



SONOMA COUNTY COMMUNITY WILDFIRE PROTECTION PLAN 2023 UPDATE

Sonoma County

Permit Sonoma Fire Prevention Division

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SONOMA COUNTY COMMUNITY WILDFIRE PROTECTION PLAN

MUTUAL AGREEMENT PAGE

The Sonoma County Community Wildfire Protection Plan (CWPP) fulfills the three requirements of the Healthy Forests Restoration Act (HFRA)of 2003 and is agreed to by the key parties below. The CWPP:

- Was collaboratively developed. Interested parties, key stakeholders, local fire departments, county, state, and federal land management agencies managing land in Sonoma County have been consulted.
- Identifies and prioritizes areas for hazardous fuel-reduction treatments and recommends the types and methods of treatment to best protect the communities within Sonoma County.
- Recommends measures to reduce the ignitability of structures throughout the area addressed by the plan.

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Acknowledgements

The following community representatives, agencies, organizations. and individuals were involved in the collaborative process of preparing the 2023 Sonoma County CWPP Update, led by the County of Sonoma's Permit Sonoma Fire Prevention Division:

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Permit Sonoma wishes to thank Fire Safe Sonoma, and all those who helped us through the process of creating, writing, and editing this CWPP, including but not limited to the following: CAL FIRE, Sonoma County Department of Emergency Management, Sonoma County Agricultural Preservation and Open Space District, University of California Cooperative Extension Sonoma, participants from Fire Safe Councils, COPEs, Sonoma County Fire Chiefs Association, residents, and groups from across our county who stepped up for wildfire safety.

Executive Summary

When agencies, individuals, and communities work together, risks of loss of life, and damage to property and the environment due to wildfire can be significantly reduced. Permit Sonoma hopes the Sonoma County Community Wildfire Protection Plan (CWPP) will inspire communities and agencies to plan and enact effective wildfire risk reduction measures.

Many decades of successful fire suppression, conversion of forest and grazing lands to residential use, and climate change have dramatically affected virtually all of Sonoma County's ecosystems, from redwood forests to chaparral to grasslands. Additionally, homes and structures must be considered a part of the fuel component in any ecosystem, which, like vegetation, can impact fire behavior. In the absence of regularly occurring fires, grazing, and active management, vegetation has become denser and fire ***fuel loads***[1] have greatly increased. Growing human populations also contribute. Most fires are caused by human activities. More people means more risk of ignition.

[1] Throughout the document, terms in ***bold Italics*** are defined in the Glossary, Appendix J.

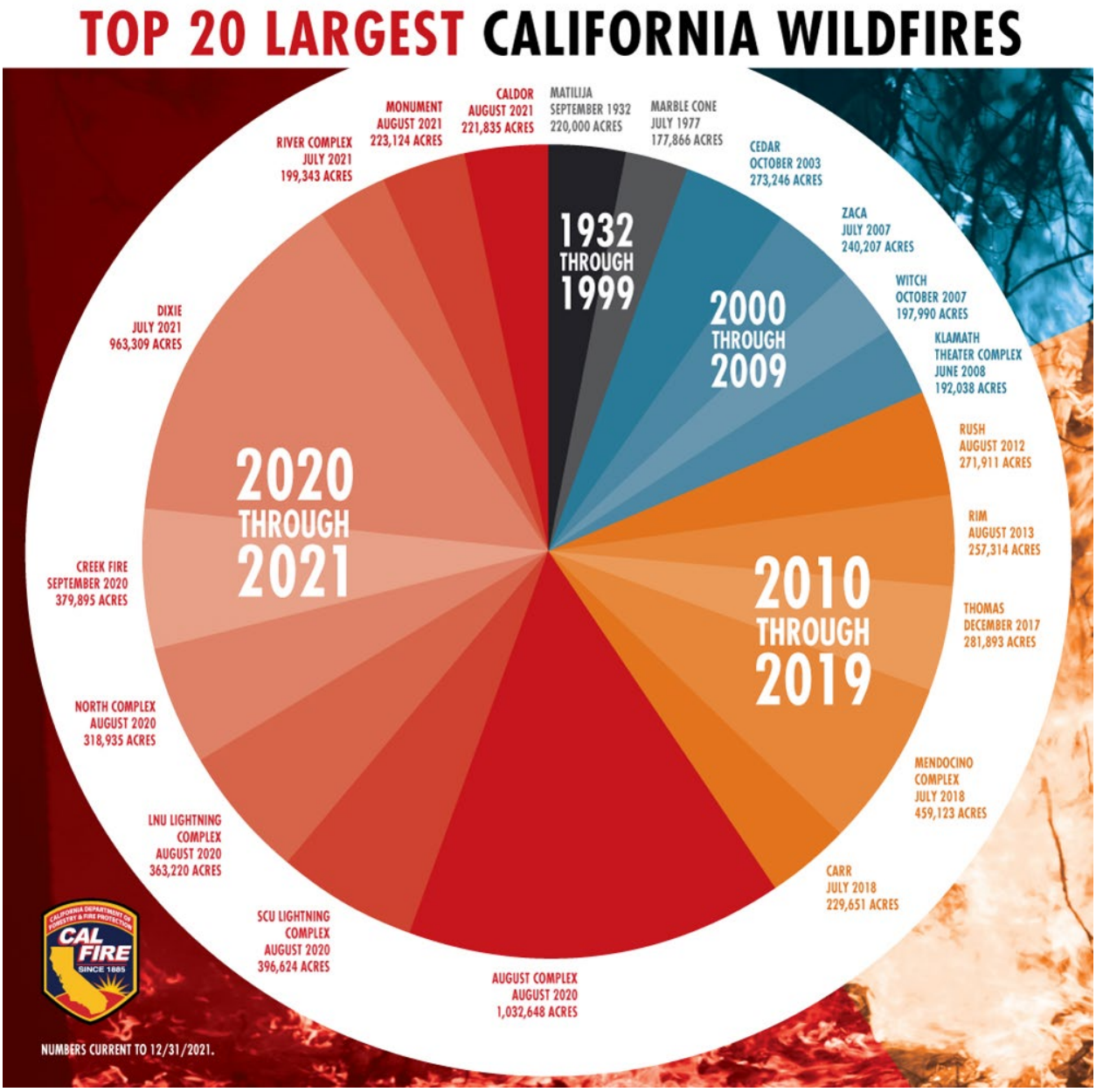

Figure 1: 20 Largest California Wildfires

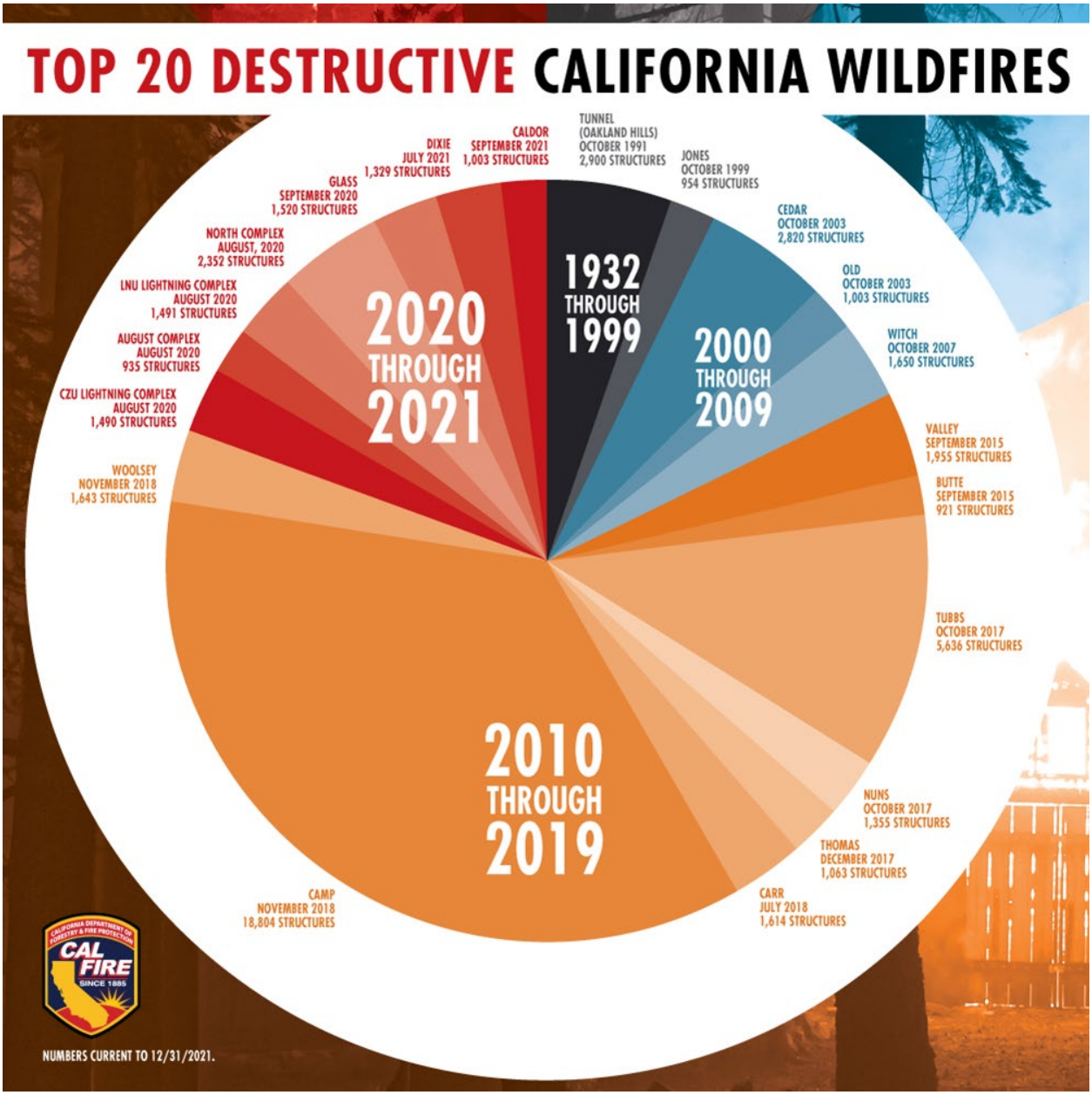

Figure 2: 20 Most Destructive California Wildfires

As the preceding charts indicate, fires and fire seasons have become larger and more destructive since 2010.[2] Since the original version of this Plan was completed in 2016, Sonoma County has experienced five major wildfires. The

[2] Li, S., & Banerjee, T. (2021). Spatial and temporal pattern of wildfires in California from 2000 to 2019. Scientific Reports, 11, 8779.

Glass, Meyers, and Walbridge Fires of 2020 burned over 100,000 acres[3] of land and destroyed over 1,500 structures[4] (in both Napa and Sonoma counties). In 2019, the Kincade Fire burned over 77,000 acres; 374 structures were lost in that fire and 60 were damaged.[5] In 2017, the Sonoma Complex fires (Nuns, Pocket, Pressley, Tubbs, and Young fires) caused 22 confirmed fatalities, and destroyed 5,636 structures and damaging another 317.[6] Within the Sonoma Complex fires, the Tubbs Fire burned over 36,000 acres including major residential areas in and around Santa Rosa. At the same time, the Nuns Fire burned much of the southeastern portion of the County while the Pocket Fire threatened communities in the Northeastern County. Recent wildfires show how fire-prone and dangerous conditions can be when human habitation areas, heavy fuel loads, drought, and fire weather combine.

Despite the trauma and material losses from these wildfire events, we can all take pride in the tremendous strides that Sonoma County residents, agencies, and organizations have taken to make Sonoma County communities safer. New community groups such as Communities Organized to Prepare for Emergencies (COPE), Community Emergency Response Team (CERT), Fire Safe Councils, and FireWise® Communities have formed to help neighbors prepare for wildfires. Residents are retrofitting buildings and "hardening" homes to prevent wildfire ignition and creating ***defensible space***. Cooperating groups composed of fire agencies, county and state agencies, and Non-Governmental Organizations (NGOs) such as Fire Safe Councils and environmental advocates have come together to develop plans and seek funding for reducing fuels, improving wildland and forest health, and increasing community safety. Robust new alert and warning systems have been launched for emergency notifications and evacuation plans developed across Sonoma County.

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[3] From CAL FIRE's fire perimeter GIS data layer, version 20_1 (https://frap.fire.ca.gov/frap-projects/fire-perimeters/).

[4] Structure loss estimates from CAL FIRE's incident report pages accessed on 7/22/2021 https://www.fire.ca.gov/incidents/2020/9/27/glass-fire/ and https://www.fire.ca.gov/incidents/2020/8/17/lnu-lightning-complex-includes-hennessey-gamble-15-10-spanish-markley-13-4-11-16-walbridge/#incident-overview).

[5] Structure loss estimates from CAL FIRE's incident report pages accessed on 7/22/2021 (https://www.fire.ca.gov/incidents/2019/10/23/kincade-fire/).

[6] Fire details from CAL FIRE's incident report pages accessed on 7/22/2021 (https://www.fire.ca.gov/incidents/2017/10/8/tubbs-fire-central-lnu-complex/#incident-links).

Regardless, it is critical that residents and agencies never lose sight of the importance of creating defensible space and modifying structural elements, such as vents and wooden attachments, that make homes vulnerable to ignition from wildfires. For individual home survival, actions that homeowners take to make homes and buildings ignition-resistant, and to create and maintain defensible space, are more important than large-scale vegetation management projects.

Returning hundreds of thousands of acres of wildland to healthier conditions is a daunting prospect. The costs of ***mechanical treatment*** and/or ***prescribed burning*** can be high. However, well-planned, and prioritized grant-funded vegetation management projects can reduce fire fuel loads while also improving ecosystem health. Science-based fuels reduction, increased use of prescribed fire, and other vegetation management methodologies will help residents to live in a fire-prone environment.

A brief description of each chapter and what it contains follows:

Chapter 1. About the CWPP

This chapter provides information about requirements and goals for the CWPP, and processes and procedures used in developing the 2023 Sonoma County CWPP Update.

Chapter 2. Overview of the County of Sonoma

This chapter provides general information about Sonoma County and demographic trends. Section 2.3 lists critical infrastructure and facilities that are vulnerable to wildfire. Section 2.4 discusses the concept of the Wildland Urban Interface (WUI), and how this term applies in Sonoma County. Fire service organization, trends, and Defensible Space Inspection Programs are addressed in Section 2.4. Sections 2.5, 2.6, and 2.7 include planning area background, land use and zoning and ownership, and building trends. Sections 2.8 and 2.9 discuss WUI building and defensible space codes and regulations.

Chapter 3. Wildfire History, House-Outward Risk Reduction Strategies, Preparedness

Recent and past Sonoma County wildfire history is outlined in Section 3.1. Subsequently, Section 3.2 discusses "house outward" strategies to reduce risk of home ignition, including reducing structural ignitibility through ignition resistant materials and construction. Section 3.4 reviews defensible space. The final chapter sections discuss the importance of individual and community preparedness, and public health impacts of poor air quality due to wildfire.

Chapter 4. Wildland Ecosystems

Chapter 4 is focused on the larger landscape of fire in Sonoma County's diverse wildland environments, including Native American burning, fire regimes, the effect of fire on natural landscapes, and the consequences of decades of fire suppression and climate change. Section 4.3 looks at the primary causes of fire in the county, and how factors like topography, vegetation, and weather impact fire behavior. Section 4.4 discusses some of the challenges inherent in implementing large scale fuels reduction/restoration projects.

Chapter 5. Wildfire Hazard and Risk Assessments

As part of the risk assessment (identification and prioritization of areas where risk reduction activities could protect at-risk communities), required for a CWPP[7], a Geographic Information System Wildfire Hazard and Risk Indices (WRI) was developed. This chapter provides background on how the WRI was developed, and how it can be used.

Chapter 6. Goals and Objectives

Based on input gathered from agencies, groups, and individuals during development of this plan, assets, and values at risk to wildfire, and goals and objectives for reducing wildfire risks, were identified. Chapter 6 lists these goals and recommendations by categories.

Chapter 7. Implementation

One of the most important goals of the CWPP is to provide a planning context that identifies and prioritizes areas where risk reduction activities could protect at-risk communities so that projects that reduce wildfire risk to lives, property, and the environmental will be developed and implemented. To do this, a

[7] Hazardous Fuel Reduction Act, 16 USC 6511

critical CWPP implementation task is to develop and maintain a process for collecting and mapping potential projects that can reduce risk, and identify gaps where risk exists but no projects have been proposed.

Chapter 7 discusses how the Sonoma County CWPP Project List may be used to view prospective projects county-wide, including how the project aligns with CWPP Risk Reduction Priorities, location, and feasibility of the project.

Chapter 8. Appendices

A. Sonoma County CWPP Project List
B. List of Local CWPPs Within Sonoma County
C. Wildfire Risk and Hazard Assessments: Detailed Report
D. CWPP Process, Public Workshops and Meeting Notes
E. Wildfire History
F. Sonoma County Fire Agencies
G. Financial Resources
H. Emergency Planning for Animals
I. Success Stories
J. Glossary
K. References

1. Introduction

1.1 CWPP Intent

The intent of the *Sonoma County Community Wildfire Protection Plan (CWPP)* is to serve as a planning tool to guide wildfire prevention and preparation activities throughout Sonoma County, subject to compliance with all applicable local, state, and federal laws and regulations.

This update to the CWPP was collaboratively developed by Permit Sonoma, with input from Fire Safe Sonoma[8], CAL FIRE, a Steering Committee (see Acknowledgements section), local fire agency personnel, as well as the Sonoma County Department of Emergency Management, and interested parties, including community members, forest and rangeland property owners, and other neighborhood groups. The CWPP is intended to help concerned residents, planning professionals, ***Fire Safe Councils***[9], responsible agencies, and all interested parties assess ***wildfire*** (or ***wildland fire***) threats to homes and communities and identify measures to reduce ***wildfire risk***, in accordance with the Healthy Forest Restoration Act.

Many strategies can be undertaken to reduce risks of wildfire to life, property, and the wildland environment, including:

- Structural modifications that make buildings more resistant to ignition during wildfires.
- Vegetation management within the 100-foot "***defensible space zone***" has been proven to be critical to home survival in wildland fires.
- Landscape-scale projects such as ***fuel breaks*** and ***shaded fuel breaks***, wherein fire fuels are strategically reduced to reduce risk to entire communities, ecosystems, or infrastructure.
- Education and pre-fire planning.

[8] Fire Safe Sonoma, Inc., is a 501(c)(3) non-profit whose mission is to increase awareness of wildfire issues in Sonoma County and help local residents and firefighting agencies to achieve improved wildfire safety (https://www.firesafesonoma.org/about/).
[9] Terms in ***Bold Italics*** are referenced in the Glossary.

Each of these strategies alone can provide significant risk reduction, but the greatest risk reduction will result from designing projects that incorporate multiple strategies.

During their planning life (typically 5 years), CWPPs are intended to be living documents and as such, appendices and elements of the plan can be reviewed and updated by the plan developers. Appendices, including project lists, links to relevant tools and documents, etc., can be amended throughout the life of the document. The CWPP Hub site will be regularly updated.

Smaller community-level CWPPs have been and will continue to be developed to identify localized threats and targeted solutions. Online links to community CWPPs are included in Appendix B and on the CWPP Hub Site.

1.2 CWPP Definition and Process

The Community Wildfire Protection Plan (CWPP) was defined in Title I of the Healthy Forests Restoration Act (HFRA) of 2003 (16 U.S.C. Section 6511) as "…a plan for an at-risk community that is developed with the context of the collaborative agreement and the guidance established by the Wildland Fire Leadership Council…".[10] The intention for the CWPP is to enhance collaboration among federal, state, and local agencies, community groups, and interested residents in order to identify strategic actions and methods for wildfire risk reduction across landscape and jurisdictional boundaries. In accordance with *Preparing a Community Wildfire Protection Plan* (p. 3), the guidance established by the Wildland Fire Leadership Council, a CWPP that meets the minimum project funding requirements funder HFRA includes the following:

- Collaboration: A CWPP must be collaboratively developed by local and state government representatives, in consultation with federal agencies and other interested parties.
- Prioritized Fuel Reduction. A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure.

[10] You can see full text of the Healthy Forests Restoration Act at: https://www.congress.gov/108/plaws/publ148/PLAW-108publ148.pdf (accessed on 12/2/2021).

- Treatment of Structural Ignitability. A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

This CWPP serves unincorporated areas in Sonoma County as a whole and is purposefully broad in evaluating fire risk-reduction strategies. It brings together interested residents, local groups, and local, state, and federal agencies. Where communities have developed local CWPPs or other planning documents (such as Firewise USA® designation), we link to those local plans. Authors of local plans can enter their top priority projects into the CWPP Project Entry Portal *to* be screened for inclusion in the Sonoma County CWPP Project List.

The goals for the Sonoma County Community Wildfire Protection Plan are to:

- Identify, assess, and coordinate risk-reduction strategies.
- Prioritize fuel-reduction areas.
- Promote wildfire awareness, especially information about structural ignitability and defensible space in at-risk communities across the county.
- Carry out annual updating of hazardous fuel reduction areas and treatments and evaluate progress and effectiveness to recommend changes as appropriate.

This CWPP is a planning document that provides information and recommendations for potential future action. The CWPP is not subject to the California Environmental Quality Act (CEQA) pursuant to CEQA Guidelines Section 15060(b) and (c), because adopting the CWPP will not result in a direct or reasonably foreseeable indirect physical change in the environment, and because it is not a project as defined in CEQA Guidelines section 15378, as it has no potential for resulting in physical change to the environment, directly or indirectly. Further, the CWPP is exempt from CEQA pursuant to the CEQA Guidelines Sections 15262, which exempts feasibility and planning studies for possible future actions that have not been approved, adopted, or funded from the requirement to prepare an environmental impact report or negative declaration provided environmental factors are considered. The CWPP provides recommendations for potential future actions and information to plan, assess, and prioritize wildfire prevention and preparation activities, including public

education and fuel reduction projects, and enables such activities to be eligible for State and federal funding. The CWPP does not commit the County or any other entity to any particular course of action. If any wildfire prevention and preparation activities are later undertaken, the public agencies authorizing such activities will be required to comply with CEQA, as applicable.

1.3 About This CWPP

This is an update of the 2016 CWPP and includes a ***Geographic Information Systems* (GIS)**-based Wildfire Hazard Index (WHI) and Wildfire Risk Index (WRI). The Wildfire Hazard Index quantifies relative wildfire hazard, that is, the inherent wildfire hazard on the landscape due to available fuels, weather potential, potential ignition sources, and suppression difficulty. The Wildfire Risk Index models the entire county and quantifies the relative risk of wildfire in 100-acre polygons. The Wildfire Risk Index can help evaluate areas for wildfire risk reduction projects, but, like any landscape-scale analysis, using remote sensing data it is not be considered definitive at scales finer than its source data allows, e.g., both the WHI and WRI use 100-acre hexagons as the mapping unit for evaluating hazard and risk. At the local- or parcel-scale, these indices should be used as one information source among many to evaluate risk.

