treated (e.g., chipped, pile burned) and spread on site (where necessary for erosion control, logs no smaller than 8 inches in diameter [small end] may be retained on the soil surface).
- Spread all mulch or chipped material to a depth not to exceed four (4) inches.
- All biomass material removed from treatment areas should be properly disposed of per County standards.
- When brush removal is necessary to achieve the spacing standards outlined above, prioritize removal of non-fire-resistant plants over fire-resistant plants.

Canopy thinning via the selective removal of trees within a stand can achieve the desired horizontal spacing between retained tree canopies to minimize potential crown fire spread. Thinning from below, a technique in which trees are removed from the lower forest/stand canopy, can reduce the severity and intensity of wildfires by reducing crown bulk density and increasing crown base height (Graham et al. 1999). Thinning or removal of only overstory trees can result in higher mid-flame wind speeds and decreased fine fuel moisture, which can increase surface flame lengths, resulting in crown fires and increased fire intensities. However, sufficient treatment of surface fuels (understory, slash, and ladder fuels) results in a reduction in fire behavior sufficient to outweigh these effects (Graham et al. 1999; Agee and Skinner 2005). Table 19 summarizes the effects and advantages associated with fuel management in tree-dominated vegetation types. Selectively limiting canopy thinning treatments to only understory or overstory trees is difficult to achieve in practice due to variations in forest structure and tree sizes. In addition, there may be permitting requirements or environmental constraints that limit the removal of larger trees. Therefore, effective selective canopy thinning can include a combination of understory tree

[7] Basal area (square feet) = (pi /(4 * 144))*DBH2 = 0.005454*DBH2, DBH=Diameter at Breast Height
[8] Site classification is based on Cal. Code Regs. Tit. 14, § 1060 - Site Classification
[9] https://sierranevadaalliance.org/wp-content/uploads/2019/12/SNYG-guide.pdf
https://chapters.cnps.org/redbud/gardening/design-and-selection/

removal (thin from below) to increase vertical clearance and break up ladder fuels with overstory removal to create larger gaps.

In addition to the recommendations above, this LMP anticipates that treatment prescriptions for forested areas would be developed during the project planning phase. A qualified professional (e.g., Registered Professional Forester) would develop treatment prescriptions on a project basis. Treatment prescriptions would identify desired residual stand density (average trees per acre) and tree spacing, tree canopy spacing, species retention/removal selection, tree trunk diameter thresholds for retention, treatment considerations for multi-stem trees, differentiation for residual tree spacing on sloped areas, specific treatment techniques for certain species, retention of fire-resistant species, depth of treated material, among others. On non-federal land, preparation of appropriate Timber Harvest Plans, Exemptions, or Emergency Notices may be necessary, as outlined in Section 5.3.

Table 19. Principles of Fire Resistance to Tree-Dominated Vegetation Types

Principle	Effect	Advantage	Concerns
Reduce surface fuels	Reduces potential flame length	Control easier; less torching	Surface disturbance less with fire than other techniques
Increase height to live crown	Requires longer flame length to begin torching	Less torching	Opens understory; may allow surface wind to increase
Decrease crown density	Makes tree-to-tree crown fire less probable	Reduces crown fire potential	Surface wind may increase, and surface fuels may be drier
Keep big trees of resistant species	Less mortality for same fire intensity	Generally, restores historic structure	Less economical; may keep trees at risk of insect attack

Source: Agee and Skinner 2005.

4.1.4 Other Combustible Material

Other combustible material, including, but not limited to, debris, trash, or yard waste that is placed, left, or deposited in any treatment area should be removed or chipped and spread according to the standards outlined above. Any material removed from a treatment area should be properly disposed of in coordination with landowners and appropriate County departments and consistent with appropriate County standards.

4.2 Vegetation Treatment Types

4.2.1 Wildland Urban Interface

Fuel reduction behind a neighborhood.

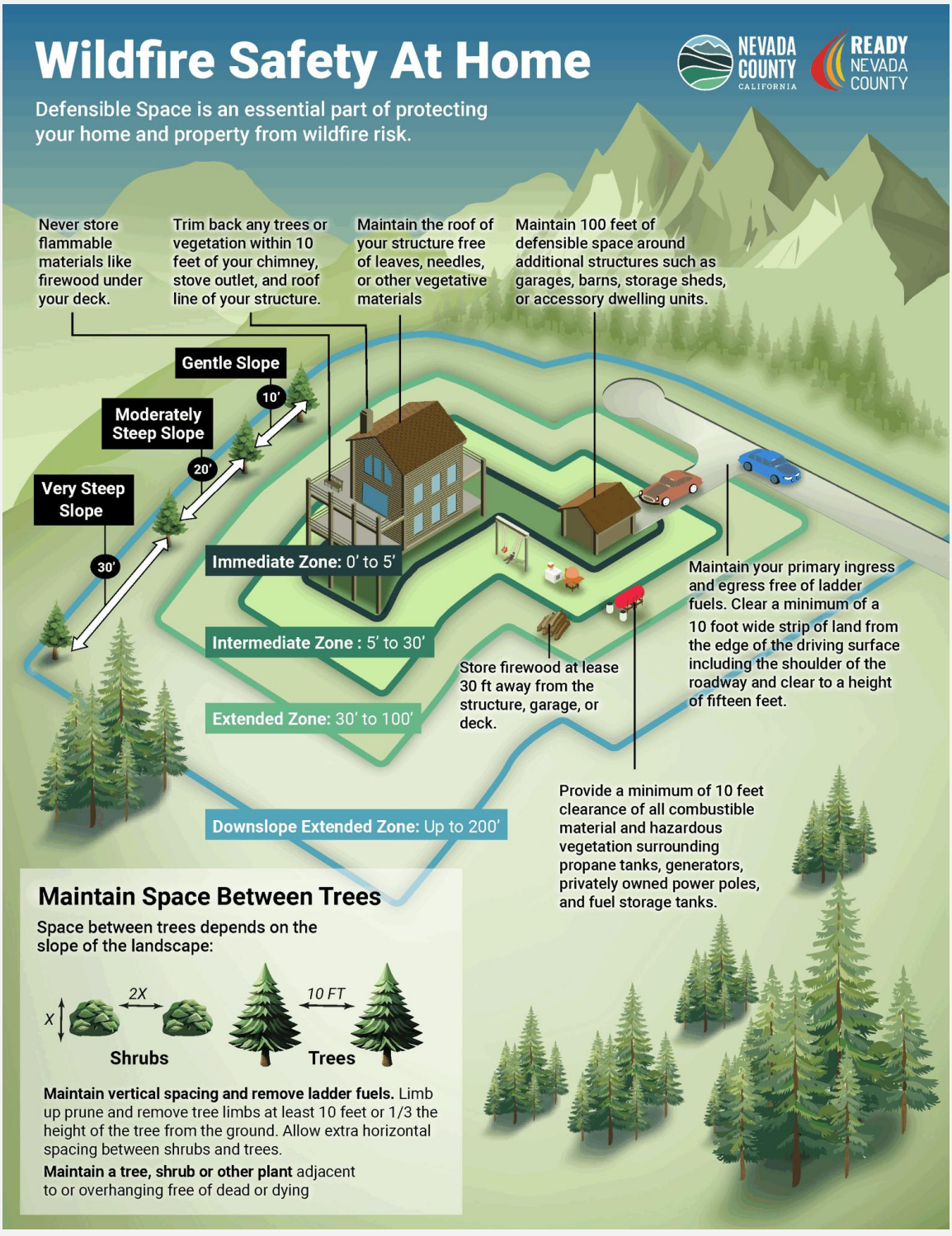
The wildland urban interface (WUI) is the geographic area where wildlands and development intersect or intermix, presenting significant fire hazard risks and a complex fire environment. When wildfires occur in WUI areas, firefighting and emergency response efforts are primarily focused on protecting human life and property. WUI fuel reduction would generally consist of strategic reduction and removal of vegetation to reduce fuel loads and prevent or slow the spread of wildfire between structures and wildlands, and vice versa. WUI fuel reduction treatments also provide emergency access points, staging areas for firefighters and equipment, and reduce flammable vegetation near emergency evacuation routes. Additionally, WUI fuel reduction treatments may enhance habitat quality in areas where existing habitats are degraded, such as through the removal of invasive plant species (additional treatments that improve habitat quality are discussed below as Ecological Restoration treatments).

WUI fuel reduction treatments would serve as one component of wildfire risk reduction efforts occurring in the WUI, such as requirements associated with WUI building codes, defensible space, and other structural hardening and fire safe development standards. As California transitions to the 2025 code cycle, wildfire-resistant construction requirements formerly located in California Building Code (CBC) Chapter 7A, California Residential Code (CRC) Section R337, and California Fire Code Chapter 49 are now consolidated into the 2025 California Wildland-Urban Interface Code (CWUIC), which is effective January 1, 2026. These updated WUI construction requirements apply to new development and work in tandem with vegetation management in WUI areas. Specific locations for WUI fuel reduction treatments would be prioritized based on evaluation of the topography, fuel loading, location within Project Priority Areas, and proximity to High Value Resources and Assets (HVRA) at risk.

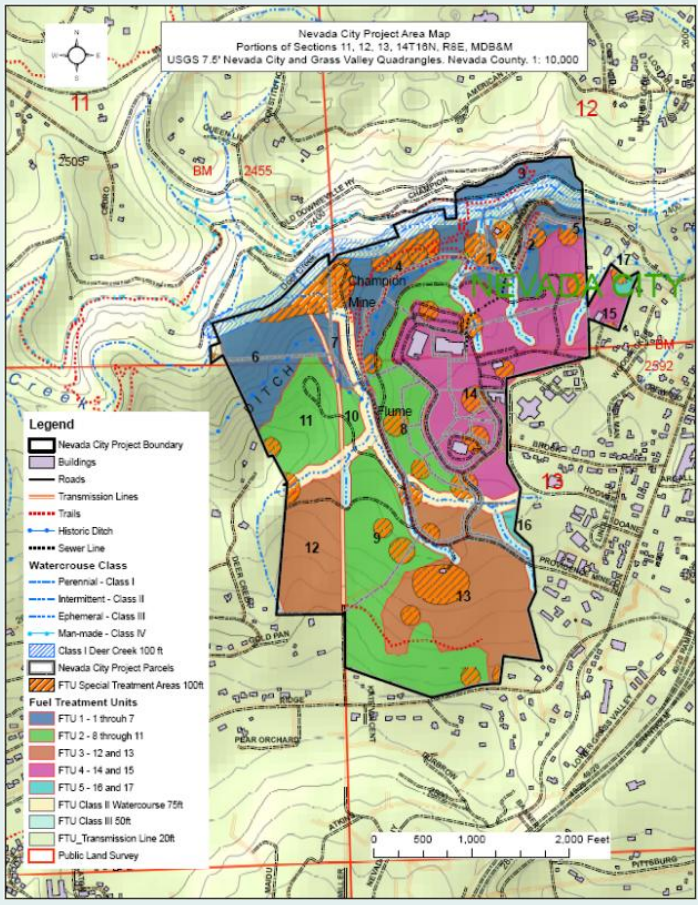
Defensible space is an effective means of reducing the risk of loss of life and property due to wildfire in the WUI. Defensible space works to achieve four objectives: (1) to reduce the risk of direct flame contact with a structure; (2) to reduce the overall fire intensity and rate of spread near a structure; (3) to remove ember sources and provide a space for embers to fall to the ground before reaching the structure; and (4) to provide an area for firefighters to safely engage with the fire and to provide access to structures. A defensible space zone around the entire structure has been proven to be effective for achieving these objectives (Syphard et al. 2014). Conversely, the lack of defensible space within 30 feet of a structure has been shown to be a key factor in structure ignition during wildfires (Troy 2020).

WUI fuel reduction treatments for the Plan Area are anticipated to occur within the space between structures and areas of non-maintained vegetation. The size of the treatment area (distance from structure) would be dictated by the most currently applicable codes and standards in place for the adjacent structures, including PRC Section 4291; County Code Title 32, Section 4908, or other more restrictive standard, and, where applicable, updated defensible space and WUI-construction requirements under 2025 CWUIC. WUI fuel reduction treatments may occur on private property or where insufficient room for required treatments exists on private property and the treatment area extends out into other undeveloped land (e.g., neighboring undeveloped parcel). Vegetation management occurring outside of WUI areas, as defined, would be categorized as Fuel Breaks or Ecological Restoration (discussed below). The information presented in Exhibit 3 graphically displays defensible space recommendations for Nevada County.

Exhibit 3. Defensible Space Recommendations for Nevada County



Example Project: Deer Creek Hazardous Fuels Treatment Project



This project, located in Nevada City, is focused on reducing fire risk in the Wildland Urban Interface. Planning for the project was funded by a grant from the Sierra Nevada Conservancy. Implementation is funded by a grant from USFS. The project targets 348 acres across 33 parcels of public and private land on the south side of Deer Creek. This area includes critical infrastructure such as the Deer Creek and Seven Hills Schools, the St. Canice Center, the Tech Center, and the City's wastewater treatment plant. These sites are located in the most heavily forested part of the city and are particularly vulnerable to wildfires originating in Deer Creek Canyon.

Vegetation treatment techniques for the project include manual and mechanical thinning, prescribed burning, mowing, and chipping. These methods aim to reduce ladder fuels, break up continuous fuel beds, and maintain low vegetation density near structures and along roadways. The project also supports the use of grazing in appropriate areas to manage grass and brush growth. Treatments are designed to be ecologically sensitive, preserving native species and minimizing soil disturbance. The project is part of Nevada City's broader wildfire preparedness strategy and aligns with regional efforts to protect communities and infrastructure from increasing wildfire threats (Under the Trees, Inc. 2024, City of Nevada City 2025).

Project Website: Deer Creek Hazardous Fuels Treatment Project | Nevada City, CA

4.2.1.1 Example Project Types

WUI Projects can include but are not limited to:

- Roadside Vegetation Removal
- Defensible Space Projects
- Hazardous Fuel Reduction
- Fuel Reduction Around Critical Infrastructure
- Strategic Fuel Breaks

- Ecological Re-Introduction of Fire/Broadcast Burning
- Community Education Specific to Vegetation Management

4.2.2 Fuel Breaks

Fuel break in mixed conifer shrub environment.