The CWPP is a resource for Fire Safe Councils, agencies, and community groups within Sonoma County to promote work on public and private lands and to educate and empower landowners and other residents to take mitigation and preparedness steps to reduce wildfire risk to life, property, and the environment. Within this document are recommendations to reduce structural ignitability, create defensible space, plan wildland scale fuels reduction projects, and prepare for potential evacuation. Additionally, to achieve the CWPP requirement of identifying areas for hazardous fuel treatments, the CWPP Project Entry Portal on the CWPP Hub site has been created to provide a platform for anyone to enter and map prospective wildfire risk reduction project areas across Sonoma County. Providing a centralized mapping resource will help reduce duplication of efforts, show areas where action might be needed, and encourage collaboration. Finally, many granting entities are requiring listing in a CWPP as a funding prerequisite in their application process. Having a project listed in the Sonoma County CWPP Project List can thus help facilitate grant funding for Sonoma County grant applicants.

The CWPP consists of two parts, the document itself and the Hub Site.

The Sonoma County Community Wildfire Protection Plan document is a general overview relevant to wildland fire risks across the county. The CWPP Appendices provide more information about specific topics. Appendices can be updated in the future as information changes. The CWPP document is located online on the CWPP Website hosted by Permit Sonoma: https://permitsonoma.org/sonomacountycwpp. The CWPP website gives an overview of the CWPP and provides answers to common questions.

The interactive CWPP Hub Site (https://arcg.is/mzC4L0) contains many resources and maps, including the Wildfire Hazard and Risk Indices, a Community Base Map, educational videos, the CWPP Project Entry Portal and Project List and much more. The interactive content is designed to engage residents and encourage further action as we all learn how to live with wildfire.

1.4 Collaboration and the CWPP Development Team

This Community Wildfire Protection Plan was updated by Permit Sonoma in collaboration with Fire Safe Sonoma and with guidance and support from a Core Team and a Steering Committee, including CAL FIRE and many local fire agencies. This CWPP also benefited from contributions by representatives from a variety of federal, state, and local agencies, along with community members and groups.

1.5 Involving Community Members: Outreach

Permit Sonoma, in conjunction with Fire Safe Sonoma and local fire agencies, held eleven community meetings in a virtual format to inform residents of the CWPP update effort.[11] Community input for the CWPP was additionally solicited at a variety of fire safety and forest health workshops throughout Sonoma County. Following revision based on public and agency comments, a second opportunity for public comment took place in November and December 2022.

[11] Due to COVID restrictions and precautions, CWPP Workshops and document review meetings were held via Zoom, an online meeting platform. For each Supervisorial District in Sonoma County, two meetings were held that focused on the district's needs. Notes from the meetings can be found on the Sonoma County CWPP Hub Site (scroll to bottom of page).

The goal was to create a collaborative document along with an online resource that is a valuable contribution to public safety. In addition to being a tool for planning and prioritizing projects, this CWPP serves as an accessible resource to assist residents in mitigating hazards around their homes and communities to further reduce the threat of wildfire.

Increasingly, Sonoma County residents understand the stakes and necessary precautions of living in a wildfire-prone environment. This CWPP will help focus residents and other stakeholders as they develop mitigation strategies and specific projects to implement those strategies. The desired outcome is that defensible space around structures, ignition resistant building practices and materials, fuels reduction near communities, adequate water supplies, and sufficient fire equipment access will become as commonplace as smoke alarms and fire extinguishers are today in residential and commercial occupancies.

2. Overview of the County of Sonoma

Approximately 40 miles north of San Francisco, Sonoma County's 1,588 square miles are bordered by the Pacific Ocean on the west, Marin County and San Pablo Bay to the south, Solano, Napa, and Lake Counties to the east, and Mendocino County to the north.

Among Sonoma County's assets at risk are homes, natural resources, critical infrastructure, and some of the world's most valuable agricultural lands, which are often interspersed with residential and commercial real estate.

2.1 Population

Demographically, Sonoma County is the 17th largest of California's 58 counties, with a population of 494,336 in 2019. Approximately 11% of the county's population lives in designated State Responsibility Areas (SRA), with the remainder in or near incorporated cities and towns. Growth of incorporated areas increased by about 4 percent between 2000 and 2018. The portion of residents living outside incorporated areas gradually decreased over that same period.

Updated data from the 2020 Wildfire Hazard Index and estimates from the latest U.S. Census data indicate that an estimated 15,437 people in Sonoma County live in areas with an extreme wildfire risk index, representing 3% of the total population. If we combine the "very high" and "extreme" Wildfire Hazard Index classes, the number of people in the county at the highest risk to wildfire jumps to 83,559, representing 17% of the total population.

Around 13,776 buildings are in areas with an extreme wildfire risk index. Assuming a replacement value of $450 per square foot (note that this estimate may be higher on some properties and should be expected to rise over time) and an average of 1,500 square feet for each structure, these structures account for nearly $9 billion in losses. Buildings that are not hardened to resist ignition from heat, flame, and embers, and those with and poor defensible space are at particular risk.

Figure 3: Table, Summary population and structure statistics from the Sonoma County Wildfire Risk Index (2021)

Wildfire Risk Index	Estimated 2021 Total Population	Percent of Population	Number of Structures	Percent # of Structures
Low (1)	631	0.1%	130	0.1%
Moderate (2)	307,517	63%	10,0534	49%
High (3)	98,523	20%	52,509	25%
Very High (4)	68,122	14%	40,162	19%
Extreme (5)	15,437	3%	13,776	7%

It is important to acknowledge that the population and structures "at risk" could include far more than those in CAL FIRE's designated high or very high Fire Severity Zones (FHSZ) or the CWPP Hazard or Risk Indices. This was demonstrated during the 2017 Sonoma Complex Fires, where Coffey Park, which is not designated as high or very high hazard or risk, was devastated by the Tubbs Fire. Wildfire starting in remote areas can quickly become a disaster for those living in areas not normally considered at risk. Defensible space and hardened structures should be maintained in most, if not all, communities, and environmentally sensitive fuels reduction in high-risk areas can benefit communities far beyond project boundaries.

2.2 Equity Considerations - Access and Functional Needs, and Low-Income Communities

Members of the community with ***Access and Functional Needs (AFN)*** and ***low-income communities*** in general are more vulnerable to wildfire.[12]

In Sonoma County, it is estimated that 9.3% of all families have incomes below the Federal Poverty Level, which is defined as about $73,000 for a four-person household[13]. Based on U.S. Census Bureau estimates, per capita income in the planning area in 2018 was $39,929, and the median income of all households

[12] *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021*(MJHMP), Vol. 1, Section 4, page 4-15, https://permitsonoma.org/Microsites/Permit%20Sonoma/Documents/Planning/Long%20Range%20Plans/Hazard%20Mitigation%20Plan/Adopted-Sonoma-County-MJHMP-Volume-1-December-2021.pdf

[13] Federal Poverty Level statistic from the Sonoma County Demographics and Social Characteristics website: https://sonomacounty.ca.gov/Health/Public-Reports/Summary-Measures-2015-17/Demographics-and-Social-Characteristics/ (accessed on 1/3/2022).

was $76,753. Low-income communities are defined as census tracts with a median household income less than 80% of the statewide average. Approximately 18.8% of households have an income between $100,000 and $149,999 per year and 10.6% of household incomes are above $150,000 annually[14]. Tools such as the Portrait of Sonoma consider other equity issues beyond income and will be incorporated into the evaluation process described in Chapter 7. Section 6.2 Risk Reduction Priorities identifies that low-income communities and AFN populations are a priority for the CWPP.

The *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021* (MJHMP)[15] indicates that low-income residents often occupy older or more poorly built housing stock, which often have deferred maintenance and can be more susceptible to damage from multiple natural hazards than other types of housing. Mobile or modular homes, for example, are more susceptible to damage than other types of housing. Additionally, low-income residents are less likely to have insurance to compensate for losses from natural disasters, and federal aid is designed to restore property to owners, not renters. Personal household economics also significantly impact people's decisions on evacuation, and the ability to withstand the multiple losses associated with wildfire, including evacuation, loss of home and possessions, and disruptions to income from loss of work.

2.2.1 Access and Functional Needs (AFN)

Those with Access and Functional Needs (AFN) (includes individuals with disabilities, seniors, children, limited English proficiency, and transportation disadvantaged residents) require greater government coordination efforts in times of emergency. According to U.S. Census data, 25% of U.S. residents have disabilities. This percentage in Sonoma County is much higher, with 30.5% of the over-65 population in the planning area having disabilities, and 7.2% of those under 65[16].

[14] MJHMP Section 4 page 19
[15] Ibid
[16] Ibid Section 4, Page 18.

The overall age distribution of Sonoma County is shown below based on U.S. Census data:

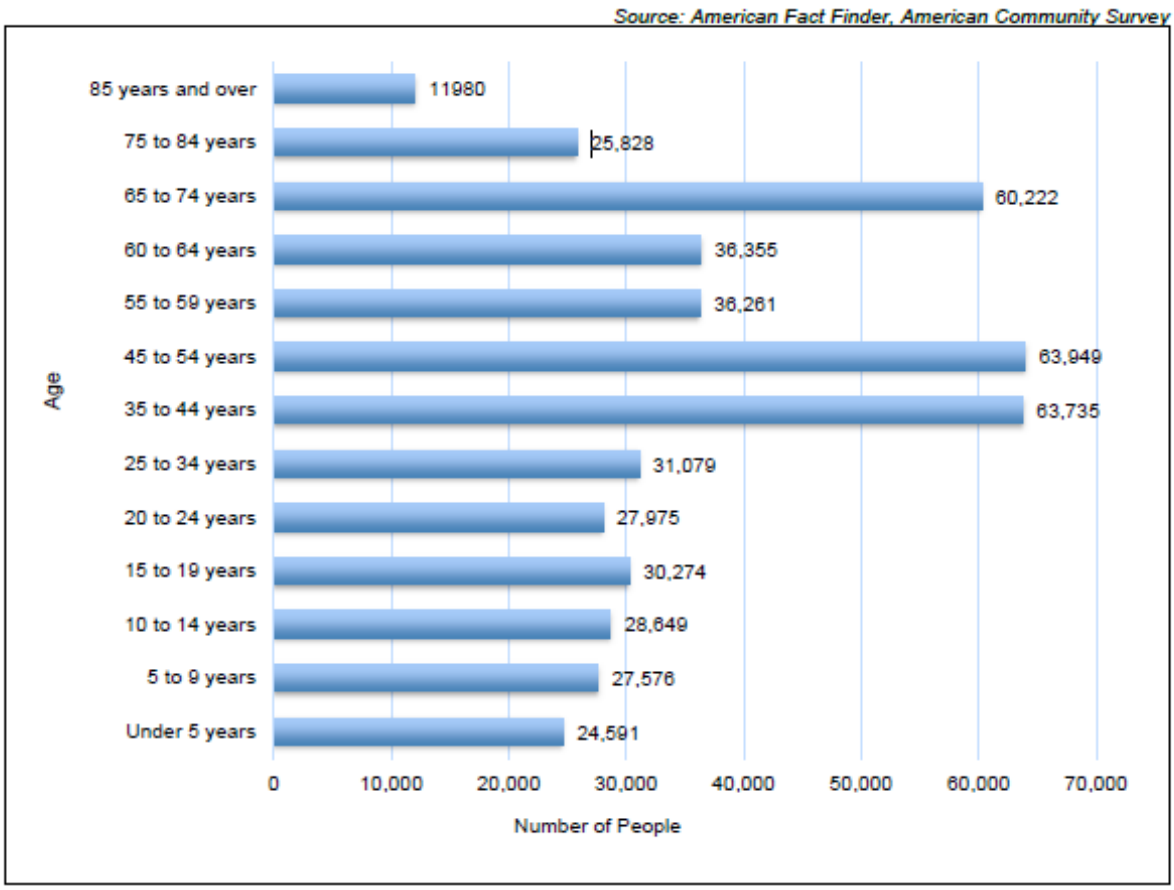

Figure 4: Planning area age distribution (MJHMP, 2021, Section 4 page 17)

Roughly one quarter of Sonoma County's population is over 60 years old. Problems associated with aging can increase vulnerability to hazards, due to decreased strength, poor tolerance of physical activity, functional limitations, and decreased sensory awareness. Likewise, older people and AFN individuals, especially those with limited income, may also face greater challenges in maintaining defensible space, hardening structures, and preparing for emergencies.

The US Census estimates that 25.9%[17] of the Sonoma County population speaks a language other than English at home. Those with limited English proficiency can be faced with significant challenges before, during, and after emergency

[17] https://www.census.gov/quickfacts/sonomacountycalifornia

evacuations. The CWPP Risk Reduction Priorities in Section 6.2 and project recommendations in 6.3 show that projects designed to reduce risk for AFN populations, such as targeted outreach and assistance in multiple languages, and projects that support all aspects of preparedness for AFN populations are a high priority for the CWPP.

Planning for evacuation and the creation of systems deployed for warning the public about emergencies are complex topics that require a high level of expertise and experience. The Sonoma County Department of Emergency Management (DEM) has worked extensively with AFN individuals and advocacy groups, as well as groups focused on service for AFN and low-income populations to create the *Sonoma County Operational Area Emergency Operations Plan*[18] (Operational Plan) for all county residents.

The Operational Plan (page 6) includes the following:

- Evacuation of individuals with disabilities or AFN may require more time and resources than the general population, so early evacuation triggers are essential to assure sufficient time to support these residents.
- People with disabilities do not necessarily require evacuation assistance – most live independently, are fully self-sufficient, and will self-evacuate.
- People with disabilities can become dependent on assistance if separated from their mobility device or medical equipment. Such equipment is essential to maintaining independence and will be evacuated with the user whenever possible.
- At times, it may be impractical to transport certain types of medical equipment or devices with their owners due to the size or volume of the equipment, and the space available in evacuation vehicles. Responders should be prepared with additional vehicles specifically for the transport of such equipment.
- Many people who are ordinarily capable of evacuating themselves may have functional needs due to physical or emotional trauma, or a temporary lack of resources or accommodations.

[18] https://sonomacounty.ca.gov/administrative-support-and-fiscal-services/emergency-management/plans

2.3 Critical Facilities and Infrastructure

Critical infrastructure includes those facilities whose disruption would have a serious negative impact on public safety, especially during a disaster. In Sonoma County, these include emergency operations centers, police and fire stations, communications facilities, schools, utilities, roads and highways, water supply systems, and hazardous materials sites. Many of these facilities can be threatened by wildfire, and if impacted, can disrupt important services during emergency events, and long after.

Critical Facilities and infrastructure can be viewed using the interactive online Community Base Map (https://arcg.is/1vGmbz1). Hardening and protection of critical facilities and infrastructure is of highest priority. Note that the Community Base Map may not represent all facilities which are critical to residents, including childcare facilities, senior centers, etc. Risk reduction for those critical community assets should also be considered in project planning.

2.3.1 Emergency Communications System

The County of Sonoma's wireless communications network for public safety and emergency response is used by state, county and city agencies, public safety officials, firefighters, and law enforcement. The network is composed of remote mountain top communication sites consisting of towers and equipment buildings, which provide wireless communications coverage throughout Sonoma County. However, there are numerous areas in the rural hills and coastal areas where "dead zones" indicate the need for additional repeaters to ensure adequate communications.

The county uses eleven tower sites for communications antennas; six are in areas at high risk of wildfire. The fire communications system is a VHF High Band system and utilizes old technology. The system is in need of an overhaul to new technology. The county regularly clears vegetation around tower sites to reduce fire risk. Most tower sites contain very little flammable material; fuel for backup generators is carefully stored to reduce risk. The communications system is designed to function even after the loss of one or more antennas, and individual sites may remain functional after a wildfire passes over their location. However, major wildfires in other areas of the state have destroyed wireless

communication sites, thereby impeding firefighting efforts, and Sonoma County's system could be damaged by similar events.

2.3.2 ALERTCalifornia Cameras

Since the 2017 fires, ALERTCalifornia (formerly ALERTWildfire) cameras have been installed throughout Sonoma County. Camera locations and live camera feeds can be viewed at https://alertca.live/. ALERTCalifornia has been enormously helpful for firefighters to discover and locate fires, and quickly scale fire resources up or down appropriately, help evacuations, and ensure contained fires are monitored appropriately during and after extinguishment. AlertCalifornia cameras are equally valuable for the public seeking information about wildfires in the area. These cameras are funded by Sonoma Water, Pacific Gas and Electric, CAL FIRE, Sonoma County, and other agencies. Fuels management near camera sites is an ongoing priority.

2.3.3 Roads and Highways

Numerous county, state, and federal roads and highways pass through high wildfire-risk areas. Larger highways in high wildfire-risk areas are a concern due to the level of traffic they carry. State and federal routes in the county passing through high wildfire-risk areas include Highway 1, Highway 12, Highway 101, Highway 116, and Highway 128. At CWPP input meetings, vegetation along roadsides was a common cause of concern for residents. Roadside fuels treatment on state and county roads is listed as a high priority for both in the CAL FIRE LNU Plan CAL FIRE and this CWPP.

Rural roads in Sonoma County can be narrow, winding, with dense tree canopy over and on the sides of roads. Many areas are served by only one road in and out. Some communities want to create roadside fuel breaks while others are attached to the beauty of tree cover and resist fuels reduction activities. This increases the complication of getting work done, especially considering the sheer number of roads, large and small, that need treatment, and the funding available to the County of Sonoma Department of Public Infrastructure achieve fuels reduction goals. In addition, roadside fuels treatment on private roads used for evacuation or fire equipment access should be considered in project planning.

The Right of Way along public roads can extend just to edge of pavement or several feet to tens of feet if local or state governments have acquired Right of Way easements. This can complicate obtaining access to complete roadside vegetation management projects. Community groups such as Fire Safe Councils can be helpful in finding funding for roadside fuels reduction and obtaining the necessary property owner permissions to do the work. However even with property owner permission, the costs and delays associated with CEQA reviews can be a challenge for those seeking funding for roadside fuels projects.

In a wildfire, smoke, flames, and the extraordinary stress of emergency evacuation, road issues can present significant danger. Inadequate road and address signage can make it difficult for evacuees to distinguish between the road out and a dead-end road or even a driveway; good road and address signage is a critical priority. For residents who live in areas with limited access, community-wide preplanning is a very high priority. In urban areas that are served by multiple roads, higher population can cause traffic backups. In either case, early evacuation is essential.

Ongoing maintenance standards, contracts, training, and incentives are one way to prevent ignitions and slow fire spread. For example, The California Department of Transportation (CalTrans) and the County of Sonoma Department of Public Infrastructure have Maintenance Strategic programs. Brush cutting and removal is a primary activity for the Sonoma County Road maintenance crews, as vegetation growth can obstruct critical safety features such as signs and streetlights or grow into the roadway.

Despite these programs, in many areas, roadside conditions are not ideal. This can be due to a number of factors, including right of way restrictions, lack of funding and adequate staffing. Maintaining evacuation routes during a wildfire event is crucial to residents within Sonoma County. A multi-agency, comprehensive program to address vegetation management and ignition reduction along roadways could help define priorities and identify partnerships to further goals.

2.3.4 Water Supply Systems

The Sonoma County Water Agency (SCWA) water supply and transmission system is made up of transmission pipelines (aqueducts), collector wells, booster

pump stations, storage tank reservoirs, and other facilities that allow the agency to supply water for drinking and firefighting, manage flood risk, and maintain health of key watersheds. The agency also manages two major reservoirs impounded by dams that are owned by the Army Corps of Engineers, and one inflatable dam.

In addition to water provided by the Sonoma County Water Agency, water is supplied to county residents by local water-distribution companies or agencies, or property-owner-maintained wells and water systems. Any of these sources can be incapacitated if the power supply is interrupted or if buildings and equipment are damaged or destroyed. This is especially a concern where local water companies (e.g., Holland Heights Water Company and the Sea Ranch Water Company) are located in areas at high risk of wildfire.

Shortages of water can be exacerbated if residents use sprinklers to wet down their property and leave water running after evacuating their property. These open connections can add to the excessive demand on water systems and use significant amounts of water. In shared water systems, this use can reduce supply overall, and impact areas that might be more directly impacted by the fire. Please consult with your local fire department if you are considering installing exterior sprinklers.

Water for firefighting is also available from residential sources. The county requires all new residential development to have a minimum water supply or storage to fight fires and protect individual structures, though older homes, especially in rural areas, may or may not have an adequate supply for firefighting. In areas not served by shared water systems, storage generally consists of large water tanks (minimum 2,500 gallons). Property owners installing tanks should refer to the local fire agency or County of Sonoma for information on specific fittings and placement for fire access (Sonoma County Code Chapter 13 - Sonoma County Fire Safety Ordinance, Article V, Division D-Emergency Water Supply. You can link to the code at https://library.municode.com/ca/sonoma_county/codes/code_of_ordinances?nodeId=CH13SOCOFISAOR_ARTVFISAST_DIVDEMWASU).

Most, but not all, fire agencies in the county have the proper equipment to connect to residential tanks. The county inspects tanks during construction but

has no mechanism to ensure that they remain serviceable over time. It is critical that property owners create and maintain "defensible space" around tanks, ensure that tanks are full, and fittings are accessible to fire apparatus throughout the fire season. Creating more accessible storage for firefighting use, especially through catching and saving rainwater, is a high priority.

2.3.5 Other Utilities

Utility systems can be disabled by wildfires, particularly in rural areas. Above-ground wiring for electricity, telephone, and cable and the poles that support them can burn. Buildings that house important equipment can burn, and equipment can be damaged by the intense heat generated by fires or water used to suppress fires even if the building housing does not burn.

In addition, the electrical power transmission lines, and other electrical equipment cause fires. In the Sonoma Lake Napa CAL FIRE Unit, electrical power was the highest cause for fires in 2020 (See Section 4.3)

Several high-voltage lines pass through high fire-risk areas of the county. According to PG&E, there are 177 miles of high-voltage transmission lines in the county. In addition, there are many more miles of low-voltage electrical distribution lines serving most inhabited areas. Numerous PG&E substations are located in high fire-risk zones, including those at Dunbar, Fort Ross, Monte Rio, Annapolis, Eagle Rock, and The Geysers.

The Geysers geothermal field is located in one of the county's highest fire-risk areas, with dozens of plants, hundreds of wells, and hundreds of miles of power line, road and pipeline. As seen in 2004, 2013, 2015, 2016 and 2019, when wildfires threaten the Geysers facilities or damage power lines, power plants are often shut down. During the 2004 Geysers fire, four high-voltage transmission lines and 400 megawatts of generating capacity were taken offline.[19] In that event, power supply to many county residents was maintained due to rerouting through the electricity grid, but people in the entire state, and especially county residents, were urged to reduce power use.

[19] PG&E news release, Sept 7, 2004, "Pacific Gas and Electric Company Urges Customers in the Santa Rosa Area to Conserve Electricity as Geysers Fire Continues to Burn."

After the 2017 fires, PG&E developed and implemented the Public Safety Power Shutoff (PSPS) program, a precautionary safety measure that may proactively turn off power lines when fire danger conditions are forecasted using PG&E's network of weather stations. Communities in high fire-threat areas are the most likely to be affected, but all PG&E customers should be prepared for possible public safety power outages. Because power lines can serve communities many miles away, even customers who do not live in high fire-threat areas or are not experiencing severe weather may lose power. Residents that rely on wells and electric pumps for water should plan ahead. To learn more about PSPSs, or for tips to better prepare you for an outage, visit https://socoemergency.org/get-ready/local-hazards/power-shutoffs/ or PG&E's safetyactioncenter.pge.com.

2.3.6 Residential Telephone and Cell Phone, and Alternative Communications Systems

Telephone communication systems are also at risk from fire. Several AT&T facilities are located in high-risk areas, and above-ground telephone lines serving the population living in high-risk areas are vulnerable. Several cellular telephone antennas, owned by various companies, are located in high wildfire-risk areas. If these structures burn, it could contribute to poor telephone functionality in various parts of the county.

Many Sonoma County residents have abandoned traditional wired phones for cell phones. In rural or hilly areas, cell phone coverage is limited, and many residents rely on internet service to operate cell phones at their homes. During a fire emergency, both cell and internet services may be disrupted by power failures and damage to equipment from fire, meaning that residents may not receive alerts or evacuation orders on cell phones, nor will they be able to call for help. All residents should ensure that they have registered for alerting systems such as SoCoAlert, Nixle and investigated other notification delivery systems, such as NOAA weather radios. Extensive information about how to register for alerts, get NOAA Weather radios, and other critical information can be found at SoCoEmergency.org.

Many communities across the county, assisted by the Sonoma County Department of Public Infrastructure (formerly the Department of Transportation and Public Works), have built alternative communications systems based on

ham radio networks or General Mobile Radio Service (GMRS) systems. GMRS is a radio service designed for short-distance two-way communication and is an excellent tool for neighborhood groups to communicate during an emergency. Users will need to purchase a radio and obtain a license (no test required). You can find out about GMRS networks in your area at the Sonoma County Radio Amateurs website at http://sonomacountyradioamateurs.com, or ask your local fire department, COPE or CERT group, or Fire Safe Council. Continuing this effort will provide redundancy and an additional capability during emergencies.

2.4 Fire Agencies

2.4.1 CAL FIRE

In areas designated State Responsibility Area (SRA), the state firefighting agency, CAL FIRE, has primary responsibility for wildland fires and fires that pose a threat of spreading into the wildland. CAL FIRE has primary command of SRA fires as soon as their units arrive on the scene. In Local Responsibility Areas (LRA), local agencies have primary command, though they may choose to request support from CAL FIRE. CAL FIRE may provide additional coverage to LRAs under automatic aid agreements, mutual threat zones and other agreements. In all areas, mutual and automatic aid agreements dispatch multiple state and local agencies to emergencies as needed.

Sonoma County is in CAL FIRE's Sonoma-Lake-Napa Unit (LNU), one of 21 CAL FIRE administrative units statewide. The LNU covers Sonoma, Lake, Napa, Yolo, Colusa, and Solano counties. LNU has primary responsibility for more than 2.1 million acres of SRA, and 2.3 million acres of CAL FIRE Direct Protection Area (DPA). It has the third largest population living within a CAL FIRE DPA. It is served by four divisions and 10 field battalions. LNU's Headquarters, including the Emergency Command Center (ECC), are located just north of St. Helena in Napa County.

With headquarters in Santa Rosa, Sonoma County comprises the West Division, which contains four battalions and covers nearly 800,000 acres. During fire season, CAL FIRE staffs nine stations within Sonoma County located in Santa Rosa, Occidental, The Sea Ranch, Cazadero, Hilton, Glen Ellen, Petaluma,

Healdsburg, and Cloverdale. Stations house fire-season staff of approximately 115, with a reduced staff of approximately 50 during the non-fire season along with14 engines and 2 dozers.

Sonoma Air Attack Base, located at the Santa Rosa Municipal Airport, provides fixed wing firefighting aircraft coverage 7 days a week, during the daylight hours of fire season. There are two Grumman S2T air tankers, each capable of dropping 1,200 gallons of fire retardant, and a North American Rockwell turboprop OV-10 "Bronco" plane, which carries a Pilot and the Air Tactical Group Supervisor. This unit coordinates aerial firefighting resources and supports ground operations.

2.4.2 Local Fire Agencies

As of 2023, there are 21 local fire agencies in Sonoma County, including Fire Protection Districts (FPDs) or Community Services Districts (CSDs) and municipal fire departments; and 8 volunteer fire departments operating under a single management structure (North Bay Fire). At the time of writing, the county is in the midst of a long-term effort towards fire department consolidation (merging multiple fire service areas together), which it is hoped will increase efficiency, save costs, and better serve the residents of the county. You can see a list of fire agencies at https://socoemergency.org/emergency/fire-departments/ or contact your local fire department for information.

The Sonoma County Fire District operates a firefighting helicopter. Its Airbus H135 helicopter utilizes a 120-gallon bucket for aerial firefighting and is staffed by a SCFD Helicopter Fire Specialist.

2.4.3 Paid and Volunteer Fire Departments

By acreage, most of Sonoma County is in the unincorporated rural parts of the county and is typically served by all-volunteer or "combination" fire departments, which have both paid staff and volunteers. Urban areas typically are served by paid firefighters, but many urban departments include volunteers on response and support staff.

Paid or volunteer, firefighters have the same responsibilities: responding to all emergency situations including medical incidents (which represent the majority of fire department responses); structure and wildland fires; vehicle crashes;

hazardous materials incidents; hazardous conditions; storm damage, as well as requests for assistance for non-emergency issues.

2.4.4 Funding Challenges for Fire Services

Running a fire department is expensive. Costs go up every year for purchasing and maintaining apparatus, payroll, insurance, training, first aid supplies, firefighter gear, communications equipment, tools, and fuel. In rural areas where low call volumes and limited revenue make it difficult or impossible to pay for full-time staffing at fire stations, the volunteer model is an essential part of the system. Though many departments maintain robust volunteer programs, some have experienced increasing difficulty attracting and retaining volunteers.

All fire agencies rely on property taxes for operational costs. Consolidation may help increase efficiency by unifying administrative costs and distribution of resources. However, challenges remain for funding emergency response, and for fire prevention programs, including inspections, community outreach, and programs to reduce community risks. As the county's population increases along with the risk of wildfire, funding mechanisms will have to be identified, and supported by the public.

Fire departments need funding for operational needs, such as staffing and equipment. Additionally, significant funding is required to reduce risks in our communities, including vegetation management, outreach and education, inspections, and assistance for residents to complete structure hardening and defensible space requirements.

These needs represent multi-million-dollar investments over multiple years. Well-funded fire agencies are an essential part of risk reduction efforts and will be critical to implementing many of the projects and recommendations in this plan.

2.5 Defensible Space Inspections

Defensible Space Inspections are carried out in state and local responsibility areas each year. The following data represents inspections performed by both CAL FIRE and Permit Sonoma in conjunction with local fire districts. Some fire districts, including the Sonoma County Fire and Sonoma Valley Fire District, also have robust inspection programs, which are not included in the following data. Defensible Space Inspections review properties for compliance to defensible

space regulations, which comprise the area in a radius of 100 feet from structures or to the property line, whichever comes first. Inspections assess vegetation management within 100 feet of building(s), and presence of combustible materials.

Figures 5 and 6 below show compliance data for CAL FIRE and Permit Sonoma Defensible Space Inspection (DSI) Programs. CAL FIRE Data represents the entire six-county Sonoma Lake Napa Unit. Number of inspections in Sonoma County is not known.

Figure 5: Table, Summary of CAL FIRE DSI inspections within the LNU (includes Sonoma County)

Year	Total Inspections		Compliant (no violations reported)	Non-Compliant (one or more violations reported)	Citations	Total Properties (one or more inspections)
2020	3,467		2,725	740	2	3,084
2021	4,294		3,820	474	0	3,886

Figure 6: Table, Summary of Permit Sonoma / Fire District Inspection Program

Year	Inspection Type	Compliant (no violations reported)	Non-Compliant (one or more violations reported)	Total Properties (one or more inspections)
2020	1st Inspection | Improved	1,333	554	1,887
2020	1st Inspection | Unimproved	184	38	222
2020	2nd Inspection | Improved	376	72	448
2020	2nd Inspection | Unimproved	16	11	27
2020	**TOTAL**	**1,909**	**675**	**2,584**
2021	1st Inspection | Improved	1208	299	1507
2021	1st Inspection | Unimproved	121	45	166
2021	2nd Inspection | Improved	138	25	163
2021	2nd Inspection | Unimproved	27	3	30
2021	**TOTAL**	**1494**	**372**	**1866**

Sonoma County Defensible Space Inspection Programs only reach a fraction of the at-risk homes in the county. However, the programs provide a crucial opportunity to educate residents and homeowners about the conditions on

their property and suggest improvements that can reduce potential damage to their home from a fire. CAL FIRE is increasing funding to complete more annual inspections. Permit Sonoma's multi-district inspection program is funded by the County of Sonoma.

Defensible Space Inspections are one of the best tools available to accomplish community-wide defensible space. Fire agencies report that following two years of inspections, the number of properties that passed the initial inspection went up significantly on the next round. Additionally, nearby neighborhoods, anticipating they would be included in an inspection program, started moving towards compliance. Increasing funding for defensible space inspection and abatement programs is a high priority.

2.5.1 Other Inspection and Assessment Programs

Permit Sonoma has received three grants from FEMA's Hazard Mitigation Assistance grant programs to help Sonoma County take measures to reduce the potential for home destruction from wildfire. The Wildfire Adapted Sonoma County program has two of these grants, serving homes within 14 communities across Sonoma County, undertaking risk reduction at a community-scale. Targeting more than 6,500 parcels, Wildfire Adapted provides assessments for defensible space on all parcels in the project area and offers free structure risk assessments on a voluntary opt-in basis. Wildfire Resilient Sonoma County (popularly known as "the BRIC grant") will implement mitigation projects in built and natural environments to reduce the risk of wildfire in three project areas. This project will include defensible space assessments on all parcels in the three project areas, voluntary structural hardening assessments, and site identification for hazardous fuels vegetation management.

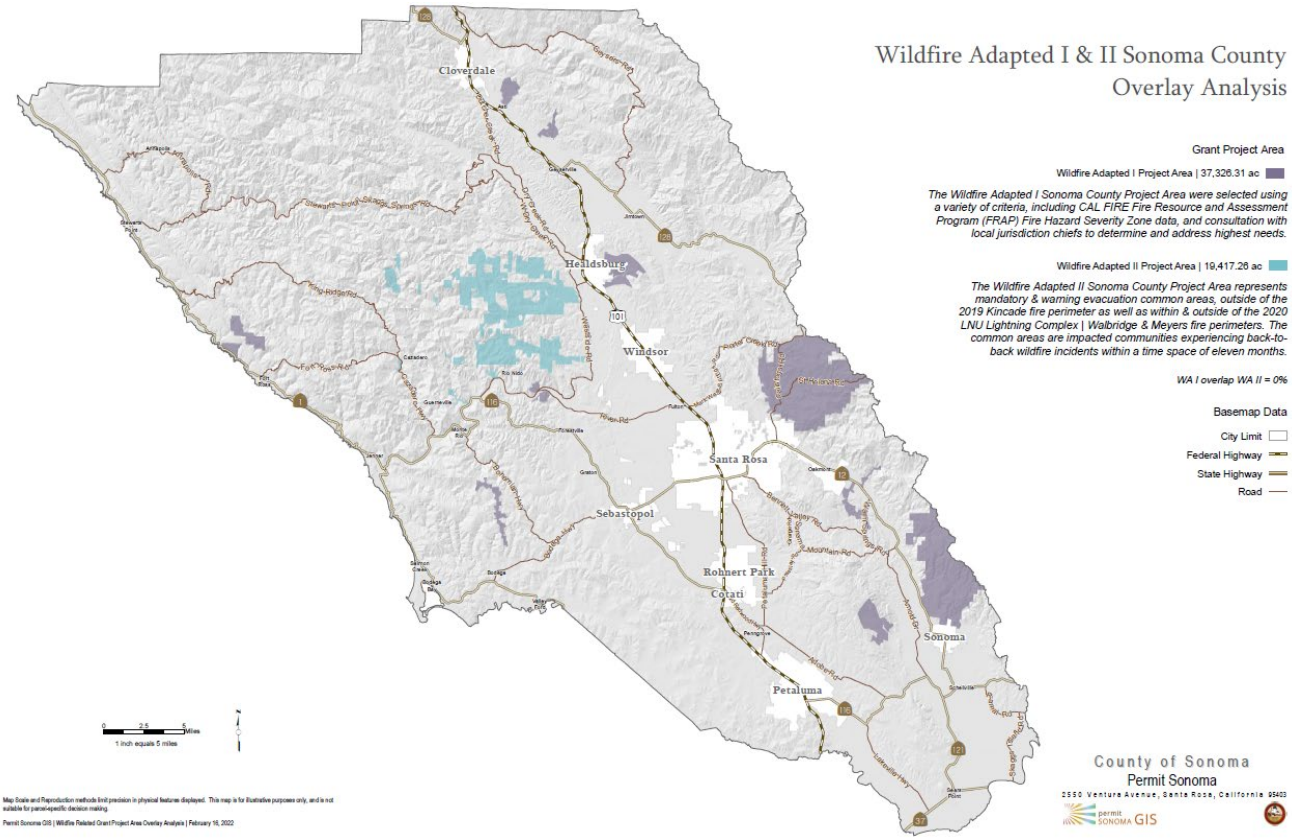

Figure 7: Project areas included in Permit Sonoma SoCo Adapts (2021) Program

One-on-one assessments are the best way to help residents understand and prioritize projects for creating good defensible space and hardening structures. Following assessment, property owners can apply for rebate incentive funding to complete high priority projects identified by the assessors. The primary focus of the assessments is to inspire residents towards positive action, rather than enforcement of regulations.

Using a community-focused approach that reduces risk by addressing vulnerabilities on and near homes and combining that with environmentally sensitive fuels reduction in wildland areas abutting communities, Permit Sonoma aims to add programs in more communities in the future. For more information on the SoCo Adapts program, visit the web site at https://sonomacounty.ca.gov/PRMD/Fire-Prevention/SoCoAdapts/.

2.6 Planning Area Background

2.6.1 Land Use and Zoning/Ownership

The Sonoma County General Plan and Zoning Code govern the types of land uses and development that may occur in different areas of the unincorporated county. Figure 8 indicates the acreages under different General Plan land use categories and zoning districts as of July 2021.

Figure 8: Table, Land use and zoning of unincorporated areas of the county

General Plan Land Use Category	Zoning Districts	Total Acres	Percent
Land Intensive Agriculture	LIA	70,121	7%
Land Extensive Agriculture	LEA	176,808	19%
Diverse Agriculture	DA	66,707	7%
Resources and Rural Development	RRD, TP	491,034	52%
Rural Residential	RR, AR	69,228	7%
Urban Residential	R1, R2, R3, PC	7,489	1%
Commercial	C1, C2, C3, CO, LC, K	3,058	0.3%
Industrial	MP, M1, M2, M3	1,967	0.2%
Public/Quasi public	PF	59,648	6%

Figure 9 (next page) shows public land ownership within Sonoma County, including tribal lands held in trust by the federal Bureau of Indian Affairs. The majority of Sonoma County's wildland areas are in private ownership. This can pose challenges when developing and implementing multi-parcel risk reduction projects due to the need to obtain access permissions from multiple property owners, who may have different goals and strategies for their wildland areas.

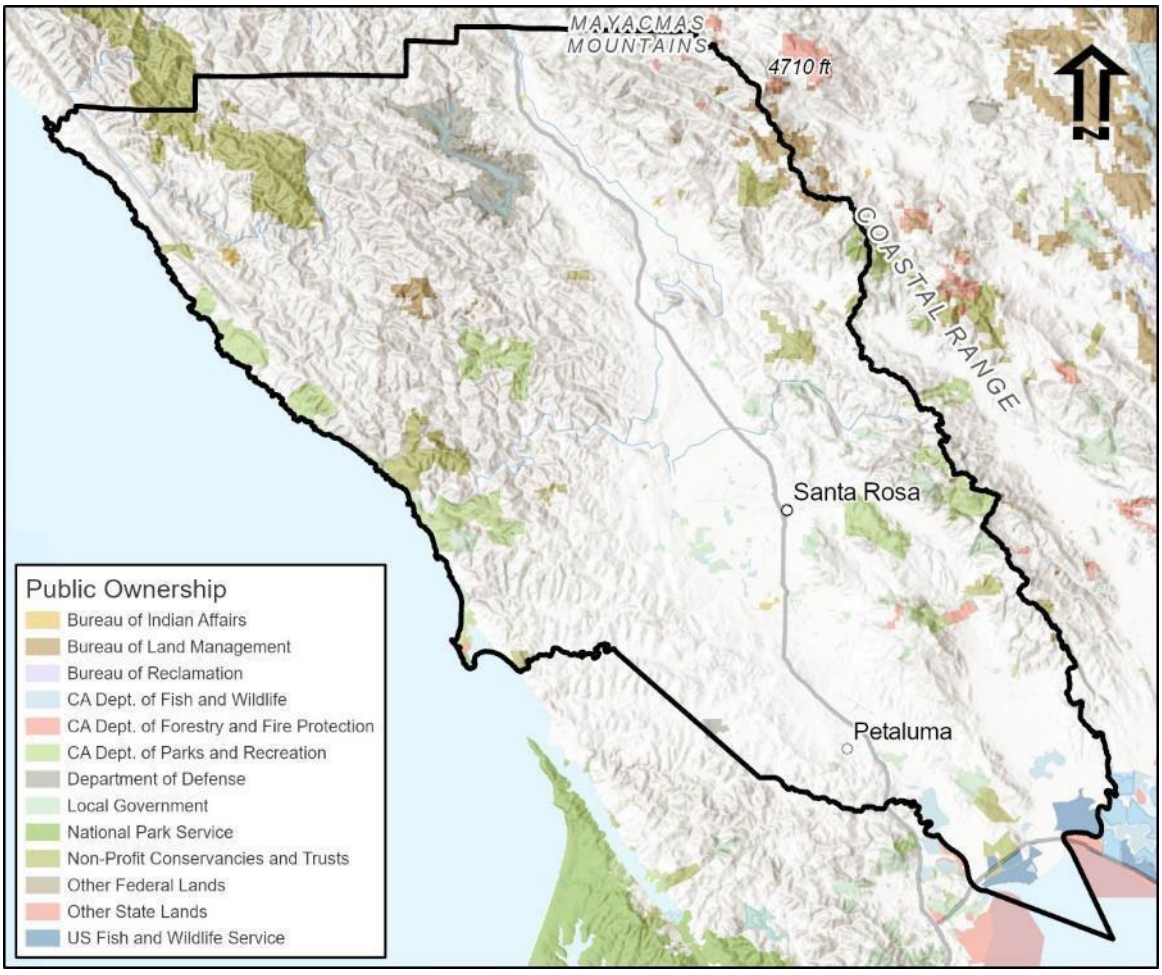

Figure 9: Public land ownership (FRAP, 2020)

2.7 Wildland Urban Interface or Intermix

"Wildland Urban Interface" (WUI) can be defined in various ways, depending on the context. In a regulatory context, the California Building Code defines the "Wildland-Urban Interface Fire Area" as "a geographical area identified by the state as a "Fire Hazard Severity Zone" in accordance with the Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires." [20]

[20] California Building Code, Chapter 7A, as amended by the Office of the State Fire Marshal, Section 702A. https://up.codes/viewer/california/ca-building-code-2016/chapter/7A/sfm-materials-and-construction-methods-for-exterior-wildfire-exposure#7A

The WUI is defined in the Federal Register report on WUI communities at risk from fire[21]. The term "WUI" comprises both Wildland Urban Interface and Intermix, but there is a distinction.

> "The **Interface** Community exists where structures directly abut wildland fuels. There is a clear line of demarcation between residential, business, and public structures and wildland fuels. Wildland fuels do not generally continue into the developed area. The development density for an interface community is usually 3 or more structures per acre, with shared municipal services. Fire protection is generally provided by a local government fire department with the responsibility to protect the structure from both an interior fire and an advancing wildland fire. An alternative definition of the interface community emphasizes a population density of 250 or more people per square mile."
>
> "The **Intermix** Community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation; wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres. Fire protection districts funded by various taxing authorities normally provide life and property fire protection and may also have wildland fire protection responsibilities. An alternative definition of intermix community emphasizes a population density of between 28-250 people per square mile."

Outside of a regulatory context, the term WUI is commonly used simply to describe "areas at risk to wildfire." Refer to the glossary for multiple definitions of "WUI."