Fuel breaks are typically wide strips of land where vegetation management has occurred so that wildfires burning into them can be more easily controlled. Fuel breaks are not intended to stop fire spread, especially where embers can be transported via strong winds over the fuel break but rather modify fire behavior and enhance firefighting capabilities. Treatments conducted in fuel breaks reduce fire intensity, slow fire progression rates, reduce flame lengths, minimize the likelihood of crown fire transition, increase fireline construction rates, and provide for points of access for fire crews (CAL FIRE 2019, Agee et al. 2000). Additionally, shaded fuel break treatments in Sierra Nevada mixed conifer forests can lower the probability of crown fire and enhance forest structure and resilience (Low et al. 2023). Vegetation treatments in fuel breaks increase the horizontal spacing between retained vegetation, increase the vertical separation between surface fuels and overstory tree canopies, and modify surface fuels (grasses, shrubs, debris) to reduce fire intensity and flame lengths. Fuel breaks can vary in total width depending on terrain, vegetation, and proximity to HVRAs, and may reach up to 300 feet (CAL FIRE 2019).

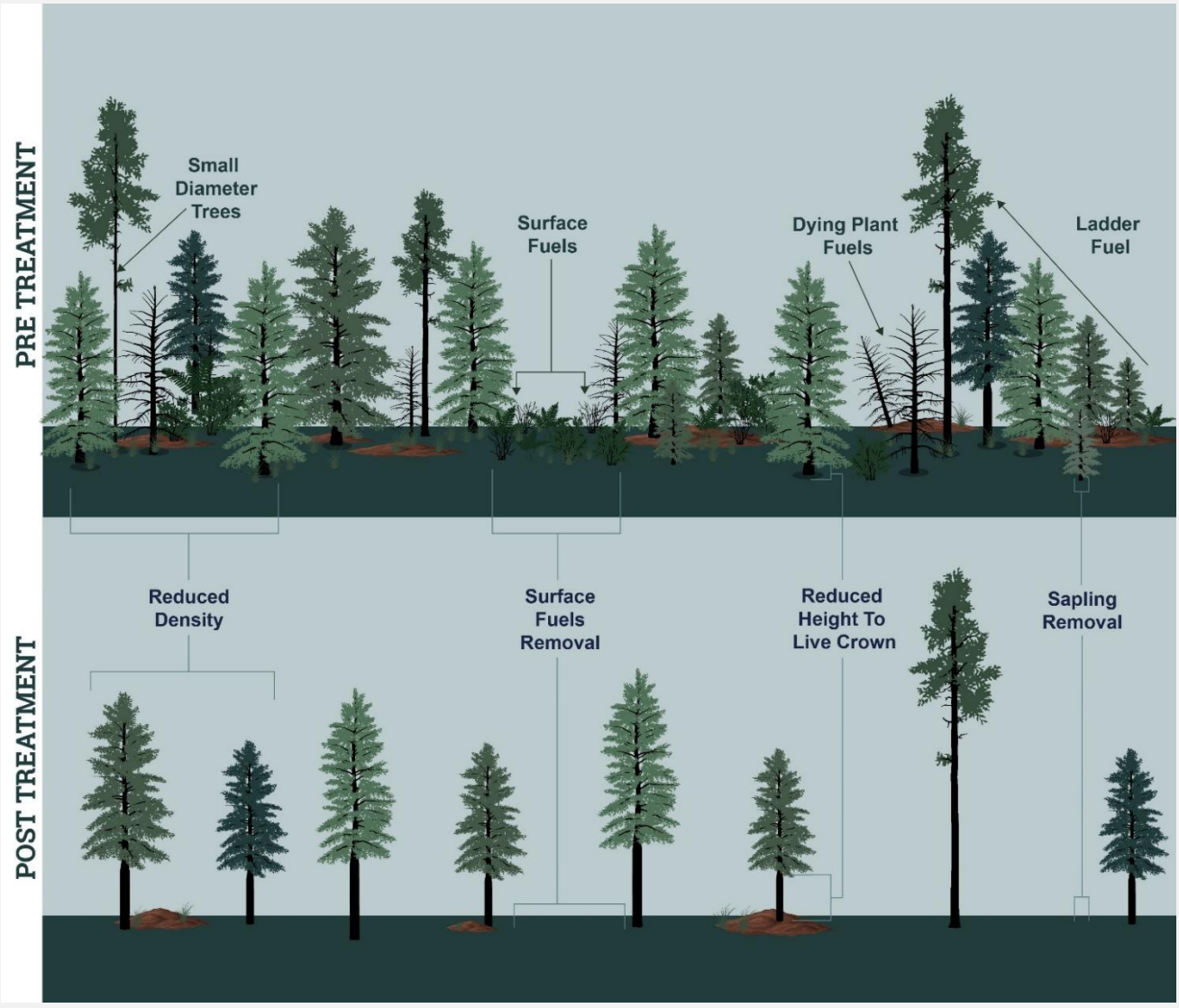
Fuel breaks in shrub-dominated vegetation types typically consist of thinning brush stands to remove dead vegetation, decrease surface fuel loading, and provide horizontal spacing between retained shrubs or shrub groupings. Fuel breaks in tree-dominated vegetation types (shaded fuel breaks) typically consist of ladder fuel removal (removal or treatment of live and dead understory trees and shrubs) to provide vertical spacing between tree canopies and understory vegetation and, in some cases, selective removal of overstory trees to provide horizontal separation between retained tree canopies. Treatment of ladder fuels is aimed at reducing the probability of crown fires.

Fuel breaks can be combined with other treatment types to increase effectiveness and should be designed considering terrain, fuel characteristics, anticipated fire behavior, and local weather conditions. The useful life of a shaded fuel break is the estimated amount of time (in years) that the mitigation action will be effective and is based on several factors including vegetation type, treatment location, and weather conditions. In general, fuel breaks in grasslands have a lower useful life (1 year); those in brush-dominated areas have a moderate useful life (2 to 4 years); and those in forested areas have a longer useful life (3 to 20 years). Maintenance of fuel breaks is necessary to maintain their utility in reducing fire hazard.

The study by Low et al. (2023) examined the long-term effects of shaded fuel breaks in California's Sierra Nevada mixed-conifer forests. The researchers found that initial thinning and prescribed fire treatments significantly reduced surface fuels and maintained larger, fire-resilient trees over a 20-year period. These treatments not only lowered the probability of crown fire but also enhanced forest structure and resilience, especially when wildfires occurred after treatment. The findings support shaded fuel breaks as a durable and ecologically beneficial strategy for wildfire mitigation and forest restoration.

The information presented in Exhibit 4 graphically displays the conditions of a shaded fuel break before and after treatment.

Exhibit 4. Pre- and Post-Treatment Shaded Fuel Break Example



It should be noted that there is a difference between a fuel break and a fire break. As discussed, a fuel break is an area where vegetation has been modified to reduce fire intensity and slow its spread and where some vegetation is retained. In contrast, a fire break is a completely cleared strip of land, often down to bare mineral soil, that is devoid of any flammable material. Fire breaks are more abrupt and, when properly designed and maintained, can stop low-intensity wildfire spread. Typically, however, they provide an entry point and anchor point where firefighting activities can effectively be initiated (USDA 2017).

The information presented in Exhibit 5 graphically displays the differences between a fuel break and a fire break.

Exhibit 5. Fire Break versus Fuel Break Example

4.2.2.1 Example Project Types

- Roadside Fuel Break
- Roadside Shaded Fuel Break
- Ridgeline Fuel Break
- Ridgeline Shaded Fuel Break
- Powerline Corridor Clearance
- Shaded Fuel Break
- Fire Break

4.2.3 Ecological Restoration

Forest restoration is defined as assisting the recovery of degraded forest ecosystems by reestablishing the composition, structure, pattern, and ecological process (fire) necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions. Ecological restoration treatments focus on restoring ecosystem processes, conditions, habitat value, and wildfire resiliency by modifying uncharacteristic fuel conditions (Fuller et al. 2020). Such fuel conditions exist for various reasons, including a history of fire exclusion, occurrence of severe wildfire events, conversion of vegetation community types, displacement of native plant communities by invasive species, increased plant mortality due to pest or disease infestations, or other influences that contribute to deviation from historic landscape conditions, such as climate change, land use conversions, and other indirect effects (Lenihan et al. 2008). Ecological restoration treatments should involve management actions to return the

Understory burn in Jones Fire scar.

treatment area to conditions conducive to resilience to stressors such as drought and wildfire. Wildfire is a natural occurrence in many California ecosystems and played the primary role in shaping the landscape and maintaining ecosystem processes in Sierra Nevada forests (Schwartz et al. 2015, Stephens et al. 2013, North et al. 2009, Pausas et al. 2004). Ecological restoration treatments can contribute to improving overall ecosystem health by increasing plant vigor, reducing susceptibility to pests and disease, increasing tolerance to drought and climate change effects, and reducing the threat of high-severity wildfire. Healthy ecosystems have a mosaic of successional stages, providing a diversity of wildlife habitats, and are comprised of vegetation that is more resistant to wildfire, pests, drought, and disease outbreaks.

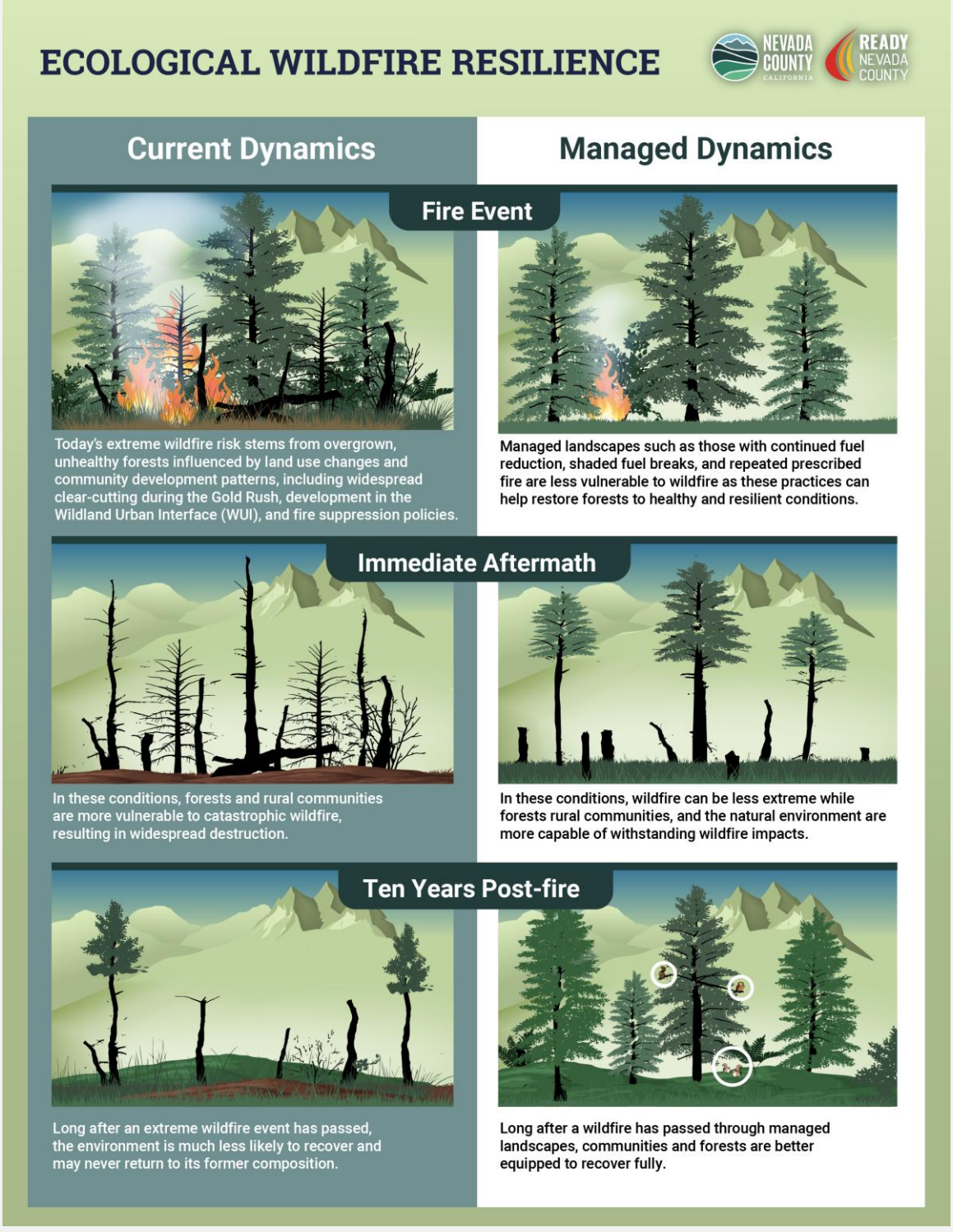
Potential ecological restoration treatments in the Plan Area may include, but would not be limited to, invasive species control or removal, managing type conversion of vegetation communities, treatments to mimic natural disturbances to control species encroachment and alter vegetation community successional stages, prescribed burning of to mimic natural fire recurrence, using prescribed fire to treat thatch buildup in grasslands, post-fire hazard tree removal, treatment of pest or disease-infected vegetation, and treating ladder fuels or thinning forest stands to reduce fuel loads and return woodlands/forests to historic compositions. In addition to their role in forest restoration, these treatment activities can accomplish fuel mitigation and reduction goals through the reduction of surface and understory fuel volumes, removing ladder fuels, and decreasing forest density. Ecological restoration and fuel treatment can converge in many ways to create a more fire-resilient landscape (Stephens et al. 2021). However, not all fuel reduction projects can be considered ecological restoration projects as well. As an example, fuel mitigation projects in the WUI with strict spacing and clearance standards would not create diversity in forest composition or structure, which is the intent of some forest restoration projects.

The information presented in Exhibit 6 graphically displays the effects of vegetation management on ecological resilience.