[21] Federal Register 66:751, 2001

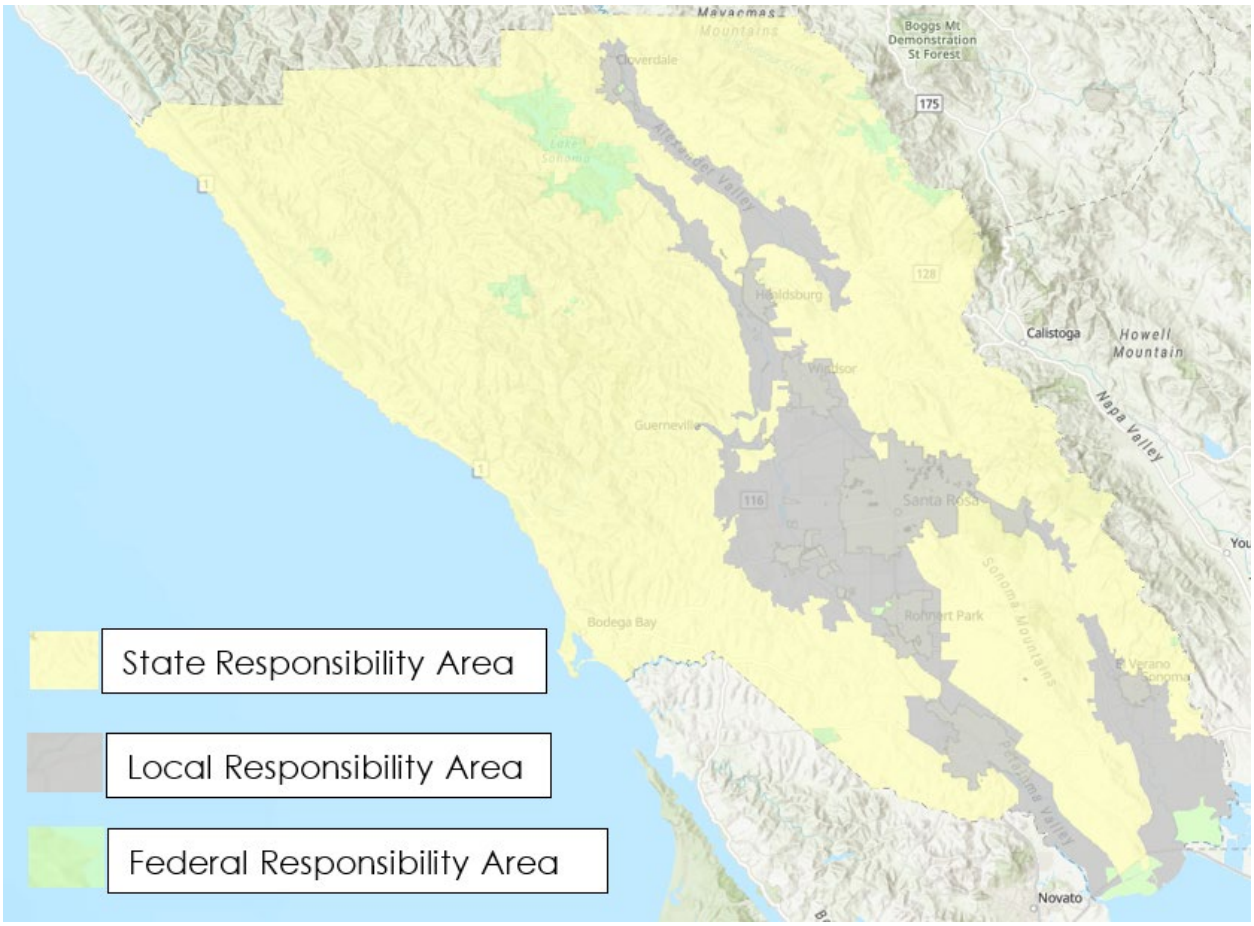

Figure 10: Local, State and Federal Responsibility Areas

CAL FIRE's Fire and Resource Assessment Program (FRAP) creates maps and Fire Hazard Severity Zone designations for all of the State Responsibility Areas statewide. Until recently in Local Responsibility Areas (LRA), local agencies and jurisdictions had to request CAL FIRE to create *Fire Hazard Severity Zone* (FHSZ) designations, and/or declare specific areas as WUI.

In 2021, Assembly Bill 642 and Senate Bill 63 required CAL FIRE to update and map *Fire Hazard Severity Zones* in both SRA and LRA. At the time of this writing, Fire Hazard Severity Zone mapping is underway for SRA, and will soon start for the LRA, but this highly complex statewide process could take several years to complete.

Please visit CAL FIRE's web site https://osfm.fire.ca.gov/divisions/community-wildfire-preparedness-and-mitigation/wildfire-preparedness/fire-hazard-severity-zones/ to check for updated SRA and LRA Fire Hazard Severity Zoning maps.

A WUI or FHSZ designation is important, as it can require that new construction in those areas adhere to the more stringent requirements of the "WUI Building Code" (California Building Code Chapter 7A). The Cities of Santa Rosa, Healdsburg and Cloverdale have all designated WUI areas within their jurisdictions, and the Town of Windsor now requires that new construction comply with Chapter 7A standards.

There is currently no declared WUI in unincorporated Sonoma County. However, within the unincorporated county, all new construction in the State Responsibility Areas (SRA) must comply with the building code requirements in CBC Chapter 7A and with the defensible space requirements in Public Resources Code §4291. When FHSZ maps are finalized by CAL FIRE, and adopted by the California Board of Forestry, the county may choose to adopt their map or leave it to the local fire protection districts to do so.

2.8 Residential Development in Sonoma County's Areas at Risk from Wildfire

United States Census data from 2020 show that the population of Sonoma County is now approximately 488,863, up by 1% from a population of 483,878 in 2010.[22] Housing units in 2020 numbered 205,136, an increase of 1% from the 2010 figure of 204,572.[23]

Throughout the 2000s, a small percentage of this growth has occurred in the unincorporated areas of Sonoma County, since the County's General Plan is focused on "city-centered growth," meaning that most growth should occur within incorporated cities or existing urban service areas. Multiple studies have recognized the need for more housing in the county, especially housing affordable to low-income households.

As recent fires have proven, wildfire home loss is increasing in Sonoma County, both in Fire Hazard Severity Zones, and in urban settings not previously considered to be at high risk. The Glass fire of 2020 burned 1,555 structures in

[22] From U.S. Census Bureau QuickFacts for Sonoma County, California: https://www.census.gov/quickfacts/fact/dashboard/sonomacountycalifornia/PST045219 (accessed on 10/27/2021).

[23] From the Bay Area Census summary page for Sonoma County: http://www.bayareacensus.ca.gov/counties/SonomaCounty.htm (accessed on 10/27/2021).

eastern Sonoma County and western Napa County and damaged an additional 282 structures.[24] Also in 2020, the Walbridge fire burned 560 structures in western Sonoma County.[25] In 2019, the Kincade fire destroyed 374 structures and damaged another 60. In 2017, the Sonoma Complex Fires (Nuns, Pocket, Pressley, Tubbs, and Young fires) destroyed 5,636 structures and damaged 317 structures, including buildings in urban areas, including Coffey Park and Fountain Grove within the City of Santa Rosa and in the Town of Windsor. In the Tubbs Fire, 3,708 structures were lost in the following FHSZs:

- Urban Unzoned (areas outside of SRA): 1984 structures, 54%
- Moderate: 519 structures, 14%
- High: 782 structures, 21%
- Very High: 423 structures, 11%

These recent events clearly demonstrate that wildfire is a significant concern in all areas of Sonoma County, especially given the current shortage of housing. Reducing risk of home loss through stronger building standards for new construction, encouraging and assisting ignition-resistant retrofit for existing homes, and increased compliance to defensible space regulations should be high priorities.

2.9 WUI Building Codes and Regulations

The state Board of Forestry and Fire Protection develops regulations that address a wide variety of building and safety issues in State Responsibility Areas (SRA), including water supply, road access, subdivision safety and secondary road access. Permitted building construction in the *State Responsibility Area* (SRA) or designated *Wildland–Urban Interface* (WUI) is required to be built according to specific codes. The codes are referenced as Chapter 7A in the California Building Code (CBC) and Chapter 337 in the California Residential Code. Chapter 7A includes requirements that harden structures against wildfire ignitions, including but not limited to:

- Class A roofing materials

[24] All destroyed-housing numbers taken from individual fire information pages on CAL FIRE's Incident web pages: https://www.fire.ca.gov/incidents (accessed on 10/27/2021).
[25] From the *Press Democrat*: https://www.pressdemocrat.com/article/news/walbridge-fire-destroys-560-structures-across-52000-acres-in-rural-sonoma/ (accessed on 10/27/2021).

- Eave and foundation vents that prevent ember intrusion
- Fire-resistant exterior covering (siding)
- Windows and openings that can withstand high heat
- Fire-resistant decking materials
- Accessory structures within 50 feet of other structures (cupolas, outbuildings bigger than 120 square feet, etc.) also need to meet WUI criteria

Approved building products for the WUI are listed by the Office of the State Fire Marshal on its website: https://osfm.fire.ca.gov/divisions/fire-engineering-and-investigations/building-materials-listing/

In Sonoma County, CBC Chapter 7A requirements apply to new construction in all State Responsibility Areas. In Local Responsibility Areas, local agencies can adopt 7A standards for new construction if they choose to do so. You can check with your local building official to see if 7A requirements apply in your area.

The use of ignition-resistant materials and design to resist the intrusion of flame, radiant heat or burning embers of wildfire is proving to be one of the most effective efforts California has made to mitigate the losses resulting from our repeating cycle of interface fire disasters. There has been increasing dialogue between code officials and fire agencies about the potential to extend CBC 7A building standards to all new construction across the county. Building to 7A can increase some construction costs, though *Building a Wildfire-Resistant Home: Codes and Costs* (2018, Headwaters Economics) found that WUI Code compliant costs can actually be lower than traditional materials. Continuing dialogue to encourage adopting CBC 7A standards to apply to all new construction throughout the county could help prevent structure loss into the future.

2.10 Requirements for Defensible Space, Vegetation Management, and Weed Abatement

Sonoma County is divided into three different jurisdictional areas: State Responsibility Areas, Local Responsibility Areas (including Municipalities), and

Federal Responsibility Areas (see below). Defensible space regulations in each responsibility area are different.

Defensible space regulations apply only in a radius 100 feet from structures (or to the property line, whichever comes first). Wildland areas where no structures or roads are present are not subject to defensible space regulations.

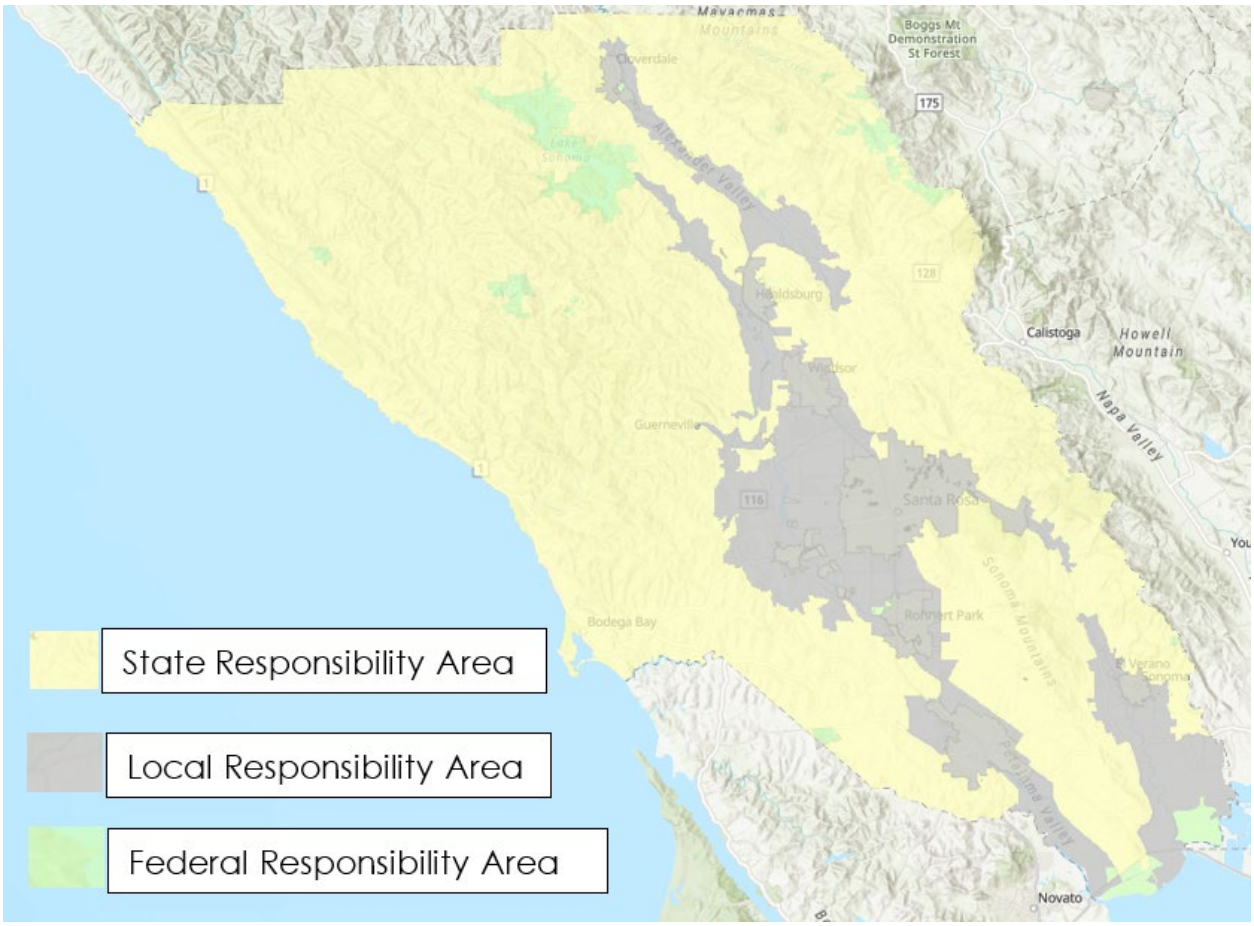

Figure 11: Local, State and Federal Responsibility Areas

Local Responsibility Areas (LRA)

- Sonoma County Code Chapter 13A defines defensible space regulations on improved parcels and unimproved parcels. See https://library.municode.com/ca/sonoma_county/codes/code_of_ordinances?nodeId=CH13ADUMADESPABHAVECOMA.
- Local jurisdictions can inspect and enforce regulations.

State Responsibility Areas (SRA)

- Public Resource Code 4291 and Title 14 of the California Code of Regulations Sections 1299.01-1299.05 define defensible space regulations. See https://www.fire.ca.gov/programs/communications/defensible-space-prc-4291/.
- CAL FIRE conducts inspections in the SRA unless they have authorized a local inspection authority through an agreement to conduct inspections through the Public Resource Code, or if a local jurisdiction has adopted an ordinance that allows them to cite violations based on the ordinance. Through title 14, and through Sonoma County Code Chapter 13A, the County of Sonoma can conduct inspections, and cite violations.
- State defensible space regulations apply only to improved parcels (those with structures).
- On Unimproved parcels in SRA areas, Sonoma County Code Chapter 13A applies and can be enforced by local authorities or by CAL FIRE, as delegated to the State by the County.

Municipalities

- Cities can create and enforce their own vegetation management ordinances, often called "weed abatement ordinances." Not all municipalities have ordinances in place. Check with your local fire department for regulations.

While similar in scope, the requirements of State defensible space regulations and SCC 13A are different. To reduce confusion to the public and enforcing agencies alike, it is recommended that a single defensible space code that reflects increasing risk of wildfire in our communities be developed and adopted for all of Sonoma County. The new code would provide identical standards for all parcels in the SRA, the LRA, and in municipalities that adopt the code.

2.11 Planning

Several important planning documents address wildfire safety, and risk mitigation. The Public Safety Element of the Sonoma County General Plan is intended to protect the community from unreasonable risks from natural

hazards. At the time of writing, the Sonoma County General Plan Safety Element is in early stages of update.

2.11.1 Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021(MJHMP)

In 2021, the Board of Supervisors adopted the *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021*(MJHMP). A thorough evaluation of hazards that could affect residents in Sonoma County was completed, including wildfire and wildfire risk. After the 2023 CWPP Update is signed, it will be administratively incorporated into the Sonoma County annex of the Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021 (MJHMP). The MJHMP and CWPP will also be incorporated by reference into the upcoming update of the General Plan Safety Element.

The MJHMP also outlined objectives, with one being "all cities, the county, special districts, and tribal organizations will develop, adopt, and implement local hazard mitigation principles…." This CWPP helps achieve that objective by integrating the wildfire-related actions identified in the MJHMP and applying that plan's guidelines to the CWPP recommendations.

In addition to adopting the local hazard mitigation principles, the action items identified in the Wildfire section of the Sonoma County MJHMP are included in this document. Please see Section 7.1 for an abridged list of actions in the MJHMP pertinent to the CWPP.

The MJHMP, its website, and other online tools are important resources for development of this CWPP and subsequent hazard mitigation projects. The MJHMP contains detailed background information regarding the county and all its hazards. In addition, as part of the MJHMP update process, an online tool was developed to help determine the severity of various hazards, including wildfire, throughout Sonoma County.

- Sonoma County Multi-Jurisdictional Hazard Mitigation Plan website: https://permitsonoma.org/longrangeplans/proposedlong-rangeplans/hazardmitigationupdate

- Sonoma County Hazard Mapping Tool: https://experience.arcgis.com/experience/64d531fc0e654c19a40a172a074a5640/page/page_8/

3. Wildfire History, House Outward Risk Reduction Strategies, Preparedness

3.1 Sonoma County Wildfire History[26]

Sonoma has long experienced significant fires, especially along the Mayacamas range on the east side of the county, and the Coastal Ridges to the west.

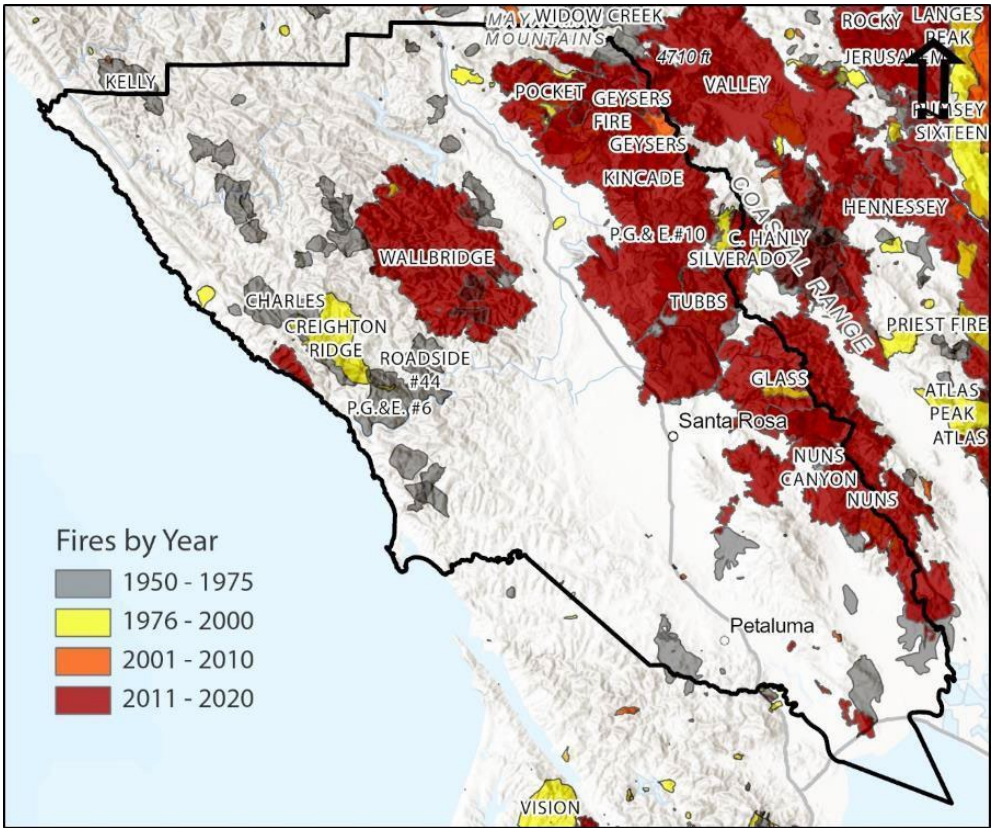

Figure 12: Fire history by year for Sonoma County[27]

[26] Original text from Chapter 15 of the *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021*, Volume one, page 15-1. https://permitsonoma.org/Microsites/Permit%20Sonoma/Documents/Planning/Long%20Range%20Plans/Hazard%20Mitigation%20Plan/Adopted-Sonoma-County-MJHMP-Volume-1-December-2021.pdf

[27] Data source: CAL FIRE fire perimeter layer version 20_1): https://frap.fire.ca.gov/frap-projects/fire-perimeters/ (accessed 6/15/2021).

Many of the fires shown on this map occurred in areas where there is a history of other large fires. The Tubbs (2017) and Hanley (1964) fires had nearly identical footprints. Additionally, historical data indicates that fires took place within the 2017 Nuns Fire footprint in 1964, 1936, 1923, and 1880. In the west county, similar patterns are evident[28]. Wildfire risk reduction in areas with a history of multiple wildfire events should be a high priority.

Some of the largest or costliest fires since 1964 are listed in Figure 13.

[28] Personal communication, Arthur Dawson, Historical Ecologist, Baseline Consulting. 10/11/2022.

Figure 13: Table, Sonoma County major fires since 1964 (data is approximate)[29]

Year	Name	Total Acres Burned	Acres Burned in Sonoma County	Structures Burned
1964	Hanley	55,961	33,026	108
1964	Nuns Canyon	9,808	9,803	27
1965	Knight's Valley (PG&E #10)	13,173	13,173	0
1965	Pocket Ranch	4,816	4,816	0
1965	Austin Creek (PG& E #6)	7,226	7,226	0
1972	Bradford Mt.	1,781	1,781	4
1978	Creighton Ridge	10,761	10,761	64
1988	Cloverdale (River)	1,205	1,205	100
1988	Geysers	11,380	11,380	7
1996	Porter Creek	538	538	0
1996	Cavedale (PG&E #8)	2,107	2,034	0
1999	Geyser Road (PG&E #22)	1,407	1,407	0
2002	Pine	1,024	1,024	0
2004	Geysers	12,525	12,244	6
2008	Pine	815	815	0
2013	McCabe	3,506	3,506	0
2015	Valley	76,085	3,716	1,955
2017	Sonoma Complex (Tubbs, Nuns, Pocket, Pressley, Young)	110,757	85,981	5,636
2019	Kincade	77,762	77,239	371
2020	LNU Lightning Complex (Walbridge and Meyers)	57,569	57,569	303
2020	Glass	67,484	26,851	601

[29] Data in Figure 13 comes from a combination of the *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021*, https://permitsonoma.org/longrangeplans/proposedlong-rangeplans/hazardmitigationupdate, and CALFIRE Incident Reports for each fire, https://www.fire.ca.gov/incidents/.

You can read details about Sonoma County's significant fires in Appendix E, Fire History.

3.1.1 Wildfire Chronology

When humans moved into the landscape now called Sonoma County, some 15,000 years ago, fire became a common feature, as native people used fire to increase food production, keep more open landscapes, and promote other ecological values. Based on anthropological literature, it is estimated that grasslands and oak woodlands were burned about every 5 years. Based on fire scar in redwood forests, mean fire intervals between 6.2 and 23 years were found on individual stumps.[30] In addition to purposefully ignited fires, lightning fires would also have been a component of fire ignitions.

Fire frequency decreased during post-statehood years, as European settlers did not perceive the ecological value of burning as it had been practiced by Indigenous Peoples. However, wildfires continued to ignite and burn, especially in historical "wildfire corridors" in the Mayacamas Mountains on the county's eastern boundary and in the Coast Ridges to the west where multiple fires have occurred in similar footprints. Large destructive fires have occurred in both areas, most significantly in 1923, 1954, 1964, 1978, and 2017, 2019, and 2020.