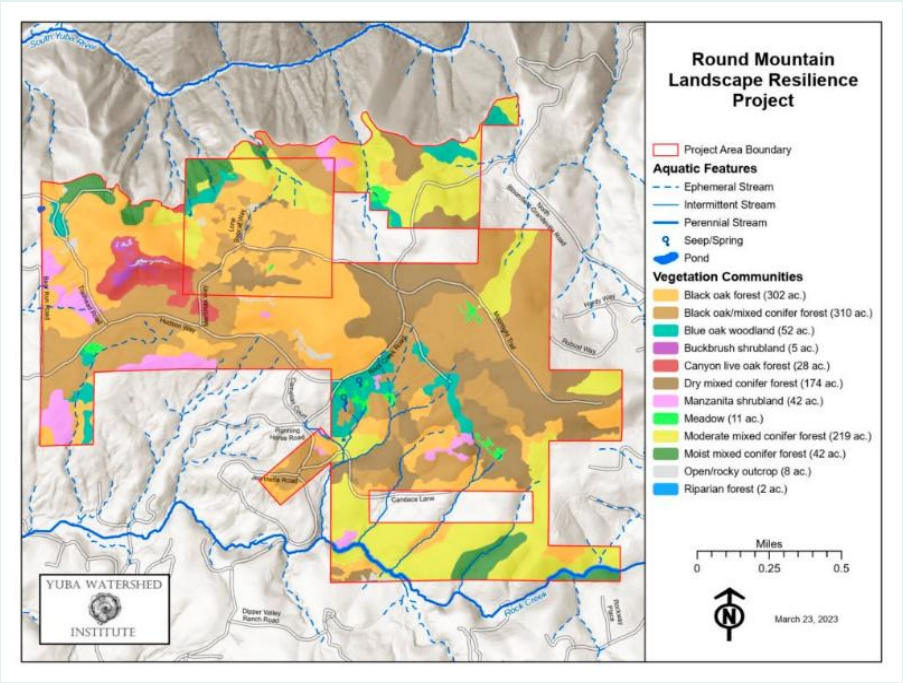
4.2.3.1 Example Project Types

- Forest Health and Resilience Projects
- Silviculture Projects
- Invasive Species Management
- Pest and Pathogen Management
- Carbon Sequestration
- Aspen Regeneration
- Meadow Restoration

Exhibit 6. Example of Fire and Post-Fire Effects of Ecological Restoration Treatments



Example Project: Round Mountain Landscape Resilience Project



This project, led by Bureau of Land Management (BLM) in partnership with the Yuba Watershed Institute and the Bear Yuba Land Trust, targets up to 1,032 acres of forested land. The project is designed to restore ecological health and reduce wildfire risk with a combination of commercial and pre-commercial thinning, manual and mechanical fuel removal, prescribed fire, and targeted grazing treatments. These treatments aim to reduce understory fuels, thin overcrowded forest stands, and construct fuel breaks, all while promoting forest health, native vegetation, and improving habitat conditions.

The project area lies within the WUI and is ecologically significant due to its biodiversity and fire-adapted ecosystems. Implementation began in 2023 and is expected to continue for at least five years. The Round Mountain project is part of a broader strategy to enhance landscape-scale resilience to wildfire and climate change, while also protecting cultural and natural resources. It reflects a growing emphasis on integrated forest management that balances fire mitigation with long-term ecological restoration (BLM 2025, YWI 2025).

Project Website: Round Mountain Landscape Resilience Project

4.3 Practices to Avoid/Minimize Impact

In addition to the Best Management Practices (BMPs) identified for the vegetation management techniques discussed in this LMP, additional practices intended to avoid or minimize potential impacts associated with vegetation management are provided in this section.

4.3.1 Fire Protection During Vegetation Management

All operations conducted in the Plan Area associated with project implementation should adhere to the fire protection standards outlined in Title 14, California Code of Regulations (CCR), Division 1.5, Chapter 4, Subchapter 5, Article 8 (Fire Protection). Per state code, projects are required to take precautions to reduce the chance of ignitions, including checking fire forecast conditions, monitoring weather, maintaining spark arrestors, and having fire guards with appropriate suppression equipment on hand. Under particularly dangerous conditions, all activities with a risk of wildfire ignition are halted. The following fire protection BMPs are provided to augment current practices:

Prework fire safety meeting.

- During vegetation management project operations that require a vehicle, machine, tool, or equipment powered by an internal combustion engine operated on hydrocarbon fuels, suitable and serviceable tools for firefighting purposes should be provided and maintained.
- All equipment with an internal combustion engine using hydrocarbon fuels should be equipped with a spark arrestor, as defined in California PRC Section 4442.
- Internal project communication procedures should be established for reporting fires or calling 911 in emergencies.
- Avoid the operation or use of construction equipment, engines, machinery, or any steam, oil, or gasoline-operated stationary or mobile equipment from which a spark or fire could originate without a qualified device or spark arrestor. During Red Flag Warnings and High to Extreme Fire Danger days, the timing and type of activities should be limited to activities that would not exacerbate fire risk or cause unintentional ignitions.
- Before initiating operations, staging areas should be identified. Staging areas should be contained within already disturbed areas or non-vegetated areas (e.g., roads, parking lots) and would account for vehicle parking and tool/equipment storage.
- Conduct mowing operations before 10 am and avoid mowing on hot or windy days.
- Prioritize the use of string trimmers over mowers to minimize ignition potential.

4.3.2 Preventing Pest/Pathogen Introduction to Treatment Areas

Pest and pathogen BMPs would be incorporated into project planning and implementation efforts. These practices encompass protection of the residual stand from mechanical damage, quarantine and sanitation practices. Outbreaks of known invasive pathogens and unknown pests and pathogens pose a threat to the Plan Area vegetation. Tool and equipment sanitation on project sites would be conducted

to reduce the spread of pests and diseases following treatments in areas of a known infestation. If soil is collected on equipment, rinsing the equipment on site with a portable water tank or water truck, or at a designated rinsing station, can remove soil-borne pathogens and prevent transport to new sites. Additionally, certain pathogen-specific measures have been developed to deal with regional pathogens. These measures would be implemented in the Plan Area, where applicable.

4.3.2.1 Bark Beetle

Some species of insects are a pest, continually threatening forest health. Bark beetles (*Scolytidae* spp.) are a common pest in Nevada County, which has caused significant mortality in forests in the past. Bark beetles are a common pest of conifers and some broadleaf tree species. Over 200 species of bark beetles occur in California, with 20 of those being invasive species. The Nevada County Agriculture Commissioner and Nevada County RCD provide guidance on managing bark beetle infestations, which have worsened due to drought-stressed trees. Proactive steps are recommended, including thinning overgrown trees, removing dense underbrush, watering high-value trees, and promptlyremoving dead or infested trees. Safe removal practices, especially near power lines, are also recommended. More information can be found here:

Bark beetle impacts to conifer stand.

Bark Beetle Information | Nevada County, CA

Management actions for controlling bark beetles include (UC ANR 2008):

- Maintain Tree Health
  - Keep trees well-watered during drought.
  - Avoid root damage and soil compaction.
  - Thin overcrowded stands to reduce competition for water and nutrients.
- Remove and Dispose of Infested Trees
  - Promptly remove trees showing signs of infestation (e.g., pitch tubes, boring dust).
  - Chip, burn, or debark infested wood to kill developing beetles.
- Preventive Insecticide Treatments
  - Apply insecticides to the bark of high-value trees before beetle flight season.
  - These treatments are not curative and must be timed correctly.
- Avoid Fresh Cuts During Beetle Flight Season
  - Pruning or cutting trees during spring and summer can attract beetles.

- Use Pheromone Disruption (Limited Use)
  - Anti-aggregation pheromones may deter beetles in small-scale or high-value areas.

4.3.2.1.1 Sierra Streams Institute Management Recommendations

Sierra Streams Institute provides management recommendations for bark beetles in their *Resource Toolkit for Landscape-Scale Management in Western Nevada County* (Sierra Streams Institute n.d.). The following preventative actions are recommended for bark beetles:

- Plant only species properly adapted to the area, while also considering future climate and pre-adaptation to expected conditions.
- Healthy trees are less likely to be attacked and are better able to survive attacks from a few bark beetles.
- Ensure that planted trees have access to resources that allow them to flourish and not have weakened pest defenses.
- Pay particular attention to old, slow-growing trees, crowded groups of trees, and newly planted trees in the landscape. Large nursery stock or transplanted trees, notably oaks and pines, can become highly susceptible to bark beetles or wood borers after replanting.
- Avoid injuries to roots and trunks, damage and soil compaction during construction activities, and protect trees from sunburn (sunscald) and other abiotic disorders.
- Dense stands of susceptible trees should be thinned (complete removal of some of the trees) to increase the remaining trees' vigor and ability to withstand an attack. High-value trees may be sprayed with insecticides to prevent beetle attacks.
- Often the largest trees in a stand are the largest hosts, and may, unfortunately, be the best target for removal during an infestation.
- Note that outbreaks often occur from a central nursery tree. If a large tree shows signs of invasion (pitch tubes and dying needles from the top down), assume infestation of immediately surrounding trees and inspect for signs of invasion.
- Prune infested limbs and remove and dispose of dying trees so that bark- and wood-boring insects do not emerge and attack other nearby trees.
- Avoid creating fresh pruning wounds during the adult beetles' flight season. Do not prune elm trees from March to September or pines during February to mid-October.
- Do not pile unseasoned, freshly cut wood near woody landscape plants. Freshly cut wood and trees that are dying or have recently died provide an abundant breeding source for some wood-boring beetles.
- Tightly seal firewood beneath thick (10 mil), clear plastic sheets in a sunny location for several months to exclude attacking beetles, and kill any beetles already infesting the wood

4.3.2.2 Managing Invasive Plant Species in Treatment Areas

Vegetation management treatments are intended to reduce fuel continuity both horizontally and vertically, and to reduce overall fuel volumes in the treatment area. This reduction in fuel volumes intentionally creates openings on the surface and in the forest canopy to reduce the potential for extreme

fire behavior. These openings also create opportunities for invasive or undesirable plants to become established within the treatment area, particularly if they are already in the project area or if treatment crews and equipment travel from areas where such plants are present (CAL IPC 2012). Certain fast growing species of invasive and undesirable plants, such as Scotch broom, can rapidly establish recently cleared sites and increase surface fuel loading, reducing the benefit provided by treatment activities.

The establishment and spread of invasive plant species can be managed during vegetation treatment projects using the following industry's best management practices:

Project Planning:

- Survey the treatment area and the surrounding areas for invasive plant species.
- Identify areas within the project site that are at high risk for establishment by invasive and undesirable plants.
- Coordinate with Nevada County RCD and Nevada County Public Works for best practices suitable to the project site.
- When determining treatment techniques, select techniques that minimize ground disturbance.
- If invasive plants are known to be in the project area, incorporate specific treatment activities to remove invasive plants and follow up treatments for any seed bank in the soil.

Project Implementation:

- Maintain shaded fuel breaks where appropriate.
- Minimize soil/ground disturbance during treatment activities.
- Clean equipment, tools, and vehicles coming from outside of the area.
- Schedule treatment activities to occur prior to the seed production of invasive and undesirable plants.

4.3.2.2.1 Noxious Plants

Noxious plants are a concern in Nevada County. A known plant of special concern is Scotch broom (*Cytisus scoparius*), which is considered one of the most invasive plants in Nevada County (Lubin and Van Zuuk n.d.). This is a large nonnative leguminous shrub that rapidly invades recently disturbed sites and threatens native plant communities, increases fuel loading, and can act as a ladder fuel. Scotch broom shrubs are copious seed producers, with individuals producing on average 9,000 to 10,000 seeds per year. Seeds can have a delayed germination of at least 4 years, enabling the development of persistent large seed banks. Management actions for controlling invasive broom species include (UC ANR 2009):

Scotch broom removal.

- Manual Removal: Hand-pulling is effective for small infestations, especially when the soil is moist. It is important to remove the entire root system to prevent regrowth.
- Mechanical Control: Cutting or mowing can reduce broom populations, but it must be repeated regularly. Cutting before seed set is crucial to prevent further spread.
- Prescribed Burning: Fire can be used to manage broom, but it must be carefully planned and followed by other treatments, as broom often resprouts vigorously after burning.
- Herbicide Application: Systemic herbicides can be effective, particularly when applied to freshly cut stumps or during active growth phases. Timing and proper application are key to success.
- Integrated Management: The most effective approach combines multiple methods—such as cutting followed by herbicide treatment or burning followed by reseeding with native plants—to reduce broom populations and restore native ecosystems.

4.3.3 Slope Stability, Erosion Control, and Water Quality

The vegetation treatment techniques identified in this LMP have the potential to affect soil stability. Soil stability may be indirectly affected by the removal of overstory vegetation. Vegetation removal can reduce rainfall interception, thereby increasing its surface erosion potential. This may result in the detachment and transportation of soil particles across the soil surface. Soil stability may also be directly affected through the use of heavy equipment, tools, hand crews, or livestock, all of which can loosen, dislodge, or compact soils. This too can increase the potential for detachment and transportation of soil particles across the soil surface.

Equipment operation conducted when saturated soil conditions exist also has the potential to dislodge soil, resulting in sediment transport. Saturated soil conditions are those where:

> Soil and/or surface material pore spaces are filled with water to such an extent that runoff is likely to occur. Indicators of saturated soil conditions may include, but are not limited to: (1) areas of ponded water, (2) pumping of fines from the soil or road surfacing material during timber operations, (3) loss of bearing strength resulting in the deflection of soil or road surfaces under a load, such as the creation of wheel ruts, (4) spinning or churning of wheels or tracks that produces a wet slurry, or (5) inadequate traction without blading wet soil or surfacing materials (California Code of Regulations, Title 14, Section 895.1)).

The California State Board of Forestry and Fire Protection has developed a procedure to estimate a surface soil erosion hazard rating that considers soil characteristics (texture, depth to restrictive layer, percent of coarse surface fragments), slope, vegetative cover, and precipitation (California State Board of Forestry 1990). The hazard rating evaluates the susceptibility of the soil within a given location to erosion. This rating would be considered on a site-specific basis when determining the need for erosion control BMPs in the Plan Area. In addition, areas where erosion has occurred in the past due to vegetation management activities should be avoided, or alternative methods implemented to minimize potential impacts on soil stability.

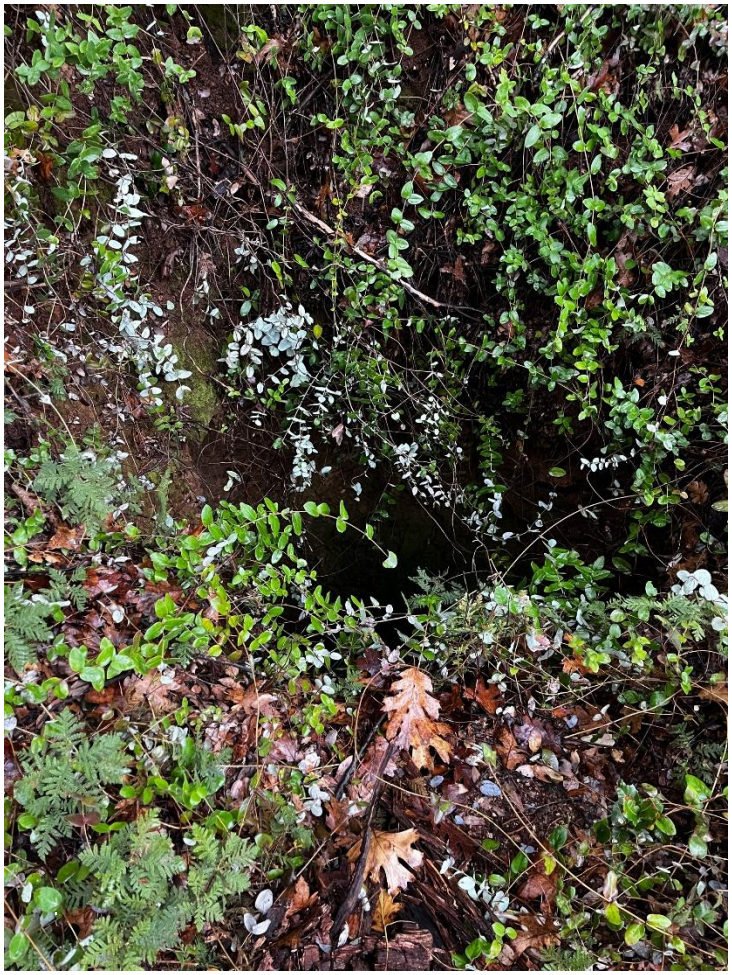
4.3.3.1 Mining History Considerations

The legacy of Gold Rush-era mine impacts in Nevada County provides important context to present day ecological conditions and should be considered in land management decisions. From approximately 1850 to 1942 gold mining was prevalent across the County, with two main types of mining taking place: hard rock and hydraulic. The techniques of extraction utilized for these types of mining are associated with specific mine features that warrant consideration when planning and implementing vegetation management projects. Land management decisions that consider legacy mine impacts can prevent exposure to physical and chemical hazards and furthermore prevent exacerbation of these hazards.

Below is a summary of the key attributes of hard rock and hydraulic mines in Nevada County.

4.3.3.1.1 Hard Rock Mines

In hard rock mining operations miners typically dug underground tunnels to access gold-bearing quartz. The ore was brought to the surface and crushed with stamp mills to release the gold. Miners then applied mercury to "bind," or amalgamate with the gold. Next, the mercury was retorted (burned off), leaving the gold and "mill sands" (crushed ore from which gold had been removed). Notable examples of hard rock mines in Nevada County include Empire Mine, Idaho Maryland Mine, Lava Cap Mine, and Northstar Mine. Legacy hard rock mines are associated with both chemical and physical hazards.



An example of a hard rock mine air shaft that was discovered in the vicinity of a fuel mitigation project. treatment activities and resulted in a rope rescue of an individual who fell down the shaft.

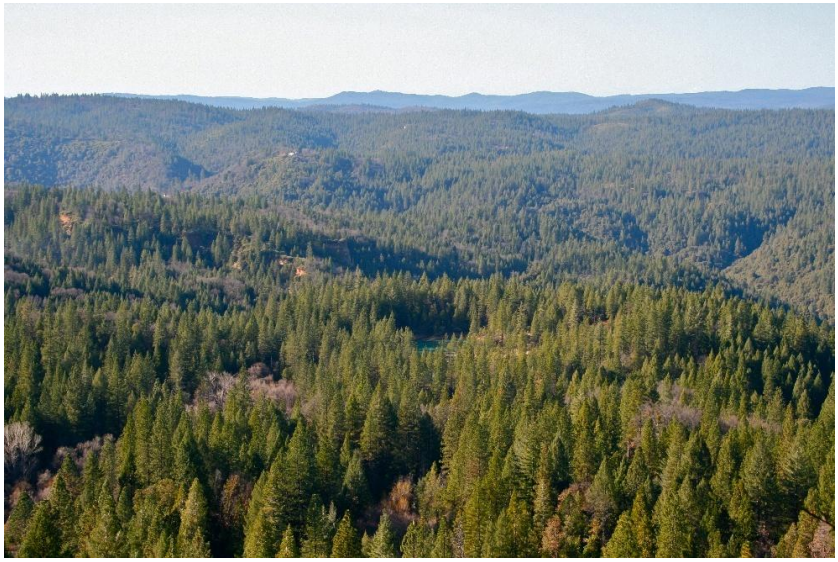
- Physical hazards include mine shafts and air vents, which can be structurally unstable and hundreds of feet deep. From a land management perspective, care should be taken to assess areas before management to identify and mark hazards with the goal of minimizing accidents during treatment activities.
- Chemical hazards include acid mine drainage (AMD). AMD can occur when high-sulfide ore is exposed to air and water, resulting in the creation of sulfuric acid, which dissolves naturally occurring heavy metals, resulting in metal loading. AMD is most oftenassociated with abandoned mine tunnels. Addressing AMD typically requires

professional intervention, including technical assessment and prescribed remediation actions.

Additionally, crushed rock containing heavy metals can be mobilized in dust. From a land management perspective actions should be taken to minimize mobilization, avoid inhalation (e.g., masks), and reduce transport (cleaning shoes and clothes before leaving the site, washing equipment).

4.3.3.1.2 Hydraulic Mines

In hydraulic mining operations, miners washed away hillsides to access fine-grain gold particles in what were once river bottoms (alluvial gold). They used hydraulic monitors (water cannons) to do this. The mud "slurry" that was generated was then funneled through sluices coated with mercury that were on-site in hydraulic pits. Like in hard rock mining, the purpose of the mercury was to capture the gold via amalgamation, with the mercury being retorted off, leaving the gold. Excess slurry and debris were routed into rivers/strams for downstream transport. Notable examples of hydralic mines in Nevada County include Malakoff Diggins, Relief Hill, Steephollow, and the San Juan Mine. Legacy hydraulic mines are associated with both chemical and physical hazards.



A legacy hydraulic mine in the forested areas along the South Yuba River. In the center of the image is a turquoise hydraulic pit lake, while to the left of the lake several "hydraulic scarps" (bare, nearly vertical cliffs) can been seen.

- Physical hazards primarily include slurry/debris to rivers/streams. From a land management perspective, care should be taken to assess areas before treatment to identify and mark hazards with the goal of minimizing accidents during treatment activities.
- Chemical hazards are primarily associated with water quality impacts. Elemental mercury bound to fine silts/clays at hydraulic mine sites (particulate-bound) can be transported off-site into waterbodies. Sediment (silts/clays) increases the turbidity of water with impacts to fish populations. Elemental mercury in water (low oxygen/anerobic conditions) can convert to methylmercury which is "bioavailable" meaning it can enter the food web and biomagnify and bioaccumulate as it moves up through the web (trophic levels). Additionally, during hydraulic mining activities, the downstream transport of slurry/debris fundamentally altered stream channels with impacts to native fish populations (ex. lower Yuba River/Yuba Goldfields).

From a land management perspective, a priority around hydraulic mines should be the prevention of off-site transport of fine-sediment and particulate-bound mercury to minimize the potential for water quality impacts. An additional benefit of minimizing the transport of material off-site is that it reduces impacts on water storage facilities. For instance, Rollins Reservoir and Combie Reservoir on the Bear River have both experienced challenges associated with sedimentation stemming from upstream hydraulic mines. Where possible, vegetation management projects should be placed with an eye toward minimizing the potential for a wildfire in the hydrologic path between hydraulic mine sites and watersheds to reduce the likelihood of post-fire erosion of fine-sediment and particulate-bound mercury into watersheds.

4.3.3.2 Erosion Control Best Management Practices

There are various erosion control practices and devices available for slowing the rate of erosion. Recent research indicates that mechanical rehabilitation treatments, including straw mulch, hay bales, and jute rolls, are more reliable for reducing soil erosion and post-fire hydrological problems than seeding or other treatments (Robichaud et al. 2010). Mulching may introduce exotic/weed seeds (Kruse et al. 2004) if brought in from off-site (as opposed to chipped on-site material), so erosion potential would be high before deciding to use this material. When soil disturbance occurs, BMPs for erosion control should be followed. A description of these BMPs is presented in the following sections. Chipping cut material and applying to the treatment or burned-over areas can be an economical and effective erosion control practice. Chipped material can reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff (County of Napa 2020). Applying chipped material back to the treatment site is most effective on gentle slopes and level areas; on steeper slopes, it can be washed away by significant precipitation.

If a wildfire event occurs in the Plan Area, stabilization of soils in the burn area is a primary concern, especially in areas with steep slope gradients. Erosion control BMPs should be installed as soon as possible and before the onset of the winter period (October 15 to April 1).

4.3.3.2.1 Nevada County Building Department Erosion Control Best Management Practices

- The Nevada County Community Development Agency, Building Department provides a handout on erosion and sediment control plans (County of Nevada n.d.1). This handout provides a description, information, and samples of erosion and sediment control plans. Recommendations in this handout are summarized below:
- Straw bales are not recommended for steep slopes.
- Silt fencing is recommended for the bottom of steep slope.
- Straw rolls/wattles are recommended for gently sloping areas where grading/soil disturbance has occurred.
- Erosion control blankets are recommended for steep slopes with gradients over 3:1.
- Erosion and sediment control measures must remain functional and be maintained throughout the winter season.
- Maintain positive drainage away from all structures.
- Seed and cover all disturbed soil with mulch.

4.3.3.2.2 Caltrans Erosion Control Best Management Practices

The Caltrans Erosion Control Toolbox describes recommended BMPs for successful, cost-effective, and sustainable erosion control treatments; it also includes erosion control treatments, control standards, and control guidance. The toolbox also includes guidance on selecting and implementing appropriate BMPs. Erosion control success is dependent on site-specific management of soils, water, and vegetation. A summary of recommended BMPs in the Erosion Control Toolbox is provided below; additional information can be found at https://dot.ca.gov/programs/design/lap-erosion-control-design/tool-1-lap-erosion-control-toolbox:

- Incorporate compost into the topsoil to improve infiltration, increase water holding capacity, improve soil health, and increase rooting depth for plants.
- Collect and respread duff following grading activities to add microbes, organic matter, nutrients, and water storage capacity to the soil.
- Place stepping stones to reduce slope steepness, reduce stormwater runoff volume and velocity, increase infiltration, trap sediment, and create a niche for seed retention and plant establishment.
- Place mulch or compost blankets to reduce raindrop erosion, improve infiltration, conserve soil moisture, provide nutrients, reduce runoff and the transport of sediment, reduce competition from invasive annual weed species, and improve the potential for vigorous long-term vegetation coverage.
- Use biofiltration strips and swales to filter pollutants from stormwater and reduce runoff.
- Plant trees, shrubs, and ground covers or brush layering to reduce raindrop erosion and hold soil in place.
- Seed with deep-root California native grasses, wildflowers, and perennials to reduce raindrop erosion and hold soil in place.
- Place fiber rolls and compost socks to shorten slope length, intercept runoff, reduce runoff velocity, and remove sediment.
- Place erosion control products such as straw blankets, jute mesh, or coir netting to provide immediate protection from surface erosion, retain soil moisture and improve seed germination and vegetation establishment.

4.3.3.2.3 California Stormwater Quality Association Erosion Control Best Management Practices

The California Stormwater Quality Association online handbook provides information on how to comply with California stormwater regulations. Land development and construction activities can significantly alter natural drainage patterns and result in polluted runoff. As such, all construction projects are required to protect the site from erosion, sediment loss, and other potential sources of water pollution by incorporating construction controls using BMPs. BMPs from the handbook are summarized below:

- Projects would be scheduled to reduce the amount and duration soil is exposed to erosion by wind, rain, runoff, and vehicle tracking. Construction activities and control practices would be implemented following the planned schedule.
- Activities would be planned to maximize the preservation of existing vegetation and minimize the potential of removing or injuring existing trees, vines, shrubs, and grasses.

- Hydraulic mulch would be applied as temporary protection from wind and water erosion in areas that require temporary protection until permanent soil stabilization can occur.
- Hydroseeding can be used for disturbed areas requiring temporary protection until permanent stabilization is established or for areas that will be re-disturbed following an extended period of inactivity.
- Soil binders can be used for temporary protection as an alternative to mulches in grading areas that will soon resume.
- Matting or rolled erosion control products can be used to cover soil surfaces and reduce erosion where the erosion hazard is high, and vegetation will be slow to establish. Mattings can be used on stream banks, swales, and other drainage channels. Matting or rolled erosion control products may be used when seeding cannot occur and would be considered for fine-grain soils.
- Velocity dissipation devices are placed at the outlet of a piper or channel to prevent scouring of the soil by high velocity flows and would be used whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach.

4.3.3.3 Access Roads

In areas where existing dirt access roads will be retained, waterbreaks[10] and drainage structures would be constructed to minimize erosion potential. All waterbreaks and drainage structures should be installed no later than the beginning of the winter period (October 15 to April 1). Outside the winter period, waterbreaks and drainage structures would be installed before sunset if the National Weather Service forecast is a 30% or more chance of rain within the next 24 hours. Waterbreaks would be constructed immediately upon the conclusion of the use of access roads that do not have permanent and adequate drainage structures. Distances between waterbreaks would adhere to the standards outlined in Table 20. Access roads would be closed to public vehicle travel following the completion of vegetation treatment operations.

Table 20. Maximum Distance Between Waterbreaks

Estimated Erosion Hazard Rating	Distance Between Waterbreaks (feet)			
	≤10% Road Slope	11–25% Road Slope	26–50% Road Slope	>50% Road Slope
Extreme	100	75	50	50
High	150	100	75	50
Moderate	200	150	100	75
Low	300	200	150	100

Source: 2025 California Forest Practice Rules (14 CCR, Chapters 4, 4.5, and 10).

4.3.4 Watercourses

When vegetation management projects take place in or near watercourses there are special considerations. Vegetation management activities within a riparian zone may require additional

[10] A waterbreak (or waterbar) is a shallow trench with a parallel berm or ridge on the downslope side, angled downward across a road and installed to control surface runoff.

permitting. The intent is to ensure that the work done will avoid or limit, to the extent feasible, negative impacts on creeks and watercourses. The primary measure to minimize impacts on creeks and watercourses in the Plan Area is avoidance or limited hand treatment to maintain treatment continuity. Should it be necessary to conduct vegetation management activities within riparian areas, all necessary permits would be obtained and would implement the following BMPs:

- Preserve creeks and riparian corridors in a natural state.
- Preserve and enhance creekside vegetation and wildlife.
- Prevent activities that would contribute significantly to flooding, erosion, or sedimentation, or that would destroy riparian areas or would inhibit their restoration.
- Control erosion and sedimentation.
- Protect drainage facilities.

4.3.5 Air Quality

The following BMPs would be implemented, where feasible, to minimize potential negative effects on air quality:

- Control fugitive dust resulting from equipment use by watering disturbed areas.
- Limit the size and quantity of equipment to that which is necessary to meet the identified vegetation management standard.
- Limit traffic speeds on dirt roads to 15 miles per hour.
- Clean construction vehicles and equipment to prevent dust, silt, mud, and dirt from being tracked onto paved roadways.
- Limit vehicle idling time to a maximum of 5 minutes for vehicles and equipment, except where idling is required for the equipment to perform its task.
- Develop and implement a burn plan and associated smoke management plan for prescribed burning activities.