Figure 14: Table, CAL FIRE Most Destructive Wildfire Statistics, 1939–2020[31]

Years	Number of Fires	Acres Burned	Structures Burned	Lives Lost
20 Most Destructive Fires				
2015–2020	15	255,080	42,418	158
1991–2014	5	30,201	9,327	49
Total	*20*	*285,281*	*51,745*	*207*
Major Fires in Previous 50 Years				
1939–1990	90	209,999	Not Available	Not Available
Total	**110**	**495,280**	**51,745**	**207**

[30] "Short Fire Intervals Recorded by Redwoods at Annadel State Park, California." Mark A. Finney and Robert E. Martin. *Madrono,* Vol. 39, No. 4, October December 1992, pp. 251-262.
[31] Source: CAL FIRE, created by Permit Sonoma GIS. Data subject to change as better data and analysis become available.

Sonoma County's wildfires since 2017 reflect increasing fire size and intensity across California and the west. Figure 14, derived from CAL FIRE data, shows the increasing frequency of destructive fires over the past 80 years. The 20 most destructive fires in state history all occurred in the previous 30 years. Of those 20 most destructive fires, the last 5 years represent:

- 75% of the number of events.
- 85% of acres burned.
- 82% of structures lost.
- 76% of lives lost.

Twelve of the 15 destructive wildfires in the past five years took place in Northern California, and seven of them burned within Sonoma County and/or in a bordering county. The data indicates a future characterized by increasing fire frequency, size, and destruction to forested and urban environments. With climate change, the potential for drought, hotter temperatures year-round, and increasing lightning events, as experienced in 2020, are all cause for significant concern.

Recent fires also indicate that wildfire does not impact only rural residents or forested areas.

3.2 House-Outward Risk Reduction - Ignition Resistant Construction and Defensible Space

Research carried out by Jack Cohen, a leader in fire prevention, and many others in recent years, shows that when vegetation within 100 feet of structures is treated to keep flames and heat away from homes, and the homes themselves are treated, they are resistant to ignition from flame contact, radiant heat, ember, and firebrand exposure.

Additionally, since the 1960s, researchers and firefighters have analyzed the causes of structure loss in wildland fires. Their work clearly indicates that, to effectively reduce home loss, residents must treat both the *vegetation* surrounding the structure (defensible space) and the *structure* itself. Structure

hardening means that buildings are hardened to withstand the multiple threats of wildfire (embers, direct flame contact, and radiant heat) without igniting.

It follows from these findings that the most effective policies to address the problem of Wildland/Urban wildfire disasters are those that focus on preparation and wildfire compatibility. Resources might be well used to educate residents about the necessary steps to reduce home loss, and to provide assistance to homeowners to treat nearby vegetation and replace fire-prone elements of their structures with fire-resistant alternatives.

The Wildland/Urban fire disaster scenario depends on exposure of vulnerable homes to uncontrollable, extreme fire behavior. If the number of burning and vulnerable homes overwhelms the fire protection capability (as has been common in recent fires across the west), fire protection effectiveness is reduced, and many homes are left without protection. If homes are ignition-resistant, the number of homes igniting is reduced, fire protection resources are not overwhelmed by the ignitions that do occur. Thus, an extreme wildfire can occur without a wildfire disaster.[32]

3.2.1 Structural Ignitability - Homes are Fuels

Typically, homeowners think first of surrounding trees and brush when assessing their wildfire risks, and the idea that ignition-prone elements on the house itself poses as much or more risk as the wildland fuels may be a new concept. However, for a fire, a building is merely another fuel source. Therefore, it is crucial for residents to understand that to keep homes from igniting, the most important action is to treat the elements on the structure that make it vulnerable to ignition.

There are three primary ways that structures ignite due to wildfire: direct flame contact, radiated and/or convective heat, and embers.

Direct flame contact ignitions occur where vegetation and other combustible materials are near enough to the structure for flames to ignite the structure itself. Direct flame contact can be minimized by removing combustible materials and vegetation within five-feet of the structure, maintaining a "lean, clean and

[32] Cohen, Jack, "The Wildland–Urban Interface Fire Problem: A Consequence of the Fire Exclusion Paradigm," *Forest History Today,* Fall, 2008, p. 23.

green" zone to at least 30 feet, and reducing wildland fuels from 30 to 100 feet of structures.

Ignition through radiation and/or convective heat can occur if nearby vegetation or structures catch fire and produce enough heat to ignite neighboring buildings, even though flames do not actually touch it. In neighborhoods where homes are close to each other, radiated heat can be a significant risk, and has been shown to be a primary driver in wildfire structure ignition. To make entire neighborhoods more resilient to wildfire, efforts to ensure compliance to defensible space regulations and retrofitting existing structures with ignition resistant building materials and techniques must be undertaken on a community-wide scale.

Embers are the most common, and probably the most insidious form of heat transfer causing structural ignitions. Embers are responsible for approximately 90% of home ignitions, far more than direct flame and convective heat. Carried for great distances on the winds common during wildfires, embers can land on ignition-prone structural elements such as wood roofs, ignite dry vegetation or materials near the structure, and/or blow into openings on the structure, such as vents, to ignite the home from the inside. Both structural vulnerabilities and defensible space must be addressed to minimize threat from embers.

3.2.2 Ignition Resistant Construction or "Structure Hardening"

Building design and construction features that include ignition resistant and noncombustible materials, can greatly reduce how vulnerable a building is to ignition. For example, Class A roofs, vents that prevent the intrusion of embers and flame, dual paned tempered glass windows, modification or removal of combustible items and plants within five feet of buildings and modifying or replacing combustible attachments and siding. It is critical for residents to understand that ignition resistant structures and creating defensible space around them are equally important. Neither strategy is as effective singularly as they are together, so they must be prioritized and tackled together.

Larger vegetation management projects, such as community fuel breaks more than 100 feet from residences, while clearly an important component of risk reduction, can give homeowners a false sense of security about wildfire risks. Fuel breaks should reduce fire intensity, thus increasing likelihood that firefighters will be able to stop or reduce fire spread. However, fuel breaks won't stop embers from landing on or near homes. It is critical that homeowners understand that to reduce their homes' risk of ignition in wildland fire, they must treat the structure and create good defensible space.

Specific recommendations and links to further information about ignition resistant construction and practices can be found in this *Wildfire Home Retrofit Guide* https://extension.unr.edu/publication.aspx?PubID=3810 3.2.3 Gels, Foams, Paints, and Sprinklers

Other risk-reduction strategies, such as exterior sprinklers, gels and foams, spray-on products, and paints may help reduce risk in some circumstances. However, hardening your home with ignition resistant and noncombustible materials, design, and construction is likely to be more effective, less expensive, and will better increase the value and longevity of your home.

There are a large number of companies selling products as solutions to home ignition. While new products are being developed and tested which may be helpful, claims of effectiveness may greatly overstate the capability to prevent ignition. Do take the time to research any products that are being offered and ask to see results of fire tests after weathering. Ignition resistant construction and materials in combination with defensible space are likely to be a better investment over time and provide more effective protection.

Fire Safe Marin has an excellent discussion of the functionality of exterior sprinklers, foam, gel, and paints. Please refer to https://firesafemarin.org/harden-your-home/exterior-sprinklers-and-coatings/

3.2.3.1 External Sprinkler Systems

There are advantages and disadvantages to exterior sprinkler systems. Of significant concern is reduction of available water supply for firefighters, and when and how the system might be activated. Residents are typically evacuated long before the fire arrives. If sprinkler systems are activated hours or

even days before the fire arrives, they can greatly deplete water availability for firefighters when flames do hit. This is especially concerning in shared or municipal water systems. Please consult with your local fire department if you are considering installing exterior sprinklers.

3.2.3.2 Firefighting Gels and Foams

There are limitations and dangers associated with the use of foams and gels. They need to be applied shortly before the fire arrives—some gel products have been shown to increase ignition potential if they dry out before the fire hits. Do not delay evacuation to apply such products to your home. If you have them, you can leave them in a clearly visible location so any firefighters who may arrive may be able to apply them or invest in a system that can remotely activate.

3.2.3.3 Intumescent Paints

Generally, intumescent paint, often touted as a means to "fireproof" wood on homes, have not been well tested for performance in exterior locations over time. The USDA Forest Service Forest Products Laboratory reported that fire-retardant coatings have an uncertain "shelf life" when used in an exterior location and would therefore need to be reapplied regularly. Because of the poor performance of coatings in exterior applications, Chapter 7A of the California Building Code does not allow the use of coatings to comply with code provisions.

Further Resources for defensible space and ignition resistant construction

For more specific information about how to reduce structure ignitability and create defensible space around homes, please see these online publications:

- Wildfire Home Retrofit Guide, University of Nevada, Reno, 2020.
    - https://naes.agnt.unr.edu/PMS/Pubs/2020-3810.pdf
- How to Prepare Your Home for Wildfires, National Fire Protection Agency
    - English: https://www.nfpa.org//-/media/Files/Firewise/Fact-sheets/FirewiseHowToPrepareYourHomeForWildfires.pdf

    - Spanish: https://www.nfpa.org//-/media/Files/Firewise/Fact-sheets/FirewiseHowToPrepareYourHomeForWildfiresSpanish.pdf
- Homeowner's Checklist – How to Make Your Home Fire Safe, CAL FIRE, 2009.
    - https://www.readyforwildfire.org/wp-content/uploads/Homeowners-Checklist.pdf
- Creating Wildfire Adapted Homes and Landscapes, Fire Safe Sonoma, 2019.
    - https://sonomacounty.maps.arcgis.com/sharing/rest/content/items/fae0763fa3ad415b8d1908320ce7f760/data
- SoCoAdapts
    - https://sonomacounty.ca.gov/PRMD/Fire-Prevention/SoCoAdapts/

3.3 Defensible Space

Creating and maintaining a ***defensible space*** radius of 100 feet from structures or to the property line, whichever is closer, is a legal requirement in local and state law. Good defensible space is designed to decrease the intensity of oncoming wildfire and provide an area from which firefighters can safely defend structures. Equally important, it can keep fires that start in buildings from escaping into wildland fuels or to neighboring structures. Defensible space does **not** mean clearcutting all vegetation or removing large trees.

Defensible space is the buffer that landowners are required to create on their property between structures and the plants, brush, or other items that could ignite in the event of a fire. Critical to protect homes from wildfire, defensible space includes a "lean, clean and green" zone 30 feet (or to the property line) from buildings, and a "reduced fuels zone," which can have more natural vegetation, from 30 feet to 100 feet (or to the property line) from structures. The primary concerns are dead and dying vegetation and plant debris, low-growing brushy plants, low tree limbs, and continuous vegetation that fire can use to cross the ground towards buildings or use as a ladder to get into treetops. There are many great websites to learn about defensible space, including CAL FIRE's www.readyforwildfire.org and Resilient Landscapes https://www.sonomaresilientlandscapes.com/firewisedesign-229767.html.

State regulations (California Public Resource Code 4291) and Sonoma County (Code Chapter 13A) require 100 feet of defensible space. For new construction Sonoma County's building codes can increase this distance to 150' and beyond where slope, topography, or fuels increase risk.

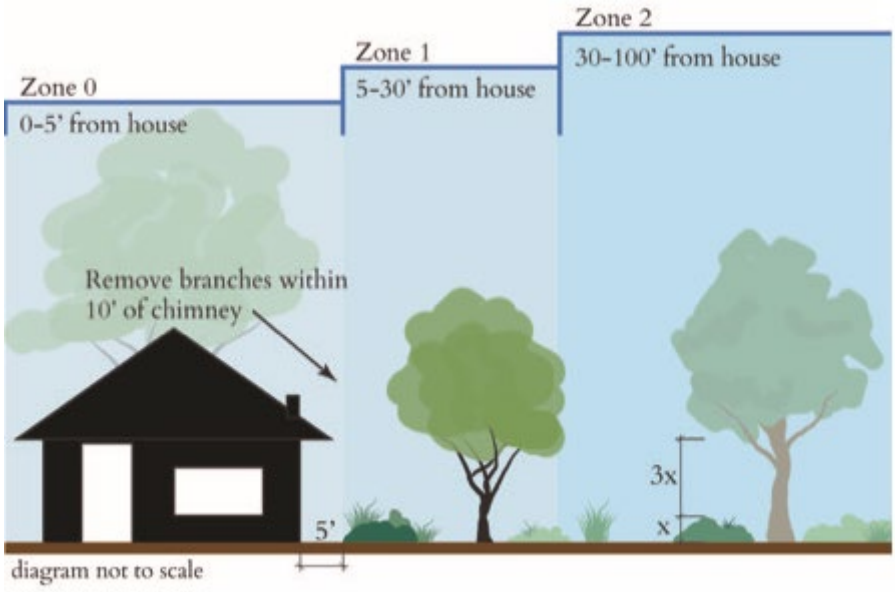

Figure 15: Defensible Space Zones

Zone 1 (30 feet from structures or to the property line whichever comes first) and Zone 2 (30 to 100 feet from structures or to the property line whichever comes first) currently make up the 100 feet of defensible space required by the California Public Resource Code. Assembly Bill 3074, passed into law in 2020, required that a third zone be added which requires that all homes in the SRA maintain an ember-resistant zone 5-feet from structure walls. Known as "Zone Zero" or the "Noncombustible Zone," this area could potentially require removal or reduction of combustible fuels, including vegetation, combustible attachments (such as fences), and items that might spread fire to buildings. It is expected to become state law for new construction within a year of publication of this CWPP and will be enforceable for all homes in the State Responsibility Area one year later. For updates on the requirement, visit readyforwildfire.org.

Though this change in the regulation will be a difficult change for some property owners, current research clearly indicates that the closer to the structure a fuel is, the higher a risk it poses for home ignition. Strict standards in this area are also

increasingly being required by insurance carriers and are a part of the California Department of Insurance's Safer from Wildfire Program.

Insurance companies are increasingly requiring that, to obtain or maintain insurance coverage, property owners need to reduce ignition potential on structures, maintain defensible space, and work together as communities to reduce the potential for multiple structure loss.

3.4 Wildfire Preparedness

3.4.1 Preparing for Emergencies and Evacuation

According to the *Sonoma County Operational Area Emergency Operations Plan Annex: Evacuation*[33], principal responsibility for evacuation planning and response resides at the local level of government. Cities retain primary responsibility for evacuating residents and visitors, and for developing supporting emergency operations plans and procedures. The county has primary responsibility for emergency evacuation of residents and visitors in unincorporated areas.

The Sonoma County Department of Emergency Management (DEM) made significant strides after the 2017 fires to foster greater community preparedness. DEM's SoCoEmergency.org website provides comprehensive information to help residents before, during and after emergencies. The "Get Ready" section (https://socoemergency.org/get-ready/) includes vital information including warning and alert systems for emergencies and how to sign up for them, evacuation zone identification, disaster-planning templates, "build a kit" guidelines, preparedness videos, and much more. SoCoEmergency.org also supports grassroots efforts, including providing a list of neighborhood programs in Sonoma County (https://socoemergency.org/get-ready/neighborhood-programs/).

3.4.1.1 Community Cooperators

Preparedness contributes to the ability of communities to be ready for, withstand, and recover from a wildfire in both the short and long term. Since the

[33] https://sonomacounty.ca.gov/WorkArea/DownloadAsset.aspx?id=2147594982, page 6

fires of 2017, residents within Sonoma County have improved wildfire community preparedness by organizing into effective groups, such as local Fire Safe Councils, Communities Organized to Prepare for Emergencies (COPE), Community Emergency Response Team (CERT), and Map Your Neighborhood (MYN) groups. Grassroots neighborhood programs are voluntary and can be very effective to enact positive change, community-wide.

There are many groups developing targeted educational programs to disseminate fire-safe information, such as Fire Safe Sonoma, the Sonoma Ecology Center, University of California Cooperative Extension Sonoma County, Permit Sonoma, Sonoma County's Agriculture and Open Space District, Sonoma County Regional Parks, Sonoma Land Trust, Pepperwood Preserve, Gold Ridge and Sonoma Resource Conservation Districts, Fire Forward and others.

Community Emergency Response Team (CERT) programs are also growing in Sonoma County. These teams have 24 hours of FEMA designed training to help support their communities in disaster response, as well as engage in preparedness activities. DEM is working to support this growth and foster more community engagement in CERT programs.

Sonoma County Community Organizations Active in Disaster (COAD) is a coalition of local nonprofit partners. The COAD has grown since 2018 and has developed a strong network of nonprofits coordinating to decrease duplication in disaster, spot and fill gaps in response, and promote preparedness throughout the county. To learn more about COAD go to https://www.sonomacountycoad.org/.

One of the best ways to help your entire community stay safe during an emergency is to become involved with one or more of these organizations focused on wildfire or emergency preparedness. Fire Safe Councils are a great way to garner support for local fuels reduction and preparedness and Fire Safe Sonoma, the countywide fire safe council, is a good place to start.

You can see a current list of local preparedness groups and consider what might work best in your area on the Department of Emergency Management's website at https://socoemergency.org/get-ready/neighborhood-programs/.

3.4.1.2 Planning for Evacuation

Planning for evacuation is essential! Learn about how to prepare evacuation plans for your family and your pets at SoCoEmergency.org. Evacuation is always complicated and difficult. The importance of developing evacuation plans cannot be overstated.

Evacuation Zone designations have been created for the entire county. It is critical for residents to "Know their Zone", so they understand which evacuation notifications apply to them. Go to SoCoEmergency, https://socoemergency.org/get-ready/evacuation-map/ to look up your zone.

The Sonoma County Department of Emergency Management (DEM) details evacuation planning in the *Sonoma County Operational Area Emergency Operations Plan Annex: Evacuation*. This document is available upon request and can be found on DEM's website (https://sonomacounty.ca.gov/DEM/Plans/). DEM continues to implement evacuation exercises in communities throughout the county.

All CWPP community meetings identified evacuation routes as a high priority. Local CWPPs developed for communities within the county have noted the difficulty of ingress and egress of many areas. Terrain, dense vegetation, narrow roads, locked gates, and limited access due to overhanging branches and bridges too weak to support heavy firefighting equipment complicate both planning for emergency response and the actual execution of fire operations. During active fire conditions, these factors can cause a dangerous delay in both response by firefighting resources and evacuation by the public. It is imperative that residents consider local conditions, know all possible ways out of their communities, and plan ahead for emergencies. All residents are encouraged to create local evacuation plans for themselves, their neighbors, and their community.

3.4.1.3 Law Enforcement's Role in Evacuations

Under California law, the responsibility for evacuation during emergencies rests with law enforcement agencies. Firefighters do not have the legal authority to order persons to leave their property or to close public roads. Effective coordination between law enforcement and fire agencies in planning and

implementing evacuations is critical. Most frequently, the task is under the jurisdiction of the Sonoma County Sheriff's Department, who also coordinates all law enforcement mutual aid. Refer to the *Sonoma County Operational Area Emergency Operations Plan Annex*: Evacuation for details of the considerations and steps to be taken by law enforcement personnel during a wildfire incident.

3.4.1.4 Temporary Refuge Areas (TRAs)

During the public workshops conducted as part of the development of this CWPP, some residents expressed the desire for the identification of Temporary Refuge Areas (TRAs) that can be used if alternate evacuation routes are not viable or available. At the time of this writing, CAL FIRE does not advocate pre-designated TRAs as an option for the public.

The concept of TRAs has been developed by the fire service to help protect firefighters tasked with structure defense when fast moving wildfires have cut off escape routes due to extreme fire conditions. In this case, by definition, a Temporary Refuge Area (TRA) is a pre-planned area where firefighters can immediately take refuge for temporary shelter and short-term relief without deploying a fire shelter in the event that access to an established safety zone is compromised.

As of this writing, CAL FIRE Sonoma-Lake-Napa Unit 2022 Strategic Fire Plan does not identify any TRAs within the county, and the practice of identifying TRAs has not been undertaken in Sonoma County. Timely evacuation of an area under an evacuation warning or order is still considered to be the best option.

Absent declared Temporary Refuge Areas, if trapped by a wildfire, wide expanses of paved or irrigated and mowed grassy areas, such as parking lots, athletic fields or areas which have minimal vegetation. Structures may provide some protection. Identification and locations of such areas can be a consideration for residents in pre-planning for evacuation.

3.4.1.5 Horses, Livestock, and Companion Animals

Many rural homes have horses and other large animals and livestock, and pets of all varieties are common in homes throughout the county. Emergency planning should include plans for pets and livestock. Residents should have

food, carriers, identification, and supplies for their pets for an extended period. Large animals, such as horses or cattle, require greater pre-planning, and if possible, early evacuation. Loading horses or livestock into trailers when there is fire and smoke and driving them on crowded roads during dangerous and stressful circumstances can be very difficult. Recent history has shown that when animals cannot be evacuated or safely sheltered in place, humans will put themselves and responders at great risk to help them, with potential catastrophic and life-threatening results. Preplanning for large and small animals in evacuation is critical.

An extensive list of resources for animal and human needs during evacuation can be seen in Appendix H.

3.5 Air Quality and Public Health Impacts

Wildfire smoke – a complex mixture of air pollutants – is unhealthy to breathe and can be especially dangerous for children, the elderly, pregnant women, and people with heart or respiratory conditions. These sensitive groups are advised to limit outdoor activities, especially when the Air Quality Index (AQI) reaches levels at or above those considered 'Unhealthy for Sensitive Groups'. Limiting outside exposure can be difficult for those whose employment is outdoors. Even healthy people may experience symptoms during or after exposure to smoke. Pets also can be affected by unhealthy air and should be brought indoors, if possible.

Those who work outdoors, including agricultural laborers and firefighters, are subject to exposure from a variety of inhalation irritants. Some of the compounds in wildland fire smoke are confirmed carcinogens (benzene, formaldehyde, and certain polynuclear aromatic hydrocarbons (PAH)) or suspected carcinogens. Health effects may include short-term conditions, such as headaches, fatigue, nausea, and respiratory distress while long-term health effects may include an increased risk of cardiovascular disease.[34]

[34] U.S. Forest Service. 2013. Wildland Firefighter Smoke Exposure. 1351 1803 5100 – Fire Management. By Broyles, George, 26 p.

For agricultural workers, existing non-profit organizations, like the North Bay Jobs with Justice[35], are working to educate workers of their rights to safe working conditions and place more community safety observers to enforce health and safety protocols. Providing free N95 masks to outdoor workers and monitoring safe best practices for mask use is critical. Additionally, more should be done to elicit health and safety recommendations from agricultural workers themselves and educate employers of their obligations to ensure the health and safety of workers, protect them from the impacts of smoke, and of working in areas where there may be active fire or the threat of fire. Safety information for agricultural workers should be created in a variety of languages in addition to Spanish, as well as in visual-only formats. It is important to note that California laws give farm workers the right to refuse to work in areas that require evacuation[36].

Prescribed Fire is a land management tool that is used to reduce wildfire risk by reintroducing fire to fire-adapted ecosystems to remove or avoid the buildup of fuel loads. In contrast to wildfire, prescribed fire is a planned event and therefore, with coordination and advance notification, communities and individuals can take health protective actions to reduce exposure. However, both planned and unplanned fire events produce smoke and air contaminants. Prescribed fires are generally required to obtain permits from the local air pollution control district to ensure they do not violate applicable air quality standards.

The U.S. Environmental Protection Agency (EPA) in collaboration with the U.S. Forest Service (USFS), the U.S. Department of Interior (DOI) and the National Institute of Standards and Technology (NIST) released a report comparing the air quality and health impacts of smoke from prescribed fire with wildfire. The "Comparative Assessment of the Impacts of Prescribed Fire Versus Wildfire (CAIF)[37]: A Case Study in the Western United States" report found that while a prescribed fire can reduce the overall size of a future wildfire and the associated

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[35] North Bay Jobs with Justice website: https://www.northbayjobswithjustice.org/ (accessed on 3/13/2022).

[36] Worker Safety – Wildfire Smoke and Evacuation Zones flyer: https://www.dir.ca.gov/dosh/wildfire/Wildfire-Safety-Infographic.pdf (accessed on 3/13/2022).

[37] For more information on EPA's CAIF report: https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=352824

smoke emissions and smoke-related health impacts, smoke is still emitted. As a result, using prescribed fire is not without risk as it can result in smoke-related air quality and public health impacts, but at a much smaller scale compared to a wildfire.

To offset large, devastating fires in Sonoma County, the scale and pace of prescribed fire needs to increase, which will mean periodic, low levels of smoke.[38] In the future, the residents of Sonoma County will continue to experience smoky days and nights from both wildfire and prescribed fire. The California Air Resources Board (CARB) offers guidance through their Smoke Ready California program.[39]

Sheltering or clear air centers for all residents throughout the county can provide a respite from poor air quality that can impact the area for weeks or months at a time. Ideal locations for these sheltering centers can be existing established centers for extreme heat or cold, such as public libraries, which are currently a nexus for other services.

[38] EPA Study on the health impacts of prescribed fire: https://www.epa.gov/newsreleases/epa-releases-report-comparing-air-quality-and-public-health-impacts-prescribed-fire (accessed on 11/19/2021)

[39] California Air Resources Board (CARB, 2021) Wildfire Smoke website: https://ww2.arb.ca.gov/protecting-yourself-wildfire-smoke (accessed on 11/15/2021).

4. Wildland Ecosystems

As stated in the Sonoma County Agriculture and Open Space "Vital Lands Initiative" (p. 80),

> "Sonoma County is home to a variety of habitats and ecosystems that make it one of the most biologically diverse areas of the world... The varied nature of the Sonoma County landscape provides habitat for many species of plants and wildlife, including some that live nowhere else in the world. These natural landscapes also provide multiple benefits to human communities, including clean water and groundwater recharge, flood protection, pollination for crops, disaster resiliency, carbon sequestration, adaptation to climate change, places to enjoy nature, and stunning natural beauty."

All of the county's wildland areas, from grasslands to majestic redwood forests, provide these benefits, and need to be considered in treatment plans.

There are approximately 511,901 acres of coniferous forests and oak woodlands in Sonoma County – roughly 49% of county land area. Most of the oak woodland and over 68% (132,000 acres) of the coniferous forest land is in private ownerships of 50 acres and less. These forests are unique, with 10 species of true oak and 19 species of conifers. Forests provide a suite of economic and non-economic benefits to the residents of Sonoma County, including fish and wildlife habitat, clean air and water, carbon storage and sequestration, recreational opportunities, and scenic attributes. Factors including population growth, regulatory requirements, and changes in the local and global economy continue to create pressure to convert wildlands to other uses.[40] As properties convert, activities such as grazing and active land management can cease, usually with subsequent increase in fuel loads.

[40] Euphrat, Fred, et al, Protecting Forests Across Landscapes and Through Generations: The Sonoma County Forest Conservation Working Group. http://sonomaforests.org/about-us/.

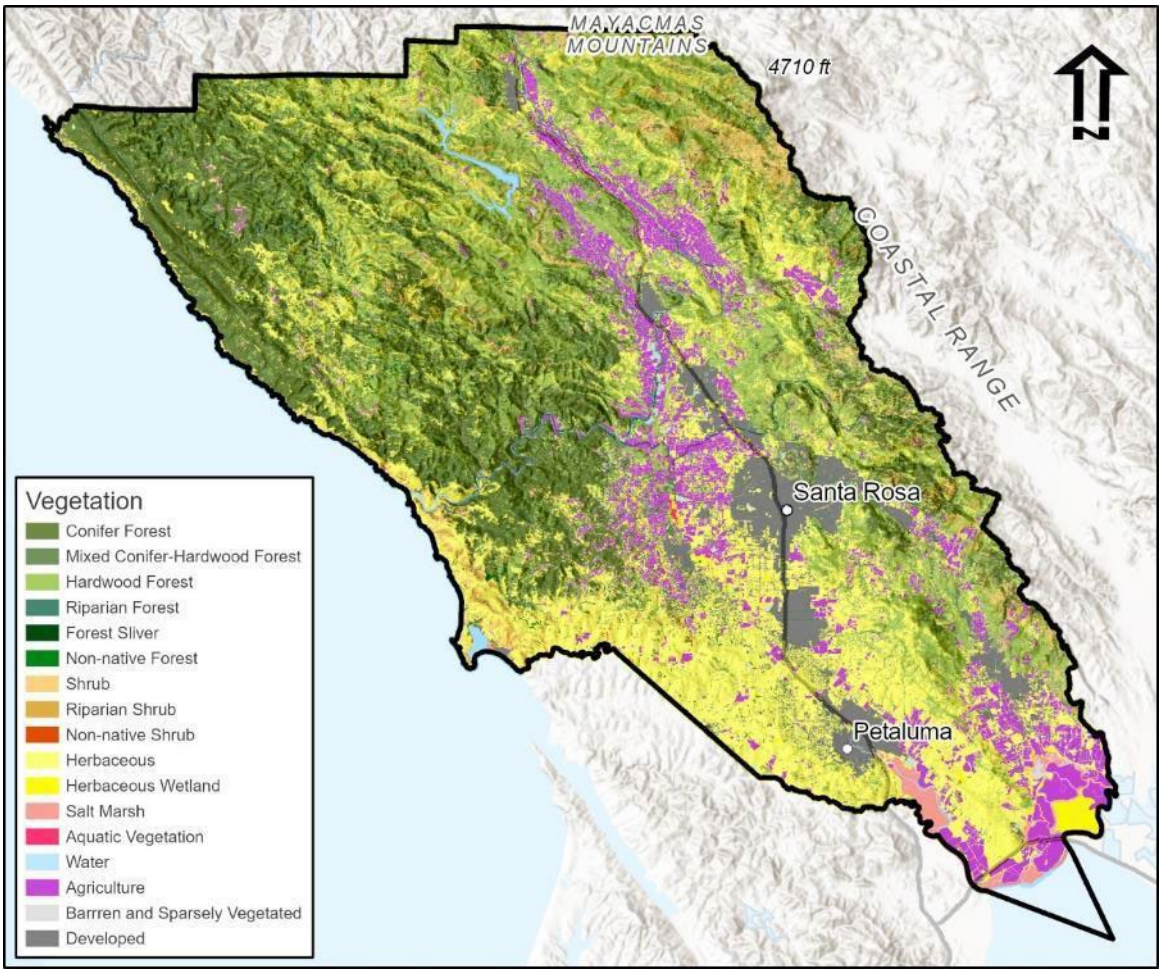

Figure 16: Vegetation map of Sonoma County (Sonoma Veg Map, 2018).

Figure 17: Table, Acres of vegetation by forest lifeform (Sonoma Veg Map, 2018)

Vegetation by Forest Lifeform	Acres	Percent
Conifer Forest	142,818.91	14%
Mixed Conifer-Hardwood Forest	97,016.59	9%
Hardwood Forest	272,065.05	26%
Riparian Forest	12,824.27	1%
Forest Sliver	3,999.89	0.4%
Non-native Forest	9,031.96	1%
Shrub	40,994.92	4%
Riparian Shrub	3,816.22	0.4%
Non-native Shrub	1,165.70	0.1%
Herbaceous	263,995.18	25%
Herbaceous Wetland	8,480.13	1%
Salt Marsh	8,951.88	1%
Aquatic Vegetation	359.06	0.03%
Water	18,108.95	2%
Agriculture	89,066.68	8%
Barren and Sparsely Vegetated	4,971.26	0.5%
Developed	70,507.59	7%

For a forest ecosystem, a 50-acre parcel is very small. However, for a landowner, attempting to reduce overgrown ladder fuels or thin an overstocked stand, on five – let alone fifty – forested acres can be an expensive challenge.

For many landowners, grant funding is needed to manage their forestlands. CAL FIRE's California Forest Improvement Program (CFIP) allows property owners to apply for funding to have a Registered Professional Forester write a Forest Management Plan, along with cost-share funds to carry out recommended treatments. For purposes of this program, "forest" is defined as 10% or more tree cover. Contact CAL FIRE for further information about CFIP.

Projects that educate wildland landowners about wildfire risks and how to better adapt structures and landscapes for a wildfire-prone environment, and help them achieve their goals, are necessary for both the health of forested landscapes and the safety of all Sonoma County residents. Groups such as the Sonoma County Forest Working Group (https://sonomaforests.org), and collaborative efforts, such as the Sonoma Valley Wildlands Collaborative (https://www.svwildlandscollaborative.com) continue to provide information to property owners and coordinate grant projects to reduce risks. Important tools

and plans, such as the Wildfire Fuels Mapper (https://wildfirefuelmapper.org) and the Wildfire Resilience Planner (in development) can assist residents and decision makers as we make decisions about how and where to treat wildland fuels.

4.1 Fire Ecology

Fire is a normal, essential ecological process operating throughout California's natural landscapes and plant communities, including the landscapes of Sonoma County. The frequency and extent of fire has been massively suppressed throughout California for over a century: estimates of average annual acres burned in California pre-1800 are 4.5 million acres/year which exceeds 2020 fire acreages[41]. Climate change is expected to shift fire frequency and/or extent (mostly increase) due to more frequent drought years and lengthened fire seasons that will return us to or increase annual fire acreage burned from pre-1800 levels. Whatever the cause, it is expected that frequency and extent of fires will be much greater than what was experienced during California's rapid development period over the past century. Past development facilitated by land use regulation and policy have placed extensive residential infrastructure into places that recent fires (e.g., Tubbs-Nuns, Kincade, Walbridge, Glass) have placed at severe risk. This risk is expected to continue and increase in coming decades; fire will recur within similar footprints and place the same infrastructure at risk into the foreseeable future, as well as occurring in now unburned areas between these fire footprints.

Low-intensity fires are considered a component for wildland health, and patchy higher-intensity, stand replacing fires also plays a critical role in maintaining biodiversity by allowing for the establishment and long-term persistence of early-successional species within the larger ecosystem. For millennia, frequent and extensive fire across California landscapes have provided multiple benefits, including thinning or opening stands, providing early successional habitats, sanitizing forest floors of pathogens, and providing a check on insect and disease infestations. Most California plant species and plant communities are

[41] Stephens et al. (2007). Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. Forest Ecology and Management 251 205-216.

fire-adapted to greater or lesser degrees or even fire-dependent for their long-term persistence.

Native American Burning

Prior to the arrival of humans in the California landscape, lightning would have been the primary cause of fire. With the arrival of humans, intentional and unintentional human-caused (anthropogenic) fire became an important new cause of extensive and regular fire. It's well documented the first inhabitants used frequent low-intensity fire for multiple reasons, including increasing food production and making harvest easier. Early European explorers were often rhapsodic in their praise of the open and abundant landscapes they saw but did not realize the role of fire in creating and maintaining these landscapes. With the arrival of European settlers, disruption of Indigenous Peoples' lifeways and prohibition of burning greatly decreased fires in the landscape. Over time, the use of fire as a management tool was nearly abandoned, and fires that did occur were actively suppressed, especially throughout the 20th Century.

Fire Regimes are associated with both the fire cycle and fire behavior of various vegetation types, and the nature of these patterns prior to the onset of wildfire suppression as a reference baseline.

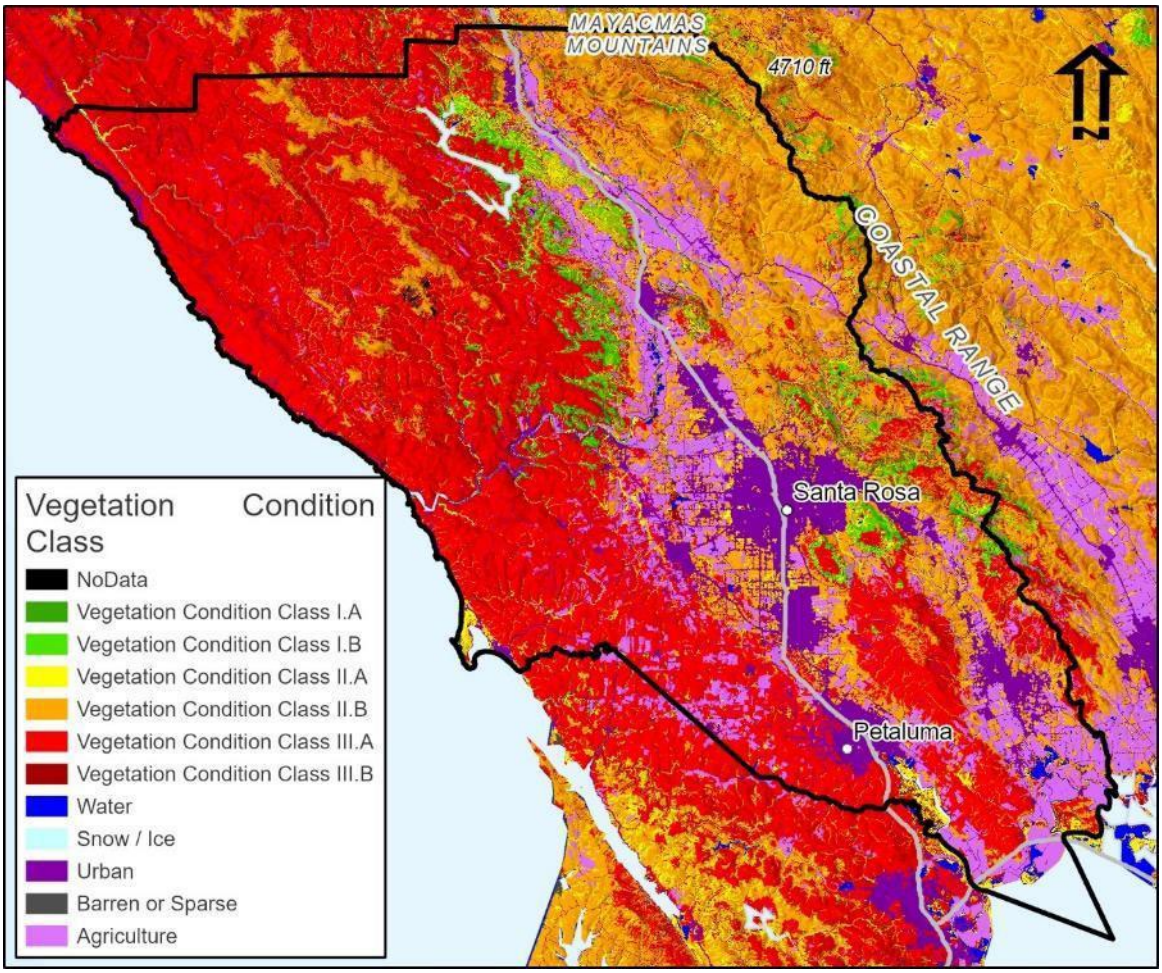

Figure 18: Vegetation Condition Class in Sonoma County

The fire regime in Sonoma County is considered to have had a moderate fire cycle historically, with woodlands and forests burning more on the order of 30 to 100 years between fires, affected by site factors such as aspect and position on slope (i.e., upper portion of ridge vs. riparian)[42]. The county is generally rated as Vegetation Condition Class III.A and II.B, indicating significant effect on the fire cycle due to fire suppression, with some loss of ecosystem integrity, especially in the western part of the county. Woodlands and shrublands, for example, can be expected to recover following fire, although invasive species may pose a threat in specific areas after a fire.

[42] van Wagtendonk, J.W., et al., 2018. Fire in California's Ecosystems. University of California Press, Oakland, California.

Invasive species can cause a significant shift in the pattern and behavior of wildfires. Replacement of woody vegetation and native perennial grasses by non-native annual grasses, for example, provides a continuous layer of easily combustible fine fuels. This conversion of fuel type – along with other factors such as drought, climate change, and an increasing population that can lead to more human-caused wildfires – can set up a cycle of increasingly frequent wildfires, with a higher risk to public safety, ecosystem integrity, and structures.[43]

4.1.1 Environmental Impacts of Fire

The environmental impacts of fire are varied and complex. Clearly, wildfires can cause changes in the natural environment, short-term or long-term. But just as clearly, wildfire can maintain natural environments, especially ones that are adapted to or even dependent on fire. Actual or perceived negative environmental impacts are also dependent on the current state Sonoma County's natural ecosystems. These ecosystems have been extensively altered or degraded from that which existed prior to European settlement. The capacity of these ecosystems to absorb and recover from a fire is arguably less than it was if for no other reason than there is less ecosystem left and what is left is often highly disturbed and fragmented by human development. Thus, the impacts of fire on plants and animals is dependent on time (short versus long-term), size of fire and the ecosystem it occurred in, and human values and perspective.

For example, after a significant wildfire, increased amounts of sediment flowing into rivers and streams has been observed which could have a negative impact on sensitive salmon fisheries for some number of years after fires. When those fisheries are already reduced or stressed by other environmental impacts, even a short-term negative impact is concerning.

Since 2016, many fires have burned throughout Sonoma County, affecting just about every ecosystem type. Agencies and organizations have stepped up their fire research to determine long-term effects of these fires. While there are areas where mature trees were lost, there are other areas where the *fire severity* was not as intense, and ecosystem integrity was not damaged. Where fires do top-kill trees and shrubs, many species resprout, including oaks, redwoods,

[43] Fusco, et. al. 2019 Invasive grasses increase fire occurrence and frequency across US ecoregions. PNAS Vol. 116, No. 47 (https://www.pnas.org/doi/10.1073/pnas.1908253116).

madrones, big-leaf maple, some manzanitas, toyon, bay laurel, and more. Additionally, post-fire conversion of fire-killed forested areas to other native vegetation communities may reflect a return to a natural, early-successional state and a restoration of a mosaic of vegetation communities closer to historic ranges across our region.

This rapid and, in some places, vigorous regrowth is both a welcome sight and a challenge for land management, particularly where significant amounts of dead standing wood remain that could be fuel for the next fire.

Where fires burn the hottest, particularly near roads, the proliferation of invasive plants, such as French and Scotch broom, can also pose problems.

These challenges are being studied and met by organizations like the Pepperwood Preserve, where staffers have increased their fire-related education and monitoring. Pepperwood serves as a Watershed Sentinel Site dedicated to tracking ecosystem health over time by systematically monitoring features like weather, soil moisture, stream flow, and the diversity and vitality of local plant and animal populations. More than 80 projects onsite are run by a combination of staff, community scientists, visiting scholars, and university partners. This long-term monitoring has immediate benefits for land and water managers and will be vital to evaluating climate impacts in real time and informing best resource management practices over time.

These efforts help educate county personnel and residents in methods to sustain our environmental resources and create resilient landscapes that will withstand future fires.

4.1.2 Wildfire Suppression and Its Consequences

Fire, ignited by lightning and Indigenous Peoples, has shaped the structure and composition of most California ecosystems for millennia and is indisputably a major component of natural background conditions in the state. In California's most abundant forest types, these historical fires were frequent although of limited intensity, consumed dead material and killed small trees, but left most large trees alive and intact.

Dr. Scott Stephens, a fire science professor at UC Berkeley, estimates that in California prior to the 1800s, approximately 4.5 million acres burned every year. That's more than the average annual area burned in wildfires throughout the entire U.S. during the period 1994–2004, which at the time, was considered an extreme decade for wildfire.[44]

Since the beginning of the 20th century, as forest/firefighting agencies have grown, and the tools in the firefighters' arsenal increased, fire agencies have become more successful at putting out both natural and human-caused fires. The last century of fire suppression has led to significant shifts in forest extent, composition, structure, and function, resulting in fires that are now uncharacteristically intense and lethal.

Throughout California, as the population has spread farther out into the countryside, the risk of home and life loss from wildfire has increased. Hills and forests that once burned regularly are now the sites of modern houses. There is tremendous pressure to put out fires that may destroy neighborhoods, lives, and homes. This risk influences wildfire policy on the national and state levels. Responses to large damaging fires have largely enhanced fire-suppression policies.

CAL FIRE aims for an "initial attack effectiveness" of 95% of fires contained at less than 10 acres in size. They meet or exceed this goal annually. This is a great achievement and has saved lives and homes; however, "initial attack" success can also result in forests that are far denser with many more trees per acre and greater buildup of dead wood on the forest floor than if frequent, low-intensity fires were common. When a fire does burn in this type of forest it can burn with greater intensity resulting in short- or long-term environmental impacts that society considers unacceptable.

The 95% of fires that are controlled at low acreage are the fires that can be put out – those that occur when less intense weather and fuel conditions give firefighters the upper hand. But suppressing most fires also means that the ecological effect of frequent, low-intensity fires are largely lost. The 95% success rate has set us up for the most dangerous 5%—those fires that occur when

[44] Northern California Prescribed Fire Council, letter; "Comments on EER Federal Register Notice Vol. 80 No. 224 FR 72840-72897". November 20, 2015.

weather and fuels conditions give fire the upper hand. Major fire events cost more to suppress than all the rest and are more likely to cause great damage to ecosystems and result in loss of structures and life. Wildfires in Sonoma County since 2017 could be a reflection of this trend.

4.2 Climate and Wildfire

Wildland fire season in Sonoma County typically spans the months after the last spring rains have fallen and until the first significant fall or winter rains occur. The months of August, September, and October have the greatest potential for wildland fires as vegetation dries out, humidity levels fall, and offshore winds blow. However, increasingly, wildfires have been occurring in Sonoma County outside of the typical fire season.

The last few decades have brought a pronounced trend of larger and more frequent wildland fires across the west. While the causes are still debated, a number of scientific studies indicate that the firefighting season has lengthened across the entire western United States because of longer, hotter, drier summers. Climate change has contributed to this phenomenon.