4.3.5.1 Northern Sierra Air Quality Management District Burning Best Management Practices

The following BMPs would be implemented, where feasible, to minimize potential negative effects on air quality during burning activities:

- Construct piles loosely, with spaces to allow adequate oxygen to reach the burning material.
- Construct piles intelligently, in a dome or teepee shape that allows heat to build so that flames can be maintained and the vegetation can be consumed rapidly.
- Create a “heart” of fine, flammable vegetation and light it down low on the side the wind is coming from.
- Check berry vines for excessive moisture by breaking a thick cane and squeezing the pith.
- Make sure your pile is clean (another regulatory requirement); an archenemy of a good burn pile is dirt, which concentrates as the vegetation burns away, reducing airflow.
- If you have a large pile or multiple piles, light a small test fire first, to make sure the smoke goes up and away from neighbors.

- Try to burn when a storm is approaching (and the air pressure is dropping); smoke dispersion is usually pretty good then. In general, low air pressure equates to better smoke dispersion. Observe wood stove smoke in your area to get an idea of how your smoke is likely to behave.

4.3.6 Reforestation/Revegetation/Restoration

Revegetation of areas subject to vegetation treatment or removal can minimize the potential for erosion by stabilizing soils. Revegetation would be conducted only in areas where disturbed and/or bare soil exists following vegetation treatment operations as a measure to stabilize soils. The need for revegetation would be determined during project planning and design or subsequent monitoring efforts and would consider slope, soil type, access, irrigation and maintenance needs, and other BMPs being implemented on-site. There should be consultation with qualified professionals (e.g., foresters, revegetation specialists) to develop site-specific reforestation/revegetation plans, as appropriate. Revegetation may include hydroseeding, direct seeding, or container plant installation. Plant species selection would be consistent with revegetation goals and would consider erosion protection value (e.g., deep-rooted species). Non-fire-resistant plants/target species would not be used for revegetation purposes.

4.3.7 Special-Status Plants and Wildlife

Vegetation treatment activities have the potential to impact special-status plants or wildlife via ground disturbance, vegetation removal or management, or the use of vegetation management tools and equipment. To minimize the potential for impacts on special-status wildlife, measures would be implemented, depending on the species present in the identified treatment area. In general, these measures include conducting pre-operations biological surveys, identifying and marking avoidance or buffer areas, conducting biological monitoring during vegetation management operations, and establishing work windows to avoid and minimize adverse effects on nesting birds and special-status plants and animals. Qualified biologists would be consulted during vegetation management project design and implementation.

Special-Status Plants:

- All vehicles and equipment would be inspected and cleaned of weed seed prior to entering a project site to reduce the spread of noxious weed seeds.
- Pre-operations surveys for rare plants would be conducted prior to vegetation treatment during the appropriate time of year when target species are evident and identifiable. If no rare plants are noted in the project area during the survey, no further rare plant avoidance or minimization measures would be necessary. If rare plant populations are observed during the survey, all populations would be documented and flagged for avoidance. Flagging will include high visibility pin flag or tape, or orange mesh construction fencing; will be temporary; and will include all individuals of the rare plant population observed. Crews would be educated on the purpose and need of avoidance of habitat areas within exclusion zones.

Special-Status Wildlife:

- For the protection of nesting birds, including raptors, vegetation treatment would be limited to the non-nesting season for birds. If vegetation management must occur during the bird breeding

season, a qualified biologist (as identified on the most current Pre-Qualified Biological Consultant List published by Nevada County) would conduct pre-operations surveys for nesting birds no more than 1 week prior to vegetation treatment activities. If no nests are observed during the survey, no further measures would be necessary. If active nests are observed, avoidance buffers appropriate for the species of bird would be implemented.

- Buffers would remain in place until the activities are complete, the young have fledged, or if the qualified biologist determines that the proposed activities will not result in impacts to nesting, rearing, or breeding success.
- For the protection of other special-status species, pre-operations surveys would be conducted by a qualified biologist (as identified on the most current Pre-Qualified Biological Consultant List published by Nevada County). Buffers or treatment exclusion areas identified by the biologist would be avoided during vegetation treatment activities. Other measures identified by the biologist (e.g., movement of nests, modifications to treat types or timeframes) would be implemented as necessary.

4.3.8 Cultural, Tribal and Historic Resources

It is anticipated that cultural resources surveys will be conducted prior to the implementation of vegetation treatment projects. Artifacts or features identified during surveys would be flagged, and appropriate exclusion or protection measures for the site would be developed. Should exclusion be infeasible, equipment limitations would be implemented (e.g., use of rubber-tired equipment to lift trees off the ground). Exclusion or limitation of equipment would be determined during the specific project planning and permitting stage. A qualified professional archaeologist would be consulted to approve work area boundaries and allowable work in the vicinity of cultural resources. At the completion of operations, any flagging used for cultural resource site identification would be promptly removed to minimize the potential for discovery and impact.

4.3.8.1 Inclusion of Tribes in Land Management

For over twelve thousand years California's ecosystems and, in fact, the entirety of the state's approximately 100 million acres were among the most managed lands in the nation. The sheer diversity of indigenous cultures that tended the landscape is evidenced by the fact that in 1542 approximately one hundred languages were spoken – one fourth of the native languages used across what would become the present-day United States (Anderson 2005, Lightfoot and Parish 2009). A myriad of unique tribes consciously and sustainably cultivated the native species of California, including the 6,300 endemic plant species that grow nowhere else on earth.

The onset of European settlement and the implementation of new extractive land management practices – from grazing, to logging, to mining, and the accompanying infrastructure projects – water, rail, power – precipitated a fundamental shift with lasting impacts. Settlers extirpated indigenous people from their ancestral lands effectively curtailing best-practices for sustaining ecological resilience that had been utilized for millennia.

In the forested headwaters of California, the severance of tribal land management was followed by development in the wildland-urban interface (WUI) and the institutionalism of suppression of wildland

fires with the aim of preventing loss of life and property. In sum, these changes largely shaped preferred land management practices and underlie the current conditions of forest ecology in Nevada County.

Inclusion of Tribes in decision-making around and implementation of land management actions is an opportunity to revitalize cultural lifeways and simultaneously leverage a vast body of place-based knowledge. Engagement and collaboration with indigenous communities early in project development supports the cultivation of relationships and the successful incorporation of place-based traditional ecological knowledge (TEK) into wildfire mitigation and forest health projects, as well as broader land management decisions that foster regional resilience.

4.3.9 Recreation Resources

Temporary impacts to recreation resources in the Plan Area may result from vegetation treatment project implementation. Temporary closures or use restrictions may be necessary for the safe operation of equipment and to ensure public safety. To minimize potential negative effects of vegetation treatment projects on recreation resources, the following BMPs have been identified:

- Restore disturbed areas to pre-operation conditions (e.g., clear blocked trails, re-contour damaged trails to minimize the potential for erosion or the creation of unauthorized trails).
- Repair, replace, or reinstall damaged, removed, or relocated infrastructure (e.g., signs, gates, picnic tables).
- Minimize the extent or duration of closures by phasing work and/or conducting work outside of peak visitation periods, where feasible.
- Where feasible, conduct operations on weekdays during daytime hours (8:00 a.m. to 5:00 p.m.).
- Control public access by posting detours, installing and maintaining appropriate and adequate signage, using flaggers/monitors where necessary, closing work areas via exclusionary fencing, and providing necessary monitoring staff to ensure access control measures are maintained and effective.
- Disseminate information regarding planned project activities via websites, social media, in-park signage, and/or via outreach to regular known user groups.

4.3.10 Tree Protection

Section 12.04.215 of the Nevada County Code addresses trees. Part B defines landmark trees as any oak tree with a trunk diameter (DBH) greater than or equal to 36 inches or any hardwood tree groves with 33+% canopy closure, or any tree/ grove whose size, visual impact, or association with a historically significant structure or event has caused it to be marked for preservation. Standards for protection of these trees include not removing or disturbing trees unless a management plan is prepared. Exemptions may apply if trees/ groves are determined to be dead, dying or public safety hazard by a certified arborist, licensed landscape architect, Registered Professional Forester (RPF), qualified biologist or botanist (qualified professional). Exemptions to the standard may also apply if a fire authority determines the trees/groves must be removed to ensure fire safe access or provide adequate fuel reduction.

If defined trees will be removed or disturbed, a management plan must be created. Due to both species having very limited distribution in the county and considered to be sensitive plants worthy of special

protection, blue oak (*Quercus douglasii*) and valley oak (*Quercus lobata*) need to be emphasized for protection in the management plan. Management plans must be prepared by a qualified professional and should evaluate the impact of the project on defined trees and groves. Emphasis should be placed on protecting groups of trees over individuals and removal of defined trees may require replacement per County standards.

In addition to the potential tree replacement requirements outlined in the Nevada County Code, the following recommended protection measures are provided to minimize impacts to retained trees:

- Avoid disturbance to tree root zones. Root damage and soil compaction can occur through improper operation of equipment while maneuvering over the root zone. Avoid operation in the root zone under saturated soil conditions and avoid contacting aboveground roots. Use existing access roads or trails where available to reduce soil compaction.
- Avoid "skin-ups" on the boles of retained trees caused by contact with equipment, falling trees, or vegetative material being yarded for removal from the site. "Skin-ups" often expose the inner bark and cambium of the residual tree. Such wounds deplete the energy reserves of the tree in order to isolate the injury and create an easy entry point for pests and pathogens.
- Avoid disturbance to tree crowns during operations. If limb removal is necessary for equipment operation, limbs would be pruned according to ANSI A300 standards.
- Avoid piling chips, soil, or other materials against the trunk/bole of retained trees.
- For tree removal operations, directionally fell trees away from the retained trees, or in a direction that would cause the least amount of damage to the surrounding tree crowns. Torn branches, like skin-ups, deplete the energy reserves of the tree in order isolate the injury, and create an easy entry point for pests and pathogens.
- For pile burning activities, site piles a sufficient distance from retained trees to minimize crown and trunk scorching and heat damage to roots.
- For broadcast burning activities, treat surface fuels and/or prune lower limbs of trees such that flame lengths and fireline intensities are low enough to minimize crown and trunk scorching.

4.4 Existing Vegetation Management Programs and Requirements

Active vegetation management plans and programs in the Plan Area identify and govern some vegetation treatment projects and activities that occur in the Plan Area. There are specific requirements in the State and County governing vegetation management activities. This section provides an overview of the plans, programs, and specific regulatory requirements.

4.4.1 Vegetation Management Programs

4.4.1.1 CAL FIRE Vegetation Management Program

The Vegetation Management Program (VMP) is a cost-sharing program facilitated by CAL FIRE focused on using prescribed fire and mechanical means for addressing wildland fire hazards. The VMP was

created in 1980 through Senate Bill 1704 and was originally focused on prescribed fire in chaparral. The VMP allows for a private landowner to contract with CAL FIRE to use prescribed fire for fire protection and resource management. CAL FIRE Units and Contract Counties implement the VMP. On average, the VMP treats 25,000 acres per year (CAL FIRE 2022e).

4.4.1.2 CAL FIRE Fuels Treatment Effectiveness Reporting

The Fuels Treatment Effectiveness Reporting evaluates the impacts of vegetation management treatments on fire behavior and highlights how fuel-reduction activities not only support suppression efforts but also protect life, property, and California's natural resources (CAL FIRE 2025a). Fuel treatment effectiveness reports consist of a summary of the treatment location, treatment activities, and then an after-action review of how the fuel treatment aided fire suppression efforts during a recent wildfire where the fire perimeter included the fuel treatment area.

4.4.1.3 CAL FIRE Grants Program

CAL FIRE facilitates several grant programs used for vegetation management or fuels reduction. The CAL FIRE Wildfire Prevention Grant Program provides funding for fire prevention projects and activities near fire-threatened communities. This program focuses on projects that increase the protection of people, structures, and communities, including hazardous fuels reduction, wildfire prevention planning, and wildfire prevention education. The CAL FIRE Forest Health Program focuses on forest restoration and associated activities creating more resilient and sustainable forests to mitigate climate change, minimize fire risk, and protect natural resources. The program aspires to increase fuels management and conserve forests, introduce fire, and treat degraded areas (CAL FIRE 2022f).

4.4.1.4 California Department of Transportation Roadside Fuel Reduction

The Caltrans Vegetation Management Program (VMP) serves as Caltrans' commitment as a partner agency in the California Wildfire & Forest Resilience Task Force (Task Force) (Caltrans 2025). The VMP oversees vegetation management along state highways. Vegetation management is separated into two categories: Roadside & Landscape and Trees. Under this program, Caltrans conducts manual, mechanical, and chemical vegetation management activities as well as tree trimming and removal. Planned work in Nevada County includes treatments along Highways 80 and 89.

4.4.1.5 Truckee Donner Public Utility District Vegetation Management Program

The Truckee Donner Public Utility District (TDPUD) Vegetation Management Program is a core wildfire mitigation strategy focused on reducing ignition risk near electric facilities. The program operates on a five-year trimming cycle and includes removal of dead or hazardous trees, clearing vegetation within a 20-foot clearance around poles and lines, and maintaining compliance with state clearance requirements. In 2024, TDPUD treated 13 miles of distribution lines and cleared 142 poles; similar efforts were planned for 2025, with priority on Tier 2 and Tier 3 High Fire Threat Districts (TDPUD 2025).

4.4.1.6 Tahoe National Forest

The Tahoe National Forest implements a variety of hazardous vegetation management programs aimed at reducing wildfire risk, improving forest health, and enhancing ecosystem resilience. Some project examples include:

- Alder 89 WUI Project: Designed to reduce hazardous fuel accumulation and restore forest conditions around the Town of Truckee and Highway 89 corridor. The goal is to create defensible space and reduce wildfire risk in a high-use area (Middle Truckee River Watershed Forest Partnership 2025).
- Glenshire Brockway Fuel Reduction Project: Covers 1,582 acres with manual and mechanical treatments to remove ladder and surface fuels. Includes pile burning and understory burning to maintain fuel reduction over time (TCSI 2025).
- Truckee Ranger District Roadside Fuel Break Expansion Project: The Truckee Ranger District Roadside Hazardous Fuel Reduction project is a collaboration between the U.S. Forest Service's Tahoe National Forest and the Nevada County Office of Emergency Services (OES) to treat approximately 110 acres of fuels along priority roads. These roads have been identified as necessary to providing critical and strategic wildfire suppression operations but are currently overgrown with dense vegetation. The largest and healthiest trees will be retained and are intended to benefit from the removal of small, dying, diseased and/or dead trees and thick brush. The long-term goal of this project is to establish and maintain a network of shaded fuel breaks, enhance public safety, and protect public drinking water resources (County of Nevada n.d.2).
- Cabin Creek Wildfire Resilience Project: As phase one of the Five Creeks Environmental Assessment, the Cabin Creek wildfire resilience project is being implemented as a collaboration between the National Forest Foundation, Placer County, and the Truckee Ranger District. This project is in the second year of a three-year contract. Project goals include reducing hazardous fuel loading to reduce potential wildfire severity on roughly 2,000 acres. The majority of timber removal is complete as of Fall 2025, with mastication ongoing through the 2026 summer season.
- Woodchopper Timber Sale: This is the first phase of the Russel Valley Categorical Exclusion and includes hazardous fuels reduction on approximately 850 acres of National Forest System lands. The Woodchopper Timber Sale is planned to start operations during the 2026 field season. This project lies north of the town of Truckee and east of Highway 89 and West of the Russel Valley community.
- Russel Valley Wildfire Resilience Project: Phase two of the Russel Valley Categorical Exclusion will be administered as a collaboration between the National Forest Foundation and the Truckee Ranger District. Project goals include improving forest health, promoting ecosystem conditions more resilient to pests and pathogens, drought, climate change and risks associated with high severity fire. This project lies north of the town of Truckee and east of Highway 89 and adjacent to the Russel Valley community, comprising roughly 1,700 acres of National Forest System lands. The timeline for project initiation is during the 2026 or 2027 field seasons.
- Big Chief Wildfire Resilience Project: Big Chief is also being executed under collaboration with the National Forest Foundation. This project comprises the second round of the Five Creeks E.A. and lies just south of the Big Jack project, helping bolster the fuels reduction footprint south to the Deer Creek drainage. Project goals include reducing hazardous fuel loading to reduce

potential wildfire severity on roughly 850 acres. The Big Chief project is planned to begin during the 2026 or 2027 field seasons.