According to the Union of Concerned Scientists, by century's end we may see up to 55% larger wildfires if we fail to make significant cuts in global warming emissions. If average statewide temperatures rise to the medium warming range (5.5 to 8°F), the risk of large wildfires in California is expected to increase about 20% by midcentury and 50% by the end of the century.[45] This is almost twice the wildfire increase expected if temperatures are kept within the lower warming range. In addition to temperature, increasing drought conditions could exacerbate fire conditions.

The EPA's Climate Change website indicates that wildfires are increasing and likely to intensify in areas with warmer temperatures, drier summers, and longer

[45] John Abatzoglou and Park Williams, "Impact of anthropogenic climate change on wildfire across western US forests," Proceedings of the National Academy of Sciences Oct 2016, 113 (42) 11770-11775; DOI: 10.1073/pnas.1607171113, https://www.pnas.org/content/113/42/11770#sec-1 (accessed on 12/2/2021).

growing seasons. Several studies also indicate increased hazards and risks associated with vegetation fires due to climate change.[46]

Since the CWPP was originally developed in 2016, the number and pace of fires occurring in Sonoma County and surrounding counties, as well as throughout California, have shown these predictions to be true. Regardless of the reasons why, it is imperative that the residents of Sonoma County learn to live with fire.

4.3 Wildland Fire Causes and Behavior

Humans and human-related activities cause the vast majority of fires. Understanding fire causes and developing programs that can address ignition risk through education or fuel modification can help us keep fires from starting. Based on fire statistics from CAL FIRE for 2020, the top four determined fire causes in the Sonoma-Lake-Napa Unit are Electrical Power, Debris Burning, Equipment (which includes all equipment, from tractors to lawn mowers), and Arson.

Natural fire causes, such as lightning, statistically account for relatively few fires in Sonoma County. However, during the four-day lightning event which began August 16, 2020, over 12,000 lightning strikes were recorded over Northern California. These lightning strikes sparked up to 585 wildfires, including Walbridge and Meyers fires in Sonoma County. Lightning fires frequently ignite in areas that can be very difficult for firefighters to access, such as remote ridge tops, which increases potential for growth. Additionally, as was the case in 2020, there were more fires across the state than there were fire resources to fight them. At present, lightning is a relatively low-frequency but high-risk event. If climate change includes the potential for more lightning events, it could become a significant contributor to ignitions.

[46] http://epa.gov/climatechange/effects/forests.html#fire

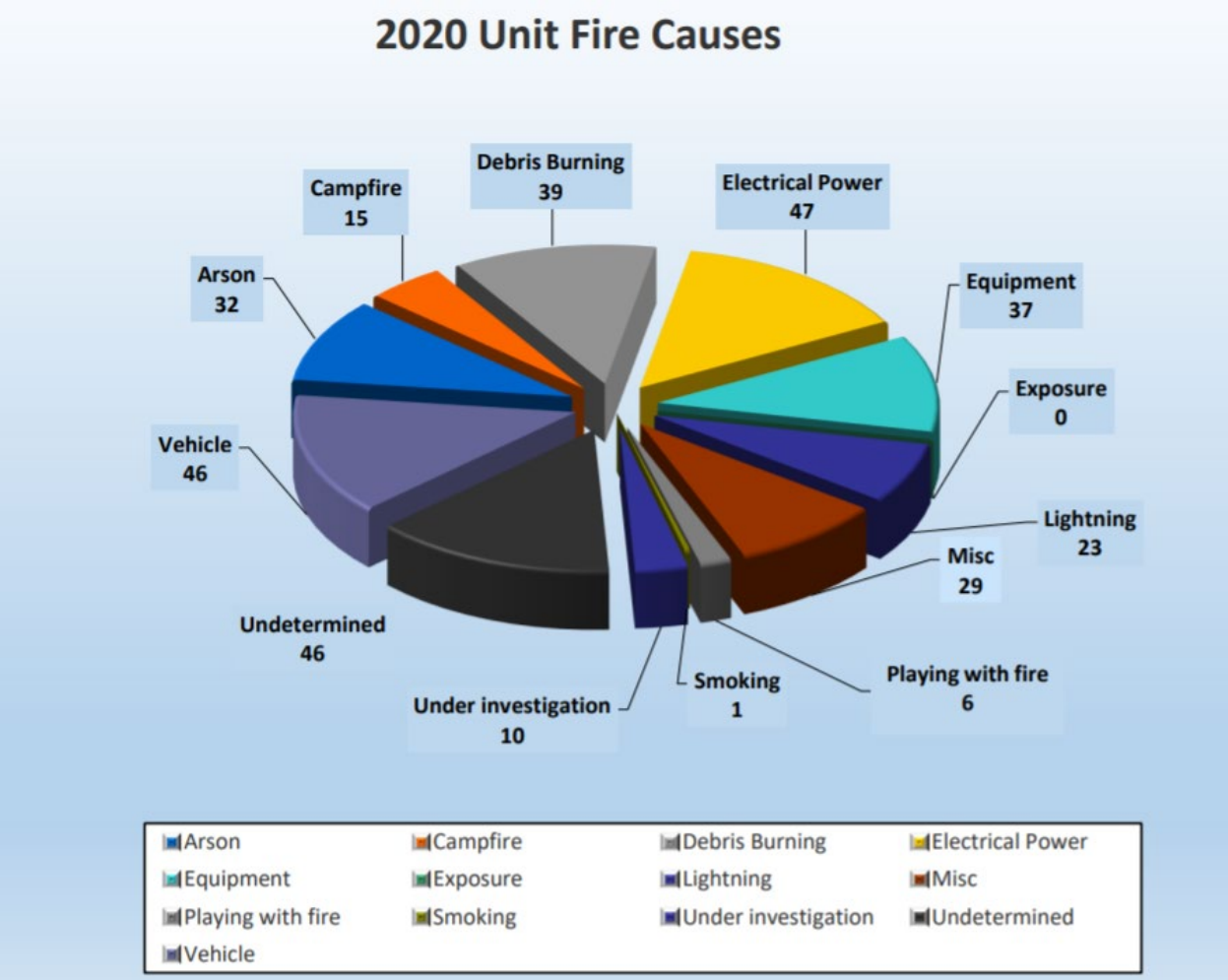

Figure 19: 2020 Fire causes in the Sonoma-Lake-Napa CAL FIRE Unit[47]

Wildfire behavior is based on three primary factors: topography, weather, and fuels. Ultimately, fire behavior is directly related to the severity of conditions of each of these three factors on any given day. The three elements are called the "fire behavior triangle." If there is only one leg of the fire behavior triangle present – say the fire starts on a steep slope where it can make a rapid uphill run, but the weather is not hot and dry, and winds and fuels are moderate – firefighters should have a good chance to stop the fire. Worst case would be if all three elements of the fire behavior triangle were bad (e.g., a fire that starts on a steep slope on a hot dry, windy day, in heavy fuel). When all three elements of the fire behavior triangle are present, there is the potential for

[47] Graphic from the Sonoma-Lake-Napa Unit 2021 Strategic Plan: https://osfm.fire.ca.gov/media/lpafffiu/2021_lnu_fireplan.pdf (accessed on 11/18/2021).

extreme fire behavior that will be very difficult for firefighters to contain. These three factors are evaluated in the following paragraphs.

4.3.1 Topography

Topography, especially slope, is a critical indicator of fire behavior. As fire moves up slope, fuels ahead of the fire preheat, speeding up a fire's uphill progress. Additionally, fires create their own up-slope winds. The steeper the slope, the faster fire will move uphill, whereas downhill slopes can slow down the rate of spread. Homes, natural resources, and agricultural assets in the hilly areas of the county face the highest wildfire risks. Property owners in hilly areas should make all efforts to create and maintain a 100-foot defensible space radius, especially downhill from structures, and ensure that buildings are built or retrofitted to resist ignition during wildland fires.

Two steep ranges dominate the western and eastern lengths of Sonoma County, and most of the county's highest risk is in the hills and valleys of these two ranges. The hills of the Coastal Range rise abruptly from the Pacific shoreline to over 2,000 feet. The slopes of the Mayacamas Mountains on the county's eastern boundary rise from sea level valleys including the Santa Rosa Plain, up to 4,500 feet on the slopes of Mount St. Helena. Sonoma County's valleys and foothills are predominantly devoted to agriculture but also contain most of the urbanized areas and population.

In steep terrain, common geographic features such as drainages, gulches and canyons can funnel air to act as "chimneys," pulling hot air, gasses, and embers ahead or outside of the main fire. Aspect, the cardinal direction that a slope faces, also has a major influence on fire behavior. South facing slopes receive heating and drying solar radiation from early in the morning until late afternoon, whereas north facing slopes will only receive solar radiation during a short period of the day when the sun is high in the sky.

With the exception of vineyards and manmade features, in both the Coast Range and Mayacamas Mountain fire corridors, there are few barriers that can be connected by firefighters to create effective firelines to stop the forward progress of a wildland fire. However, while "fuel breaks," roads or vineyards can

be effective in moderate fire conditions, during critical fire weather conditions, the effectiveness of any fuel break will be reduced.

4.3.2 Vegetation and Fuels

Fuel, quite simply, is something that will burn. In a wildland fire, plants, buildings, and combustible items such as mulch, fences and outdoor furniture are simply fuels that the fire uses to spread through the environment. Even so-called "fire safe" plants will burn in a wildland fire if the fire is hot enough and/or they are not maintained to be free of dead materials and irrigated during the dry months. The closer vegetation is to structures, the higher the risk posed for home ignition.

In Sonoma County, many decades of fire suppression and changing land use have altered many forests and other natural plant communities by increasing the density of trees and brush and allowing the buildup of dry, dead surface materials, thereby increasing the potential for severe wildfires, especially when dry conditions exacerbate fuel risks. While some ecosystems are more fire prone than others, all County residents in or near wildland areas would be well advised to focus on defensible space and hardening buildings as the first line of defense from wildfire.

California's plant communities evolved with fire in the landscape. Many native plants are evolutionarily adapted to fire for their survival or propagation. When fires take place in environments with fire-adapted plant species which have not burned for many years, extreme fire behavior can result, killing back the stem and canopies of trees (although often not the roots) or in very hot fires, causing a stand replacing fire that kills trees to the roots.

Most of the grasslands of California have been taken over by non-native annual grasses which grow during the wet season and dry by late summer to create the classic "golden hills of California". A hillside grass fire on a windy day can move incredibly quickly and be deadly, even though it burns with less intensity than a fire in trees or brush. In grasslands, fire exclusion and/or cessation of grazing has allowed brushy species to colonize, changing fuel models and fire behavior potential. This conversion of native bunch-grass grasslands to dense, continuous stands of non-native grasses may exacerbate fire behavior. Restoration of native grassland and prairie is an activity that may be worth further consideration.

Brushland ecosystems like chaparral, which include plants such as chamise, manzanita, and scrub oak, host an incredibly rich and diverse number of animal, insect, and plant species and are a vital ecosystem. However, brushland ecosystems, left unburned and unmaintained for many years will burn with incredible intensity. Homeowners who live in or near brushlands need to be aware of the risks and take ecologically appropriate mitigation strategies.

Forested landscapes have wide variability in their fire potential, depending on species composition, and forest condition. Long-unburned forests with low "ladder fuels" growing under taller trees and lots of dead wood littering the forest floor and canopy, will burn far more intensely than a forest that is less dense. Fire exclusion and lack of management are contributing factors to an increase in ladder fuels and forest density.

In recent years, a variety of pathogens such as Sudden Oak Death (SOD), caused by nonnative *Phytophthora ramorum*, and insects such as pine/fir borer beetles have caused significant tree mortality. In Sonoma County, SOD has killed hundreds of thousands of trees, especially tanoak, and coast live oak[48]. Spread especially by warm spring rains, SOD mortality can slow down in drought years. Unfortunately, when trees are stressed by drought, the voracious activity of pine and fir borers goes up.

4.3.3 Weather

Weather is another of the key factors for fire behavior. Sonoma County's wildfire season spans the months after the last spring rains have fallen and until the first significant fall or winter rains occur. The months of August, September and October have the greatest potential for wildland fires as vegetation dries out and humidity levels fall. Strong and dry north-east "Santa Ana" or "Foehn" winds, which significantly increase likelihood and severity of wildland fires across California and the west, are most likely in the fall months. Apart from areas immediately along the coast, during the fire season the weather is generally warm and dry during the day, with peak summer day temperatures 80°–100° F, and relative humidity ranging between 20% and 35%.

[48] University of California Cooperative Extension and Sonoma County Department of Emergency Services, *Sonoma County Sudden Oak Death Strategic Response Plan*, 2008.

Gradient winds are generally out of the South/Southwest at 5–10 mph, strengthening to 10–15 mph in the late afternoon and diminishing by dark. Coastal onshore flow, often accompanied by fog, frequently prevails after sunset, allowing for good nighttime relative humidity recovery in the warm inland areas. In the inland valleys, fog usually dissipates by 11 am. The fog layer depth is usually between 1,000 and 1,500 feet. Elevations above this often do not experience fog nor do they receive the same nighttime cooling and moisture recovery as lower elevations.

"Red Flag" warnings are issued for weather events that may result in extreme fire behavior that will occur within 24 hours. In red flag conditions, low relative humidity, strong winds, dry fuels, the possibility of dry lightning strikes, or any combination of the above could lead to rapid or dramatic increases in wildfire activity. If these critical weather patterns align with the topography, extreme rates of spread can result, especially along exposed ridges and through constricted areas.

5. Wildfire Hazard and Risk Assessments

Wildfire hazard is defined as a fuel complex[49] that determines the degree of ease of ignition and of resistance to control.[50] There are many ways to measure and map wildfire hazards. CAL FIRE has produced several data products that aim to characterize wildfire hazard.

CAL FIRE's Fire and Resource Assessment Program (FRAP) assesses the amount and extent of California's forests and rangelands, analyzes their conditions, and identifies alternative management and policy guidelines. FRAP produces Fire Threat Maps for California. Fire threat is derived from a combination of fire frequency (from 50 years of fire history) and expected fire behavior under severe weather conditions. Fire behavior is derived from fuels and terrain data. The resulting fire threat can be used to help estimate the potential for impacts on various assets and values susceptible to fire.

[49] Further defined by fuel volume, type, condition, arrangement, and location.

[50] Source: National Wildfire Coordinating Group Glossary website: https://www.nwcg.gov/glossary/a-z. Accessed on 9/8/2021.

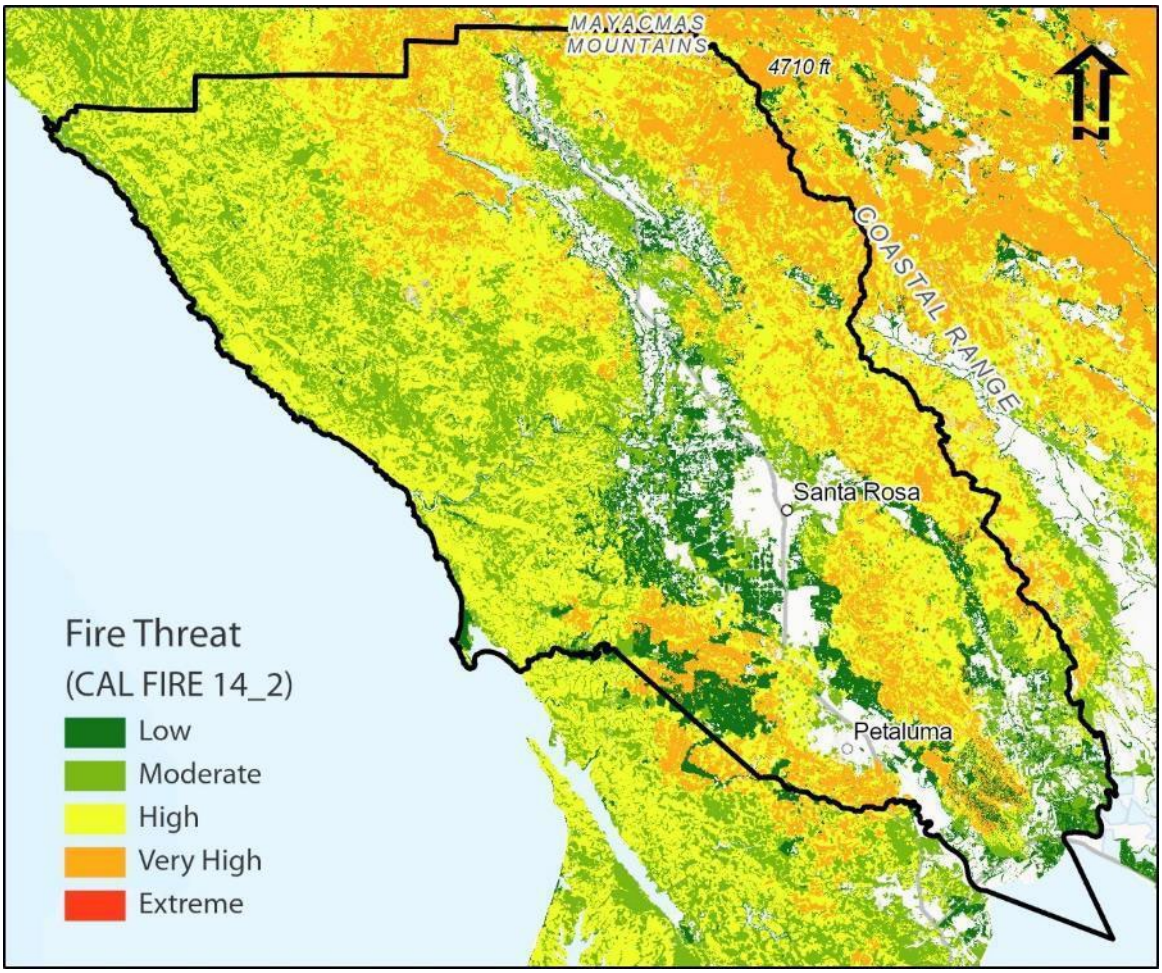

Figure 20: Fire threat in Sonoma County and surrounding area as defined by CAL FIRE (version 14_2)[51]

CAL FIRE also produced the Fire Hazard Severity Zones (or FHSZ) for all of California. Fire Hazard Severity Zones in State Responsibility Areas (SRAs) are based on potential fuels, fire weather conditions, and terrain, and represent potential fire hazard exposure to structures and other human infrastructure assets. Fire Hazard Severity Zones are referenced in various fire safety regulations, building construction standards, and real estate hazard disclosure requirements. Under the authority of Govt. Code Sections 51175-89, CAL FIRE also made recommendations of Very High Fire Hazard Severity Zones in Local Responsibility Areas (LRA) which are based on the same hazard model used for SRA, but only for areas that meet the criteria for the Very High Fire Hazard

[51] CAL FIRE FRAP Maps can be viewed at https://frap.fire.ca.gov/mapping/pdf-maps/

Severity Zones classification. Upon adoption by local ordinance, these areas confer similar fire safety regulations as those required in SRA FHSZ zones.[52]

Below is a map of FHSZ in the SRA and LRA for Sonoma County (November 2007 version). An interactive map hosted by CAL FIRE can be accessed at this link: https://egis.fire.ca.gov/FHSZ/.

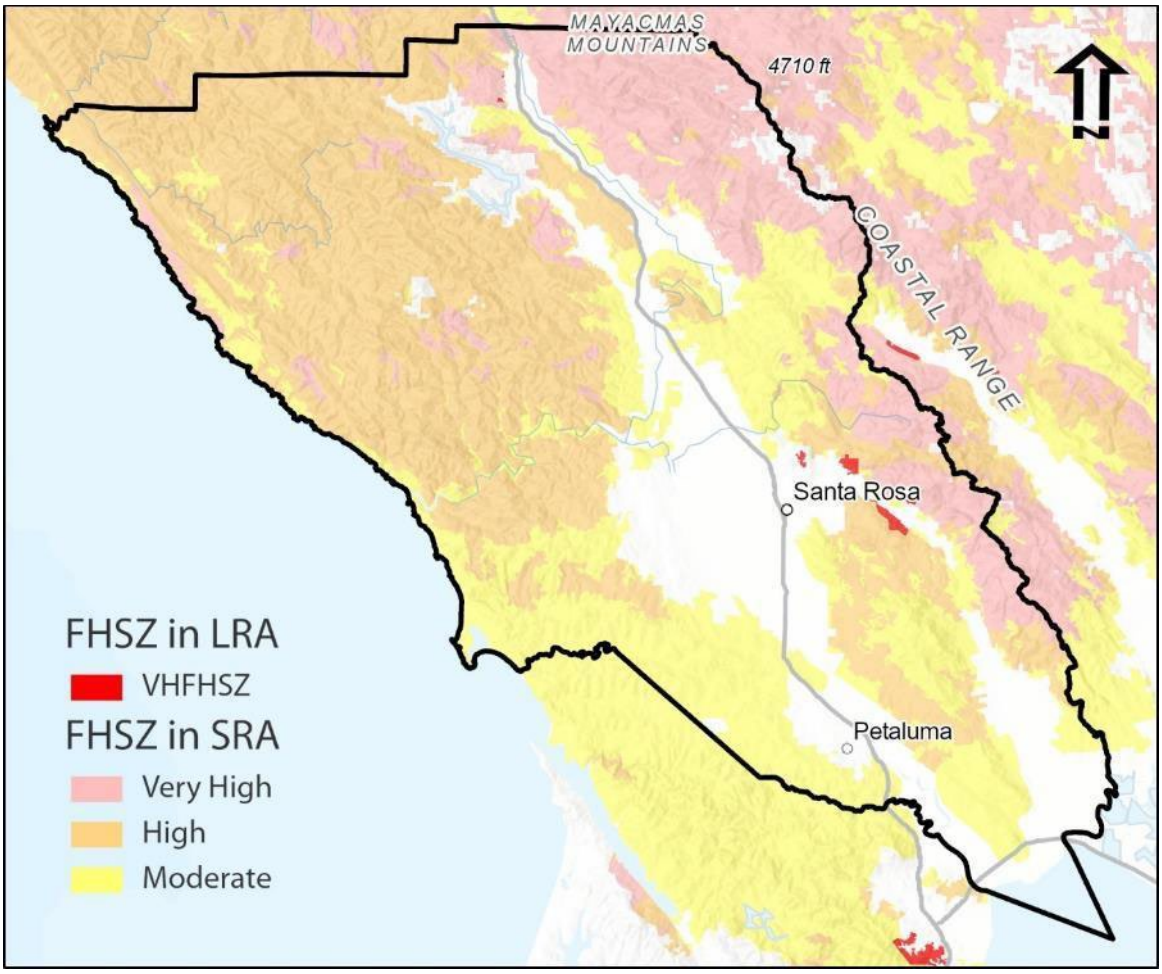

Figure 21: Fire Hazard Severity Zones in Sonoma County and surrounding area as defined by CAL FIRE (version 06_3, November 2007)

The 2007 FHSZs have been revised by CAL FIRE's fire scientists and wildfire mitigation experts to reflect hazard scores based on factors such as fire history, existing and potential fuel (natural vegetation), predicted flame length, blowing embers, terrain, and typical fire weather for an area. At the time of writing this

[52] Source: FHSZ Viewer Help page: https://egis.fire.ca.gov/FHSZ/Help.html. Accessed on 9/8/2021.