- Boca Forest Health Project: A collaboration between the Truckee River Watershed Council and the Truckee Ranger District proposes a range of forest health, fuels reduction, wildlife habitat improvement and riparian area restoration actions on approximately 2,200 acres. This project is located north of the town of Truckee and east of Highway 89 and is designed to address forest stand resilience, reduce hazardous fuels, improve ecosystem health and provide protection from the impacts of high severity fire. The Boca Forest Health Project is planned to begin work sometime during the 2026 or 2027 field seasons.
- Alpine Meadows and Olympic Valley Fire Protection Project: This project is also being enacted under collaboration between the National Forest Foundation and the Truckee Ranger District and comprises approximately 800 acres between Alpine Meadows and Olympic Valley. The project's purpose is reducing fuel loading, improving forest stand health and providing adequate long-term community protection from wildfire in Alpine Meadows and Olympic Valley. This project is scheduled to begin implementation during the 2026 or 2027 field seasons.

4.4.1.7 Nevada County Office of Emergency Services

Nevada County Office of Emergency Services (OES) manages several hazardous vegetation management programs aimed at improving wildfire resilience and public safety. Some project examples include:

- Roadside Vegetation Management Program: This program targets hazardous fuels along 300 miles of public roadways and 17.5 miles of roads in Truckee. It aims to maintain safe evacuation routes by clearing vegetation and creating fuel breaks. The project is phased, with planning (e.g., surveys, mapping, permitting) followed by implementation (e.g., fuels reduction, biomass disposal). It is supported by FEMA's Hazard Mitigation Grant Program (County of Nevada n.d.3).
- Critical Evacuation Route Hazardous Vegetation Removal Program: A microgrant initiative focused on improving evacuation safety along privately maintained roads. Eligible applicants include Firewise communities, HOAs, road associations, and nonprofits. Projects must reduce hazardous vegetation and enhance emergency ingress/egress. Grants range from $20,000 to $120,000 and require 1:1 match, with implementation beginning in Fall 2025 (County of Nevada n.d.4).
- Vegetation Management Projects (Public Works): The County's Public Works Department conducts seasonal vegetation trimming, brush removal, and herbicide treatments along 255 miles of county-maintained roads. Property owners can opt out of herbicide use through a formal agreement but must manage vegetation themselves. These efforts support fire mitigation and ecosystem health (County of Nevada n.d.5).
- South Yuba Rim Hazardous Fuels Reduction Project: This large-scale, landscape-level project covers up to 6,000 acres along the north rim of the South Yuba River canyon, from Bridgeport to Malakoff Diggins State Park. Lead and managed by OES and YWI, it is focused on planning, environmental compliance, and community engagement across 270 parcels (Phase 1) and will implement fuel reduction treatments on approximately 800 acres using mechanical, manual, and prescribed fire techniques (Phase 2).
- Woodpecker Ravine Fuels Reduction Project: Under this project selective thinning will take place on a total of 1,136 acres of land along critical evacuation routes and strategic ridges. This

treatment has been scoped as consisting of 150 feet of treatment on either side of primary evacuation routes, 75 feet of treatment on either side of secondary evacuation routes, and 150 feet of treatment along strategic ridges. Treatment along strategic ridges will serve to tie road system arteries into a comprehensive shaded fuel break. 410 strategic acres will be treated in Phase I and 726 acres will be treated in Phase II (County of Nevada n.d.6).

- Ponderosa West Grass Valley Defense Zone: This multi-phase, large-scale project aims at improving shaded fuel breaks just west of Grass Valley. Adjacent to Highways 49 and 20 the project will cover approximately 5 miles. In Phase I, 1,200 acres of privately owned parcels will be treated, followed by an additional 728 acres of maintenance on the same footprint. Phase II will treat an additional 236 acres of private land (Ready Nevada County n.d.1)
- Lower Deer Creek-Penn Valley Hazardous Fuels Reduction Project: A 1,011-acre hazardous fuels reduction project aimed at protecting critical infrastructure, providing safe ingress and egress for first responders and residents in case of an emergency, and improving watershed resilience and protection. The project, when completed, will have treated 107 acres around sanitation and wastewater treatment facilities, 726 acres of roadside vegetation, and reduce fuel loading in 178 acres in and around Deer Creek Canyon (Ready Nevada County n.d.2).

4.4.1.8 Nevada City Vegetation and Mitigation Projects

Nevada City's Office of Emergency Services (OES) currently has their own Fire Fuels Mitigation Crew working to enhance the community's safety from wildfire through various vegetation management tasks throughout the city. This five-person team works closely with the community to create and clear defensible spaces, conduct fuels abatement, masticate hazardous fuels, and perform other vegetative maintenance duties. The Fire Fuels Mitigation Crew performs projects on both city-owned parcels and open spaces (City of Nevada City OES n.d.). Additionally, the City operates several vegetation management and wildfire prevention programs many of which are funded through Measure C. Key programs include:

- Deer Creek Hazardous Fuels Treatment Project: The City of Nevada City received a planning grant from the Sierra Nevada Conservancy (SNC) in the amount of $111,665 to develop an environmentally sound fuels-treatment plan for heavily forested wildland properties in the Wildland Urban Interface (WUI). The project area encompasses 33 parcels of private and public land totaling 348 acres on the south side of Deer Creek in the southwest portion of Nevada City, in Nevada County. These parcels include the Deer Creek and Seven Hills Schools, the St. Canice Center, the Tech Center, which houses numerous businesses, Nevada City's wastewater treatment plant, and other critical infrastructure. This is the most heavily forested area within the city limits and is vulnerable to wildfires coming up Deer Creek Canyon (City of Nevada City 2025).
- Defensible Space Inspections: During the Month of May the City's certified Defensible Space Inspectors carry out inspections on all properties within City boundaries.
- Home Hardening Grant: The first 100 homes will be eligible for $100 in reimbursement for upgrading vents, adding weather stripping, or caulking to their homes (City of Nevada City n.d.1).
- Community Green Waste and Chipping Program: Nevada City provides free green waste bins in Pioneer Park for residents to utilize. Residents can also access free chipping within city limits (City of Nevada City n.d.2).

- Defensible Space Assistance Program: Nevada City runs a defensible space assistance program to aid vulnerable residents in creating defensible space around their homes and properties (City of Nevada City n.d.3).

4.4.1.9 Grass Valley Defensible Space

The Grass Valley Fire Department details the city's defensible space guidelines. The City of Grass Valley requires all property owners to remove flammable vegetation, combustible materials, and debris annually by May 1 and maintain compliance through October 31 or the end of the declared fire season. Fuel-reduction requirements vary by parcel size, ranging from full-parcel clearance on lots under one acre to 30-foot and 100-foot Fuel Modification Areas on larger properties, along with standards for trees, shrubs, roofs, and ladder-fuel reduction. Additional rules ensure emergency vehicle access by requiring horizontal and vertical vegetation clearance along driveways, streets, and access roads, which supports firefighter entry during an emergency. The City may enter properties to abate hazards and recover costs, and open burning is prohibited except in approved devices or under special permits (City of Grass Valley Fire Department n.d.).

4.4.1.10 Truckee Fire Protection District

The Truckee Fire Protection District (TFPD) operates several hazardous vegetation management and wildfire prevention programs, many of which are funded through Measure T. Their key programs include:

- Vegetation Management and Fuels Reduction: TFPD conducts ongoing forestry and fuels projects to reduce hazardous vegetation and improve forest health. These include thinning, chipping, and prescribed fire treatments in high-risk areas (TFPD n.d.1).
- Defensible Space Evaluations: Fire inspectors provide property-specific assessments to help residents meet defensible space and home hardening standards. These evaluations are part of a broader effort to reduce structural ignitability in the wildland-urban interface (TFPD n.d.2).
- Green Waste Curbside Pick-Up and Chipping: Seasonal programs allow residents to dispose of vegetation cleared for defensible space. This supports ongoing maintenance and reduces the risk of fire spread from yard debris (TFPD n.d.2).
- Community Wildfire Prevention Grants: TFPD offers funding opportunities for local projects that align with wildfire mitigation goals, including vegetation management and evacuation route improvements (TFPD n.d.1).

4.4.1.11 Nevada County Resource Conservation District

The Nevada County Resource Conservation District has developed a strategic plan that addresses its stated goals of 1) Carbon Sequestration, Biomass Removal, and Wood Product Utilization; 2) Wildfire Mitigation and Resilience; 3) Climate Resilience Actions; and 4) Social and Cultural Well-Being. The plan identifies strategic initiatives, including livestock grazing and prescribed fire, biochar usage for mine restoration and soil health, carbon sequestration and ecosystem health, and recreation and tourism utilization. Projects identified in the plan include fuel reduction and fire prevention, prescribed fire training, education, reforestation, biomass utilization, and early warning systems enhancements, amongst others.

4.4.1.12 Nevada Irrigation District

Nevada Irrigation District (NID) manages eight reservoirs in the foothills and Sierra Nevada Mountains and provides water to over 25,000 homes, farms, and businesses (NID n.d.; NID 2025). NID is responsible for providing water, forest health and stewardship, recreation, and hydropower in Nevada County. NID's Vegetation Management Program implements adaptive management techniques that are environmentally sound, effective, efficient, and fiscally prudent to control algae and vegetation that pose challenges to reliable and successful water delivery. The Vegetation Management Program practices include education, prevention, physical control methods, mechanical control methods, herbicide control methods, and biological control methods. In 2025, NID released their 2025 Weed Management Program, documenting their approach to weed management across the district (NID n.d.; NID 2025).

4.4.1.13 Sierra Streams Institute

Sierra Streams Institute is a watershed monitoring, research, and restoration group based in Nevada City, California, in the Sierra Nevada foothills. Sierra Streams Institute authored the *Resource Toolkit for Landscape-Scale Management in Western Nevada County*. The toolkit identifies techniques for responsible land management in the Northern Sierra Foothills over the year. The management plan identifies locally relevant management tips and resources for managing forest fuels. Sierra Streams also conducts research on fuel load impacts on wildfire severity, general forest health, dendrochronology, and treatment efficacy, including on-going research on burn temperatures in prescribed fire relative to fuel load and invasive species cover as well as post-fire invasion and revegetation as a subcomponent of the Sierra Foothill Forest Climate Resilience Project.

- Sierra Foothill Forest Climate Resilience Project: This project is located within the boundaries of the Jones Bar Firewise Community, the Nevada City School of the Arts, and the Shady Creek Outdoor School. This Wildlife Conservation Board (WCB)-funded partnership between Sierra Streams Institute and Nevada County OES has created a new model of community-based forest health planning across a large 625-acre contiguous forest across private parcel boundaries. Treatments were designed with community input and include mastication, hand thinning, and prescribed fire, as well as research and education on and about treatment efficacy and forest health.

4.4.1.14 Yuba Watershed Institute

The Yuba Watershed Institute (YWI) leads several hazardous vegetation management and forest resilience projects in the County, including (YWI n.d.):

- Little Deer Creek Landscape Resilience Project: This project is located just east of downtown Nevada City and aims to restore forest structure and protect homes, recreation areas, and water infrastructure. It is a collaboration between YWI, the Sierra Streams Institute, the Bureau of Land Management (BLM), and the Bear Yuba Land Trust.
- Inimim Forest Restoration Project: This project is a long-term effort to restore ecological resilience on 1,200 acres of BLM-managed land on the San Juan Ridge. It focuses on reestablishing historical forest structure and improving biodiversity and fire resilience.

- Round Mountain Landscape Resilience Project: This project targets 1,200 acres between downtown Nevada City and the South Yuba River canyon. It aims to improve forest health and reduce wildfire risk through partnerships with BLM and Bear Yuba Land Trust.

4.4.2 Current Vegetation Management Regulations

4.4.2.1 State

California Public Resources Code

California Public Resource Code (PRC) Section 4290 requires minimum defensible space fire safety standards applicable to residential, commercial, and industrial building construction in SRAs designated as VHFHSZs. Regulations include fire access road standards, sign standards, fuel break green belts, and minimum water supply requirements.

PRC Section 4291 requires fire hazard reduction around buildings within or adjacent to mountainous areas, forest-covered lands, brush-covered lands, grass-covered lands, or land covered in flammable material. A minimum of 100 feet of vegetation management is required around all buildings. PRC Section 4291 is the primary mechanism driving fire prevention activities on private property within CAL FIRE jurisdiction. PRC Section 4291 requires removal of dead or dying vegetation, debris removal on roofs, and vegetation clearance within 10 feet of the outlet of a chimney or stovepipe outlet. Exemptions may apply for buildings with an exterior constructed entirely of nonflammable materials.

PRC Sections 4292–4296 and 14 California Code of Regulations (CCR) 1246 address vegetation clearance standards for electrical utilities around power lines and conductors.

PRC Section 4741 states that CAL FIRE shall assist local governments in preventing future wildland fires by making its wildland fire prevention and vegetation management expertise available.

Title 14 (California Code of Regulations Title 14, Division 1.5, Chapter 7, Subchapter 3, Fire Hazard) sets forth requirements for defensible space and provides alternate options if the required distances cannot be achieved.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires state and local agencies to identify environmental impacts of proposed projects and avoid or mitigate those impacts when feasible. It also is intended to inform the public and decision-makers through environmental documents like Environmental Impact Reports (EIRs) or Mitigated Negative Declarations (MNDs). Vegetation management projects can result in environmental impacts and typically require CEQA review unless exempted. Given the urgency of wildfire threats, California has implemented certain CEQA streamlining mechanisms:

- CalVTP: Streamlined CEQA for Vegetation Treatment: CalVTP (California Vegetation Treatment Program) was created under Senate Bill 1260 to streamline CEQA compliance for vegetation management projects. It includes a Programmatic EIR (PEIR) that covers a wide range of treatment types (e.g., prescribed fire, mechanical clearing, herbivory). Agencies can use a Project-Specific Analysis (PSA) checklist to determine if their project fits within the CalVTP scope, bypassing the need for a full EIR (Fuller et al. 2020).

- Emergency Proclamations and CEQA Suspension: In 2025, Governor Newsom issued a State of Emergency that temporarily suspended CEQA review requirements for certain wildfire prevention projects. This allowed for faster implementation of vegetation management projects. This suspension is temporary and applies only to projects deemed critical for public safety (Office of Governor Gavin Newsom 2025).
- CAL FIRE's Environmental Protection Program: CAL FIRE ensures its vegetation management projects comply with CEQA unless exempted. It uses mitigation strategies and public input to minimize environmental impacts. CEQA documents (e.g., NOEs, MNDs, EIRs) are posted publicly for transparency (CAL FIRE n.d.).

California Forest Practice Rules

CAL FIRE enforces the California Forest Practice Act (14 CCR, Chapters 4, 4.5, and 10), which regulates commercial timber harvesting on non-federal lands in California. A Timber Harvesting Plan (THP), Exemption, or Emergency Notice must be prepared by a Registered Professional Forester for timber harvesting on non-federal lands in the state. THPs are prepared for timber operations and must be consistent with applicable laws and regulations. THPs have been certified to serve as a functional equivalent of an EIR under CEQA, require public noticing and solicitation of public input, and include feasible mitigation measures and an evaluation of alternatives that would lessen or avoid adverse environmental impacts.

Exemptions allow certain timber operations to proceed without a full THP as long as they meet specific limitations and operational standards. These exemptions are valid for one year after approval and still require compliance with all applicable provisions of the Forest Practice Act and district rules, including restrictions on alternative practices within Watercourse and Lake Protection Zones. The exemptions cover activities such as harvesting Christmas trees and removing dead, dying, or diseased trees, including fuelwood or split products, up to ten percent of the average per-acre volume, as well as removing slash and woody debris outside protected zones. They also allow for fuel-reduction tree removal near legally permitted structures, provided the work is limited to within 150 feet of the structure and excludes clearcutting or certain regeneration steps. All operations under these exemptions must conform to local general plans, ordinances, and zoning requirements.

California Code of Regulations Title 14 Division 1.5

CCR Title 14, Division 1.5, known as the State Minimum Fire Safe Regulations, constitute minimum wildland fire protection standards (California Board of Forestry) employed in conjunction with building, construction, and development in SRAs for emergency access; signing and building numbering; private water supply reserves for emergency fire use; vegetation modification, fuel breaks, greenbelts, and measures to preserve undeveloped ridgelines.

4.4.2.2 Local Codes

Nevada County

The Nevada County Fire Safety Regulations (County Fire Safety Regulations) (Title 4) (Chapter 1) defines hazardous vegetation and combustible material abatement. This chapter extends and supplements PRC 4291. This chapter matches the same treatment requirements in PRC 4291 and extends hazardous vegetation and combustible material abatement beyond the property line of a parcel. This ensures

defensible space is maintained on parcels adjacent to improved parcels, along emergency access, evacuation routes, and fire access easements.

This chapter is applicable to all unincorporated areas of the County of Nevada and requires hazardous vegetation and combustible materials within 100 feet of a structure (or greater as determined by the public official) or along roadways that serve as primary ingress or egress routes be in accordance with this chapter.

Truckee Fire Protection District

The Truckee Fire Protection District enforces hazardous vegetation management through local fire code ordinances, notably Ordinance 01-2022, which adopts the 2022 California Fire Code with specific amendments. These regulations require property owners to maintain defensible space by clearing flammable vegetation around structures and ensuring fire-safe landscaping. Additionally, Ordinance 02-2012 reinforces these requirements by aligning them with PRC 4291.

City of Grass Valley

The City of Grass Valley Municipal Code 8.16.230 requires every owner, occupant, or person in control of private land within City limits to abate combustible materials that constitute a fire hazard. Type (improved or unimproved) and size (less than one acre, one to five acres, and greater than five acres) of property define the requirements to be in compliance with the municipal code.

Nevada City

The Nevada City Municipal Code (Title 8, Chapter 8.10.040- 060) is in alignment with PRC 4291 and the Nevada County defensible space ordinance (Title 4 Fire Safety Code, Chapter 1).

5 Plan Integration

5.1 Roles and Responsibilities

This Land Management Plan (LMP) outlines a framework for strategically managing vegetative fuel loads in the County to reduce wildfire hazard while avoiding or minimizing potential environmental impacts resulting from vegetation management activities. The following summarizes the roles and responsibilities under this LMP:

- Nevada County Office of Emergency Services (OES). County OES will support collaborative project planning and design. For OES-led projects, OES will be responsible for project planning, management, prescription development, environmental review and permitting, landowner coordination, implementation funding and oversight, monitoring, and project reporting. As the LMP lead, County OES will also be responsible for project tracking, project map and database management and maintenance, public outreach and coordination, and annual LMP project reporting. Project tracking and mapping will be facilitated through the County's GIS Application.
- County Fire Agencies. County fire agencies (CAL FIRE, USFS, and local fire agencies) are anticipated to provide technical assistance during project planning efforts, but may also identify and implement vegetation treatment projects. As potential project proponents, fire agencies may also be responsible for project planning, management, prescription development, environmental review and permitting, landowner coordination, implementation funding and oversight, monitoring, and project reporting.
- Cooperating Municipalities, Agencies, and Landowners. Municipalities, agencies and landowners seeking to complete projects under this LMP will be responsible for identifying projects, developing treatment prescriptions, and managing project outcomes. Necessary environmental review and permitting may also be the responsibility of municipalities, agencies, and landowners, though collaboration with County OES, USFS, CAL FIRE, and local government agencies.

5.2 Adaptive Management

Implementation of this LMP will take an adaptive management approach. Adaptive Management is an iterative process of implementation, monitoring, reporting, and adjustment of management actions based on monitoring results (McEachern et al. 2007). This LMP recognizes that vegetative fuels are dynamic, and the existing conditions and management actions discussed herein are considered appropriate at the time of LMP completion. Wildfire hazard conditions can change rapidly due to environmental conditions, the occurrence of wildfires, and the implementation of vegetation treatment activities. Implementation, monitoring, and reporting will require a collaborative approach, as multiple agencies may implement vegetation treatments across the County, including County OES, fire agencies, municipalities, agencies, and landowners. The County CWPP goals encourage communication, collaboration, and coordination of wildfire risk reduction actions across land ownerships and

jurisdictions to ensure effective vegetation treatments. Thus, an adaptive management approach including consistent monitoring and reporting is needed to achieve the goals and objectives of this LMP.

5.3 Project Planning

Vegetation management project planning is anticipated to be conducted routinely as projects are identified and implemented. Project planning includes multiple steps, which are summarized in the flow chart below. As noted, the project planning process is intended to be adaptive, where monitoring results influence project identification and planning efforts.

5.3.1 Nevada County CWPP and GIS Application

The Nevada County Community Wildfire Protection Plan (CWPP) identifies Project Priority Areas. These Project Priority Areas were determined by the results of the Quantitative Wildfire Risk Assessment (QWRA), which helped to identify and prioritize areas based on potential impacts to identified High Value Resources and Assets and results from CWPP community outreach efforts. The Project Priority Areas, therefore represent the focus areas for wildfire risk reduction efforts identified in the County, including vegetation management projects conducted under this LMP.

In addition to the CWPP, County OES has developed a GIS Application. This application allows the County to monitor CWPP implementation, maintain a system for the submission of wildfire mitigation project data with internal review capabilities, host the viewable results of the CWPP, and provide an interactive playground for public users.

5.3.2 Engage Stakeholders

Once projects/project areas are identified, the project lead would be responsible for engaging stakeholders, landowners, coordinating agencies, tribes, or other entities that may be affected by or have involvement in project implementation. This phase includes conducting community outreach to educate the public about the project and coordinating project site access.

5.3.3 Project Planning

Project planning is anticipated to include site evaluations, delineation of treatment areas relative to treatment history and current landscape-scale treatment objectives, identification of treatment type(s) and technique(s), development of treatment prescriptions, identification of project BMPs, and coordination and communication with landowners, tribes and other interested parties. Concurrent planning and scheduling of multiple vegetation management activities on different properties may also occur. Planning may also consider treatment timing priorities and constraints, available resources (staff, contractors, and funding), and coordinated implementation of projects across properties. This phase would also include coordination with necessary agencies and preparation of burn and smoke management plans (for prescribed burn activities).

5.3.4 Environmental Review

Environmental review for vegetation management projects proposed under his LMP would likely be necessary. This phase would entail determining the status of current environment review documents that may cover project-related activities. If not covered under existing documents, environmental review would be necessary prior to project implementation. The following sections identify environmental review requirements.

5.3.4.1 National Environmental Policy Act (NEPA)

Proposed fuel treatment projects on federal lands must comply with the National Environmental Policy Act (NEPA). Projects that qualify under specific criteria—such as limited acreage, location in WUI areas, and consistency with land management plans—may be eligible for Categorical Exclusions (CEs), which exempt them from more extensive review (USDA 2004). Projects not qualifying for a CE require preparation of either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), depending on the potential for significant environmental impacts (Defense Logistics Agency 2019). NEPA review is initiated during the project planning phase and must include public involvement, especially for projects authorized under the Healthy Forests Restoration Act (HFRA). The lead federal agency is responsible for determining the appropriate level of NEPA analysis and ensuring compliance with related laws such as the Endangered Species Act and the National Historic Preservation Act. All vegetation management activities must be consistent with existing resource management plans and undergo site-specific analysis before implementation.

5.3.4.2 California Environmental Quality Act (CEQA)

Proposed fuel treatment projects on non-federal lands may require compliance with CEQA. Private landowners conducting defensible space projects under PRC Section 4291 guidelines are not subject to

CEQA review requirements. Non-defensible space fuel treatment projects on non-federal lands that are discretionary and are carried out or approved by public agencies would be subject to CEQA review and documentation (CEQA Guidelines 21080(a)). CEQA review for non-defensible space fuel reduction projects would be instituted during the project planning process. Typically, the lead agency under CEQA is the public agency with discretionary authority over a project (i.e., principal responsibility for carrying out or approving the project). The appropriate level of CEQA analysis will be decided by the lead agency, which could be a Categorical Exemption, Initial Study/Mitigated Negative Declaration, Environmental Impact Report, or a document tiered from the CalVTP Program EIR, which is further discussed below.

In 2025, California introduced new CEQA exemptions to accelerate wildfire prevention and resilience efforts. These include statutory exemptions for prescribed fire, thinning, and fuel-reduction projects in communities with limited evacuation routes (AB 442), and a temporary two-year exemption for fuel-reduction projects in very high fire hazard severity zones (AB 1227). Additional exemptions apply to wildfire prevention initiatives funded by Proposition 4, covering planning, construction, and maintenance of parks and trails intended to support fire resilience. Agencies also continue to use categorical exemptions, such as Class 4 for minor land alterations and Class 8 for resource protection, for activities like brush clearing, pile burning, and small-scale thinning.

5.3.4.2.1 California Vegetation Treatment Program (CalVTP)

The California Board of Forestry and Fire Protection developed the CalVTP in an effort to address California's ongoing wildfire issues. The CalVTP includes the use of prescribed burning, mechanical treatments, manual treatments, herbicides, and prescribed herbivory activities to reduce hazardous vegetation, construct fuel breaks, and restore healthy ecological fire regimes. The CalVTP Program EIR was prepared in accordance with CEQA and was approved by the Board of Forestry and Fire Protection in December 2019. The Program EIR provides a programmatic analysis of potential impacts related to vegetation treatment activities within the Treatable Landscape, which is defined by the CalVTP. Project proponents may tier from the CalVTP Program EIR to analyze project-related impacts for future projects within the Treatable Landscape. Fuel management projects occurring in the Treatable Landscape can complete a streamlined CEQA review via the Project Specific Analysis process outlined in the CalVTP Program EIR. Project planning efforts would examine the project's location relative to the CalVTP Treatable Landscape to determine suitability for analysis under the CalVTP Program EIR.

5.3.4.3 California Forest Practice Rules

CAL FIRE enforces the California Forest Practice Act (14 CCR, Chapters 4, 4.5, and 10), which regulates commercial timber harvesting on non-federal lands in California. A Timber Harvesting Plan (THP), Exemption, or Emergency Notice must be prepared by a Registered Professional Forester for timber harvesting on non-federal lands in the state. THPs are prepared for timber operations and must be consistent with applicable laws and regulations. THPs have been certified to serve as a functional equivalent of an EIR under CEQA, require public noticing and solicitation of public input, and include feasible mitigation measures and an evaluation of alternatives that would lessen or avoid adverse environmental impacts. Timber operations conducted under this LMP would require preparation of a THP, Exemption, or Emergency Notice by a Registered Professional Forester prior to operations. Timber operations include cutting/removal of trees for commercial purposes (where the resulting material would be sold, bartered exchanged, or traded). Timber operations would not include removal of smaller trees

for fuel management or non-commercial purposes, with specific criteria outlined in California PRC Section 4527(b).

5.3.4.4 California Department of Fish and Wildlife

The California Department of Fish and Wildlife's (CDFW) "Cutting Green Tape" initiative, launched in 2021, is designed to streamline regulatory processes for ecological restoration through tools like the Statutory Exemption for Restoration Projects (SERP), the new Restoration Management Permit (RMP), and Restoration Consistency Determinations. By consolidating multiple permitting requirements into one streamlined process, the RMP helps cover authorizations such as take of protected species and streambed alterations. SERP, originally authorized by SB 155 and extended through 2030 by SB 174, offers CEQA exemptions for eligible habitat restoration projects, enabling faster lead-agency concurrence (typically within 60 days) while still safeguarding environmental standards.

5.3.4.5 Agency Consultation/Permitting

Regulatory permits may also be required for fuel treatment actions that would adversely impact riparian areas under the jurisdiction of the U.S. Army Corps of Engineers, the Regional Water Quality Control Board, and the California Department of Fish and Wildlife. It is anticipated that the U.S. Army Corps of Engineers may require a fill permit under Clean Water Act Section 404. The California Department of Fish and Wildlife may require a streambed alteration agreement under California Fish and Game Code Section 1602. The Regional Water Quality Control Board (RWQCB) may require a water quality certification under Clean Water Act Section 401. Vegetation management projects would also be subject to the Regional Water Quality Control Board's Timber Waiver program, even if activities do not occur in timber areas. Additionally, it is anticipated that the U.S. Army Corps of Engineers would consult with the U.S. Fish and Wildlife Service pursuant to federal Endangered Species Act Section 7 during the Section 404 permitting process for potential impacts to special-status plants/wildlife and their habitats. Applications for each of these regulatory permits can be processed concurrently; however, some may take longer than others to process and obtain.

5.3.5 Project Implementation

Project implementation would include preparing bid specifications and bid packages; screening, selecting and hiring contractors; training crews; coordinating, scheduling delivery, and staging equipment; installing and maintaining BMPs; posting project-related notifications; conducting vegetation management treatments; and treating or disposing material. Other needs may arise specific to project type, treatment technique, vegetation type, and project location.

5.3.6 Monitoring and Reporting

Monitoring efforts conducted in support of this LMP will be used to prioritize vegetation treatment projects and determine vegetation management technique effectiveness or ineffectiveness; determine if changing or modifying treatment techniques or the timing, duration, or priority of vegetation treatment projects is necessary; and determine if additional or modified avoidance/minimization measures or BMPs need to be employed to reduce potential adverse effects of vegetation management. Monitoring will also allow for consideration of other factors occurring outside the parameters of this LMP, such as

a neighboring jurisdiction creating a fuel break or a wildfire occurrence that could alter the fire environment and the management techniques employed.

County OES has developed the GIS Application that will serve as a hub for managing planned and completed vegetation management activities conducted throughout the County, and for recording changes in the fire environment due to wildfire, development, or other factors (Table 21). An interactive map database will allow for location-based assessments of work histories and treatment effectiveness. Various agencies/entities may use this documentation during subsequent planning efforts. The database would be updated on a continual basis (annually at a minimum), as management projects are proposed and implemented. Additionally, wildfire occurrences would be added to the database annually (at a minimum), at the end of each fire season. Monitoring is an important component of the overall adaptive management approach.

Monitoring should be routinely conducted for the following purposes:

- Monitoring vegetation management activities during operations to ensure that avoidance measures and BMPs are being properly implemented.
- Monitoring treated properties following vegetation management activities to ensure that management prescriptions are met and management standards are achieved.
- Monitoring treated properties to determine the need for follow-up management actions.
- Monitoring treated properties to determine the need for post-operations BMPs.
- Monitoring to document the success of vegetation management activities and identify needs for adjustments to vegetation management activities or standards.

Agencies implementing vegetation management activities and monitoring should conduct regular reporting summarizing the results of monitoring efforts, quantifying the number of projects and acreage treated, documenting project expenditures, identifying any additional resource needs, and summarizing any pertinent issues. Based on the results of monitoring efforts, annual reporting should identify any proposed future changes to vegetation management activities conducted in the Plan Area; however, any identified changes should be consistent with the techniques and standards outlined in this LMP.

Table 21. GIS Application Documentation Components

Planned Projects	Completed Projects
• GIS data that includes project location • Project size (acres) • Treatment type and treatment techniques proposed • Contact information	• GIS data that includes polygon(s) of the project area, • Project size (acres) • Treatment techniques/activities used • Dates of treatment activities/treatment maintenance

Finally, this LMP has been developed considering existing site conditions, which are subject to change due to environmental conditions or the occurrence of wildfires. Therefore, this LMP would be reviewed at least annually. Necessary updates to this LMP would be determined based on this annual review.

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Appendix A
Glossary of Terms

Glossary of Terms

Key Term	Definition
Active Crown Fire	Active Crown Fire occurs where surface and crown fire energy are linked. Surface intensity is sufficient to ignite tree crowns, and fire spread and intensity in the tree crowns encourage surface fire spread and intensity.
Adaptive Management	Adaptive management is an intentional approach to making decisions and adjustments in response to new information and changes in context.
Anthropogenic	Anthropogenic is related to or resulting from human influences on nature.
Asset	A useful or valuable thing, person, or quality.
Best Management Practices (BMPs)	Best management practices are means of performing activities, prohibited practices, maintenance procedures, and other management practices that prevent or reduce the impacts of land-disturbing activities.
Box Canyon	A box canyon is a narrow canyon with a flat bottom and narrow walls. Fires starting near the base of box canyons and narrow canyons may react similarly to a fire in a wood-burning stove or fireplace. Air will be drawn in from the canyon bottom creating very strong upslope drafts. These upslope drafts create rapid-fire spread up the canyon, also referred to as the chimney effect. This effect can result in extreme fire behavior and can be very dangerous.
Broadcast Burning	Broadcast burning is a 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.
Brush	A collective term that refers to stands of vegetation dominated by shrubby, woody plants or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.
Burn Plan	A burn plan is a written prescription for the prescribed fire including critical elements such as the weather conditions under which the burn will be conducted, the number of personnel and duties of each, and the type, amount and placement of equipment needed to safely conduct the burn.
Burn Probability	Burn probabilities represent the likelihood of a given location on your landscape burning. Burn probabilities are related to the sizes of fires that occur on a given landscape.
Canopy	The stratum contains the crowns of the tallest vegetation present (living or dead), usually above 20 feet.
Chaparral	Chaparral is a plant community consisting of shrubs and found primarily in California, Southern Oregon, and the northern portion of Baja California. It is shaped by a Mediterranean climate (mild wet winters and hot dry summers) and infrequent, high-intensity crown fires. Chaparral features summer-drought-tolerant plants with hard evergreen leaves.

Key Term	Definition
Chemical Techniques	Chemical techniques involve the use of herbicides to kill vegetation or prevent growth and are typically used in combination with other types of fuel reduction treatments. Herbicides do not remove any vegetation from a treatment area; therefore, dead plant material remains unless otherwise treated.
Chimney Effect	The chimney effect is the upslope draft in a canyon that can result in a rapid-fire spread up the canyon.
Chipper Program	A chipper program is a fuel reduction program that assists residents in maintaining defensible space around their homes and helps residents dispose of the cut vegetation.
Climate	Climate is the long-term prevalent weather conditions in an area.
Combustible	Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.
Community Outreach	Community outreach is building relationships with community members and stakeholders.
Community Wildfire Protection Plan	A community wildfire protection plan is a plan developed at the community level for areas at risk of wildfire. The plan is created in collaboration with community members, fire agencies, local government, and other stakeholders.
Cultural Resource	Cultural resources are tangible remains of past human activity in an area. This can include buildings, structures, prehistoric sites, historic or prehistoric objects, rock inscriptions, earthworks, canals, or landscapes. Cultural resources are nonrenewable resources that require specific protection.
Crown Fire	A fire that advances from top-to-top of trees or shrubs and is more or less independent of a surface fire.
Defensible Space	An area either natural or man-made where material capable of allowing a fire to spread unchecked has been treated, cleared, or modified to slow the rate and intensity of advancing wildfire. This will create an area for housing increased emergency fire equipment, for evacuating or sheltering civilians in place, and a point for fire suppression to occur.
Diurnal Cycle	The diurnal cycle is the daily weather pattern and most often refers to the change of weather from daytime conditions to nighttime conditions.
Ecological Restoration	Ecological restoration focuses on repairing damage to natural ecosystems most often by human activities. The goal is to return the natural systems to an earlier state or on that resembles conditions unaltered by human activities.
Environmental Impact Report	Environmental impact reports are reports to inform the public and public agencies about the significant environmental impacts a proposed project may have. The reports also identify mitigation measures to reduce those effects and describe reasonable alternatives.
Environmental Review	Environmental review is the process of reviewing a project and its potential environmental impacts to determine whether it meets federal, state, and local environmental standards.
Extreme Fire Behavior	A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually

Key Term	Definition
	involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.
Fine Fuels	Fast-drying dead fuels that are less than 0.25-inch in diameter and are generally characterized by a comparatively high surface area to volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.
Fire Behavior	The manner in which a fire reacts to the influences of fuel, weather, and topography.
Fire Front	That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, it is assumed to be the leading edge of the fire perimeter.
Fire Hazard Severity Zones	FHSZ were developed and mapped by CAL FIRE to score hazardous areas in the state based on factors (fire history, topography, vegetation, predicted fire behavior etc.) and assign them a rating of Moderate, High, or Very High. Areas within FHSZ have different requirements for building codes, feasible space, and development standards.
Fire History	Fire history is the patterns of fire in a given area and provides an estimate of the historical range of variability of fires.
Fire Prevention	Activities, including education, engineering, enforcement, and administration are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.
Fire Return Interval	The time between fires in a designated area
Fire Safe Council	Fire safe councils are grass-roots community-led organizations that mobilize residents to protect their homes, communities, and environments from wildfires. Fire safe councils educate homeowners about community wildfire projects while working with local fire officials to design and implement projects that increase the wildfire survivability of their communities.
Fire Season	1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) a legally enacted time during which burning activities are regulated by state or local authority.
Fire Suppression	The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.
Firebrand	Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pinecones, glowing charcoal, and sparks.
Firebreak	A gap or strip of land where vegetation and other flammable materials have been removed to slow or stop the spread of wildfire. It can be natural (e.g., river, rocky area) or man-made (e.g., cleared strip of land, road). Firebreaks may be used in wildfire management and prescribed burns to protect structures, communities, and natural resources.
Fireline Intensity	Fireline intensity is the available heat of combustion per unit of ground and the rate of spread of a fire. It is interpreted as the heat released per

Key Term	Definition
	unit of time for each length of the fire edge. Fireline intensity is measured in Btu per second per foot.
Flame Length	Flame length is the distance measured from the average flame tip to the middle of the flaming zone at the base of the fire. It is measured on a slant when the flames are tilted due to winds and slope. Flame length is typically measured in feet.
Flammability	The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.
Forecast Zone	An area with similar climate and weather conditions
Fuel	All combustible material within the WUI or intermix, including vegetation and structures.
Fuel Break	An area, strategically located for fighting anticipated fires, where the previously occurring vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting
Fuel Driven Fire	Fuel-driven fires where the fuel composition and fuel load are the primary drivers of fire growth.
Fuel Moisture	Fuel moisture is the amount of water in fuel and determines the flammability of said fuel. Fuel moisture is divided into living fuel moisture which is the moisture content of live foliage and dead fuel moisture which is the moisture in any cured or dead plant.
Fuel Load	The volume of fuel in a given area and is generally expressed in tons per acre.
Fuel Model	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
Fuel Modification	Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.
Fuel Modification Zone	A strip of land, typically 100 feet wide or more, between an improved property and wildlands, where combustible vegetation has been removed, thinned, or modified and may be partially or totally replaced with approved drought-tolerant, fire-resistant, and/or irrigated plants to provide an acceptable level of risk from vegetation fires. Fuel modification reduces radiant and convective heat, thereby reducing the amount of heat exposure on the roadway or structure and providing fire suppression forces a safer area in which to take action.
Grassland	Grasslands are large open areas covered in grasses and can have annual or perennial grass species.
Grazing	Grazing is a method of using livestock to reduce the fine fuel loading of live herbaceous growth, shrubs, and new growth of trees.
Ground Fire	Ground fires occur in the subsurface and consume buried vegetation.
Hand Labor Techniques	Hand labor involves pruning, cutting or removal of trees or other forest vegetation by hand or using hand-held equipment. Other hand labor treatments involve removing dead wood, piling material, lop and scattering, and spreading chips/mulch.
Hazardous Fuels	Hazardous fuels are any kind of living or dead vegetation that is flammable.

Key Term	Definition
High Value Resources and Assets	High Value Resources and Assets are natural or man-made resources, including plant and animal species, cultural resources, and residences that influence project location and prioritization.
Herbicides	Herbicides are chemicals that can be used to manipulate, reduce or control undesirable vegetation.
Independent Crown Fire	A fire that advances in the tree crown alone and does not require any energy from the surface to sustain combustion or movement.
Integrated Hazard	Integrated hazard combines burn probability and conditions flame length and quantifies wildfire hazard.
Invasive Plant Species	A plant species that is not native to the region and has demonstrated the ability to aggressively outcompete native plant species that would normally colonize a given area.
Ladder Fuel	Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.
Mechanical Techniques	Mechanical treatments include all methods that employ motorized heavy equipment to remove or alter vegetation. Mechanical treatments rearrange vegetation structures, compact or chip material, and move material to landings, staging areas, or burn piles
Mediterranean Climate	The Mediterranean climate is a dry summer climate that is characterized by dry summers and mild, wet winters.
Microclimate	A microclimate is a climate of a very small or restricted area that differs from the climate of the surrounding area.
Mitigation	Actions or efforts that reduce the potential for the loss of life and property by minimizing the impact of natural disasters (i.e. Wildfires) on highly valued resources and assets.
Passive Crown Fire	Passive crown fire is a fire in the crown of trees in which a tree or a group of trees are torched or ignited by the passing front of a fire.
Pile Burning	Pile burning involves stacking hand or machine-cut vegetation into piles and allowing the material time to dry out and then later burned.
Plume Dominated Fire	A plume-dominated fire is a fire whose activity is determined by the convection column.
Prescribed Fire	Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area, and to produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.
Prevailing Wind	Prevailing wind is from the direction that is predominant in a particular place or season.
Red Flag Warning Conditions	A Red Flag Warning is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds that may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.
Reforestation	Reforestation is the process of regenerating or replanting forest areas that have been destroyed or damaged.

Key Term	Definition
Saddle	Saddles are at the tops of canyons and can alter the flow of surface fires and produce extreme fire behavior.
Special Status Species	Special status species are designated (rare, threatened or endangered) and candite species listed by either the California Department of Fish and Wildlife or the U.S. Fire and Wildlife service.
Spotting	The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.
Structural Hardening	Structural hardening actions that reduce the vulnerabilities of residential or structural losses in WUI areas.
Surface Fire	A surface fire is a fre that only burns the surface litter and undergrowth of the forest.
Surface Fuel	Fuels lying on or near the surface of the ground, consist of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.
Topography	Topography is the forms and features of land surfaces.
Understory	Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.
Unincorporated Areas	Unincorporated areas are regions that are not governed by a local municipal and within the jurisdiction of the County.
Vegetation Management	Vegetation management uses various techniques to address wildland fire fuel hazards and other resource management issues.
Wildfire	An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.
Wildfire Hazard Assessment	A wildfire hazard assessment evaluates and determines the wildfire hazard in a given area.
Wildfire Hazard	Wildfire hazard refers to the state of fuels and the potential fire behavior if a fire were to occur.
Wildfire Risk Assessment	A wildfire risk assessment determined the wildfire risk of a given area or community.
Wildfire Risk	Wildfire risk is the likelihood of a fire occurring and the potential effect of the fire on highly valued resources and assets.
Wildland Urban Interface	The area where structures and other human developments meet or intermingle with undeveloped wildland.

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