CWPP Update, the revised FHSZs are under review prior to approval. You can see proposed FHSZs for State Responsibility Areas and learn more about the process on the Office of the State Fire Marshal's website at https://osfm.fire.ca.gov/fire-hazard-severity-zones-maps-2022/.

In 2021, Assembly Bill 642 and Senate Bill 63 required CAL FIRE to update and map *Fire Hazard Severity Zones* in **both** SRA and LRA. Mapping FHSZs for LRA Areas will start after SRA FHSZs have been adopted. Refer to the website above for updates.

5.1 Updated Data

For this CWPP update, newer data products, specifically the 2017 Sonoma County Vegetation Map (referred to as the Sonoma Veg Map) was used as the primary source for mapping and data collection.

The Sonoma Veg Map is a map of Sonoma County's plant communities at the Alliance Level using California Fish and Wildlife Department's Natural Plant Community Classification (https://sonomavegmap.org/).

In addition to the Sonoma Veg Map, a ***fuel model***[53] layer has been developed based on vegetation type, canopy characteristics, a ladder fuel metric derived from the LiDAR data, and a detailed crosswalk with the mapped plant community alliances in the Sonoma Veg Map.[54]

From the new fuel model layer, a landscape file was developed to allow fire behavior predictions to be made based on the fine-scale vegetation map and the LiDAR derived canopy characteristics. The fire behavior predictions were developed using FlamMap.[55]

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53 A fuel model is a standardized description of fuels available to a fire, based on the amount, distribution and continuity of vegetation and wood. It is used to simulate a fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

54 More information about the fuel model layer based on the fine-scale Sonoma Veg Map can be found here: https://sonomaopenspace.egnyte.com/dl/yAxsmlvuND/?. Accessed on 9/8/2021.

55 FlamMap website: https://www.firelab.org/project/flammap. Accessed on 9/17/2021.

FlamMap is a fire analysis desktop application that can simulate potential fire behavior characteristics (spread rate, flame length, fireline intensity, etc.), fire growth and spread and conditional burn probabilities under constant environmental conditions (weather and fuel moisture). With the inclusion of FARSITE it can also compute wildfire growth and behavior for longer time periods under heterogeneous conditions of terrain, fuels, fuel moistures and weather.

However, fire growth simulations were not used in the analysis performed for Sonoma County. Instead, Fire behavior was calculated for each pixel on the landscape independently such that potential fire behavior was calculated for the entire landscape.

5.2 Sonoma County Wildfire Hazard Index

The components that went into developing the Sonoma County Wildfire Hazard Index are explained in more detail in the next section of this document. The results of that analysis are shown below.

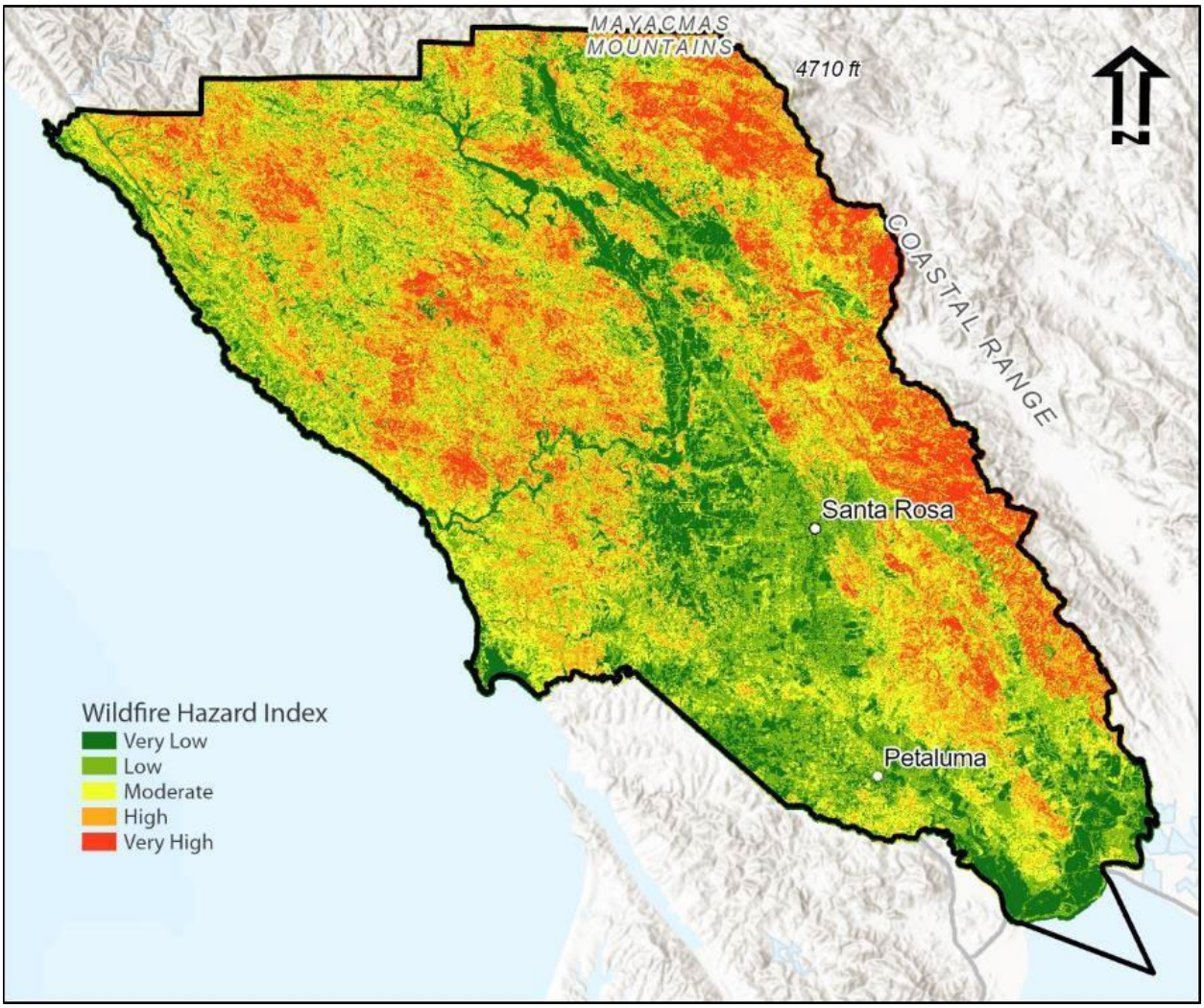

Figure 22: Sonoma County Wildfire Hazard Index (Tukman, 2020)

In brief, this data indicates that the highest wildfire hazard in Sonoma County exists in the eastern mountains of Sonoma County. In addition, the coastal mountains north of the Russian River also show a consistent pattern of high to very high wildfire hazard.

These data support CAL FIRE's identified known wildfire hazardous areas in the county, which are predominately the Guerneville/Cazadero, areas the Geysers area northeast of Santa Rosa, and eastern Sonoma Valley. Moreover, the newer data shows a more nuanced landscape, allowing for a more strategic assessment of wildfire hazards and risks within Sonoma County.

5.3 Wildfire Assessment Summary

The wildfire assessment developed for this CWPP was completed with the best available data resources, but with efficiency and compatibility in mind.

To quantify and assess the hazard and risk posed by wildfire, newer data sources were utilized to develop a simple, straightforward Wildfire Hazard Index (WHI) and a vector-based hexagonal Wildfire Risk Index (WRI), which can be integrated with the results from other risk assessments.

The WHI quantifies the relative wildfire hazard, that is, the inherent wildfire hazard on the landscape due to available fuels, weather potential, potential ignition sources, and suppression difficulty.

The WRI adds three additional components to the WHI:

1. The likelihood embers will accumulate in the event of a wildfire.
2. The presence of structural assets.
3. The relative usability of the road network in Sonoma County.

Both the WHI and WRI are explained in further detail in Appendix C.

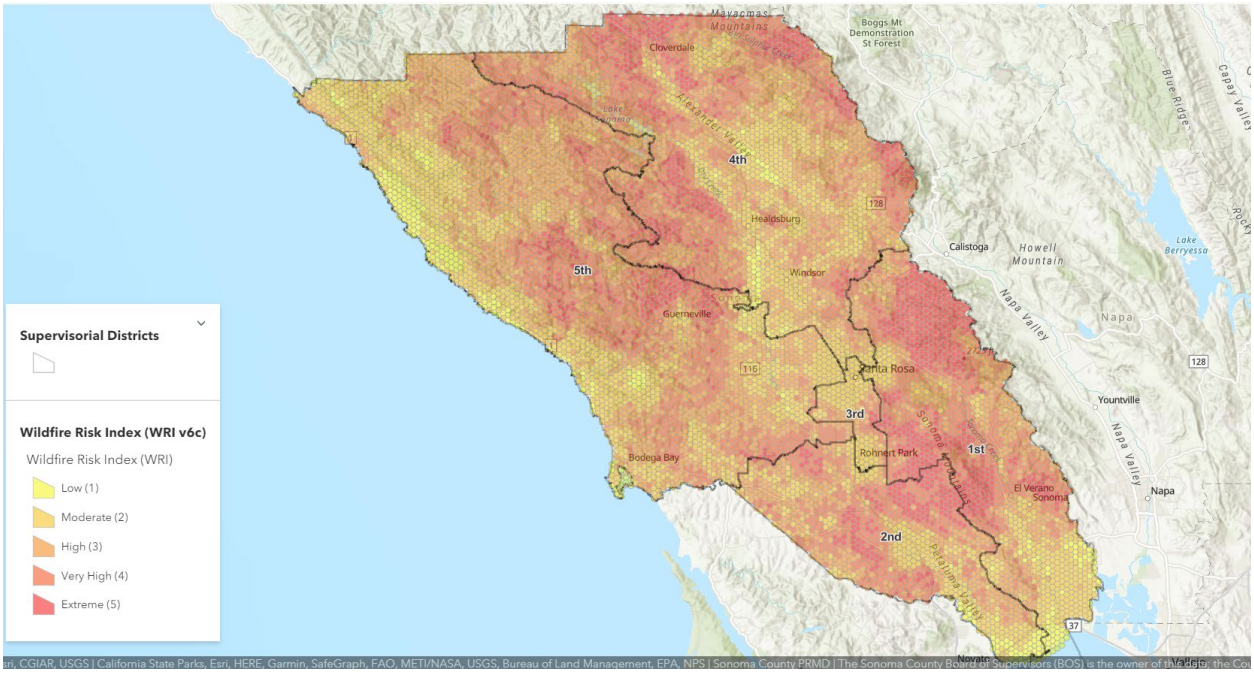

Figure 23: Wildfire Risk Index (WRI) developed for Sonoma County based on the Wildfire Hazard Index (WHI) and other factors (2021)

The WRI is a high-level model that predicts relative wildfire risk. For WRI, the county's landmass was divided into 100-acre polygons. Conditions will vary significantly within each polygon. Areas of relatively low risk may exist within a polygon that has high overall risk. While the WRI may serve as a screening tool for individual projects, it should be considered as one source of information among the many other factors that need to be evaluated in a site specific or parcel-level analysis. Parcel-and project-level analysis require actual field observation or data-collection to determine local wildfire risk. The value of the WRI's high-level analysis is to identify overall trends, which then can be used to suggest the need for and nature of measures that can be taken to reduce risk to acceptable levels.

Note also that the road network rank does not impact compliance with Sonoma County Fire Safe Standards (Chapter 13, Section V) or Board of Forestry Fire Safe Regulations. The road network rank provides a high-level analysis, whereas the local standards and state regulations govern site-specific parameters and access.

Overall, the WRI results indicate that areas most at risk are concentrated in the Mayacamas Mountains, both in the northern and southern parts of the county along the county boundary, as well as areas surrounding Cloverdale and Lake Sonoma. In addition, the Sonoma Mountain area ranked high, as did areas north of the Russian river and southwest of Petaluma.

6. Goals and Objectives

Based on input from agencies, groups and individuals gathered during development of the CWPP, values at risk from wildfire, and goals and objectives for reducing wildfire risks to those values, were identified.

6.1 Values at Risk

During the public-input meetings conducted for this CWPP, attendees were asked to identify the values they felt were at risk from wildfire. As with any public process, the answers provided were varied. Some were very specific (e.g., a single structure at a specific address), while others were vague (e.g., people and homes). Regardless, these values were gathered into a spreadsheet and categorized according to the FEMA Community Lifeline[56] categories, plus one category added to better reflect community input as follows:

- Food, Water, Shelter, Agriculture
- Health and Medical
- Communications
- Safety and Security
- Transportation
- Hazardous Materials (not identified in any value)
- Energy
- Natural Resources (not a FEMA lifeline but added due to values identified by participants)

In addition to identifying their values, participants were asked to vote on the importance of the values presented. Most participants overwhelmingly voted for values that were best characterized by the "Food, Water, Shelter, Agriculture" category, which received 47% of the total votes. Next, "Natural Resources" and "Transportation" both garnered 15% of the votes. Following those categories came "Communications" at 9% and then "Safety and Security" at 8%. The

[56] A FEMA Community Lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security. Definition from the FEMA Community Lifelines website: https://www.fema.gov/emergency-managers/practitioners/lifelines (accessed on 1/3/2022).

categories that got the least number of votes were "Health and Medical" as well as "Energy" (both at 3%).

These identified values were taken into consideration in the CWPP's Risk Reduction Priorities and specific project recommendation lists in this section. Further detail from the community meetings about identified values and recommendations can be seen in Appendix D.

6.2 Risk Reduction Priorities

Wildfire hazards can be reduced by a variety of means. Most importantly, homeowners need to ensure that homes and surrounding vegetation are treated to resist ignition. Larger-scale projects can create fuel breaks to reduce fire intensity near communities and enhance environmental values in wildland areas or improve conditions on evacuation routes.

The following list of risk reduction priorities, originally included in the 2016 CWPP and amended during this CWPP Update, incorporates the recommendations of agencies and community members. This list represents the priorities that will be considered during project evaluation for addition to the CWPP Project List, as described in Section 7.3. These broad recommendations are not listed in priority order.

- **Access and Functional Needs, Low-Income Populations:** Projects that achieve risk reduction and resilience goals for low-income communities and individuals with Access and Functional Needs, including but not limited to persons with disabilities, limited English proficiency, and elderly residents.
- **Access & Egress:** Projects that improve safe travel for evacuation and firefighter access during a fire, including vegetation management and road structures such as bridges, culverts, etc.
- **Defensible Space:** Help create buffers to stop or slow wildfire up to 100 feet from structures and along driveways and private access roads.
- **Ignition Resistant Construction and Retrofit:** Projects that support reducing structural ignitability for homes and structures and infrastructure (Structure Hardening).

- **Community Education:** Projects that provide education to increase understanding of wildfire and wildfire risk reduction, including defensible space, structure hardening, fire ecology, fire risks, ecosystem, and forest health, and how to reduce risks efficiently while enhancing environmental values and services.
- **Community Preparedness:** Projects that promote emergency preparedness efforts such as preparing go-bags and executing evacuation drills.
- **Critical Infrastructure:** Projects that protect critical community infrastructure such as communications, water supply, medical facilities, power grid, etc.
- **Community Level Planning:** Development of local plans, such as CWPPs, risk assessments, or environmental compliance documents such as California Vegetation Treatment Program (CAL VTPs), that increase safety and allow large land-holding managers and nearby residents to achieve mutually acceptable strategies for fuels management.
- **Fuel Breaks:** Implementation of strategic fuel breaks that may help firefighters slow the advance of wildfires, thus protecting homes, communities, and natural resources. In addition to reducing wildfire threats, fuel breaks should serve to maintain and enhance ecosystem health, biodiversity, and make use of site-appropriate understory forest thinning (improving tree spacing, reducing tree density and/or ladder fuels). Vegetation management projects might be accomplished with a variety of methods, including prescribed burning, cultural burning, mechanical treatment, targeted grazing, and hand tools.
- **Post-Fire Mitigation:** Projects that address and improve conditions in post-fire environments.
- **Workforce Development and Training:** Projects that seek to increase employment capacity and training for implementation of risk reduction projects.
- **Ecosystem Health:** Projects that improve conditions and health in a variety of fire-prone ecosystems, especially in areas impacted by fire, tree diseases, pathogens, or insects, or in areas where native species are at risk because of changing conditions, disruption of native disturbance regimes, or invasive plant species.

- **Biomass Utilization:** Projects that provide for beneficial use of woody debris, including for creek restoration, and use of existing or emerging technologies such as biochar.
- **Capacity Building:** Capacity building for "grassroots" organizations and other entities seeking to increase wildfire resilience.
- **Fire Service Support:** Projects that support and aid fire agencies in achieving their missions to protect life, property, and the environment.

6.3 Specific Project Recommendations

The following list represents ideas presented by participants in the CWPP process. They can be used to guide development of projects suggested in a CWPP. Projects listed in both the CWPP and the Berkeley Center for Law, Energy and the Environment (CLEE) *Priorities for Sonoma County's Wildfire Settlement Vegetation Management Funds*[57] report are identified.

6.3.1 Defensible Space & Reducing Structural Ignitability

- Development of robust, on-going, coordinated, science-based public engagement programs to educate all residents about why structure hardening and defensible space are critical to reducing ignition, and how to prioritize projects that reduce risk on home and community scales. Important topics include:
    - Educational resources in multiple formats (print, online, video, in person, social media) and in multiple languages. Messaging should be developed collaboratively to ensure consistent and accurate messaging.
    - How to recognize risks and create and maintain defensible space.
    - Structure hardening priorities to reduce vulnerabilities on buildings, and measures to reduce risk.

[57] Full report available at this link: https://www.law.berkeley.edu/wp-content/uploads/2021/03/Priorities-for-Sonoma-Countys-Vegetation-Management-Funds-March-2021.pdf (accessed on 3/13/2022).

- Financial assistance to help property owners, especially those in low-income and Access and Functional Needs communities, identify high-priority structure hardening and defensible space measures, and provide funding to help them design and implement recommended projects.
- Continue and enhance efforts to improve collaboration with AFN populations and low-income communities in order to better serve community needs for wildfire safety and risk reduction education and outreach.
- Develop strategies for addressing structure hardening and defensible space on rental properties.

6.3.2 Vegetation Management/Mitigation Strategies Recommendations

- Develop funding and capacity for fuels management / prescribed fire workforce[58] that is equitable and well paid.
- Develop or compile Best Management Practices (BMPs) for fuel/vegetation management and/or natural resource stewardship projects that enhance biodiversity and habitat complexity while managing fuels to create environments that are beneficial to people and nature.
- Develop educational programs and materials that promote efficient and beneficial treatments for wildland areas that simultaneously reduce fuels and enhance ecosystem health
- Implement projects in recently burned areas that can take advantage of the fuels reduction subsequent to wildfire while increasing future resiliency and enhancing ecosystem benefits.
- Develop Best Management Practices for post-fire recovery in a variety of ecosystem types.
- Prepare and plan to take advantage of post-fire Federal Management Assistance Grants (FMAG).
- Increase and encourage the use of prescribed fire throughout Sonoma County to improve forest/ecosystem health and reduce hazardous fuels.

[58] On page 35 of the CLEE report, the authors recognize "The County will need a skilled and dedicated workforce equipped to meet the immediate and long-term vegetation management need—rather than relying on solely volunteer labor—because many tasks associated with vegetation management require focused training, licensing, and proper insurance coverage."

- Support and develop capacity for use of cultural burning for Indigenous People in Sonoma County.
- Develop guidelines for collaboration with a variety of public and private agencies and companies for cost-shares on mutually beneficial projects.
- Increase collaboration between Indigenous People and land management agencies to help address the specific needs and desires for management of tribal lands.

6.3.3 Roads and Infrastructure

- Increased roadside fuels management on public and private roads throughout the county, enforcement, strategic fuel treatment planning and implementation
- Development of a cross-jurisdictional program to address fire ignitions and vegetation management along roadways.
- Upgrade Fire Communications system to utilize newer more effective technology.
- Identify mechanisms for fuels reduction and regular vegetation maintenance to protect critical communication infrastructure locations.
- Prioritize risk reduction that will serve to protect all critical infrastructure, as identified in FEMA's *Community Lifelines*
- Increase availability of broadband and other communications infrastructure, especially for rural areas.
- Maintain or increase buffers along public roads as needed
    - Explore full native vegetation restoration/replanting to remove exotics and return site to reduced-fuel, native condition
    - Mow flashy fuels
    - Explore and incorporate other technologies (e.g., long-term retardant applied with consideration for organic certification, or weed management mats)
- Streamline permitting and access within and beyond county and/or state rights-of-way.
- Continue and enhance efforts to ensure that all access roads and homes are identified with reflective signs as described in County Code Chapter 13.

6.3.4 Ignition Prevention

- Develop a cross-jurisdictional program to reduce common fire ignition causes, such as equipment use, debris burning, roadside ignitions, etc.
- Develop coordinated fire ignition cause databases in conjunction with state and local agencies to accurately monitor, track, and analyze fire ignitions in order to develop effective ignition prevention programs.
- Improve and expand existing ALERT Wildfire webcam system for early fire detection and monitoring to allow for future technological upgrades.
- Explore access restrictions and open flame bans during Red Flag conditions

6.3.5 Community Safety/Evacuation

Generally, issues pertaining to evacuation, including evacuation of animals, falls under the duties and responsibilities of the Sonoma County Sheriff and Law Enforcement in partnership with the Department of Emergency Management (DEM), Animal Control and other agencies and cooperating groups. Many of the recommendations listed below are being implemented by these agencies, as well as community groups and organizations, such as COPEs, CERT, COAD, and other committed groups.

Evacuation Readiness Recommendations

- Further efforts made by DEM and others to provide educational materials in as many languages as possible[59] and to develop targeted evacuation preparedness educational material for diverse populations.
- Increase capacity and funding for evacuation planning and drills:
    - Identify evacuation routes in communities that are constrained by few or narrow routes and identify means to improve one-way-in/one-way-out routes.
    - Improve street and route signage throughout the county.

[59] The CLEE report specifically states on Page 25: "A distinct but related portion of funds could be directed to staff time/capacity dedicated specifically to equity-focused, bilingual outreach, education, and workforce development efforts. Broad outreach both to private landowners and renters should be a priority."

- Funding for communities that have formed, or want to form local preparedness support groups, such as COPE, CERT programs, Map Your Neighborhood, etc.
- Increased outreach to support public awareness of:
    - Alert and notification systems, and how to sign up for them
    - The importance of planning for all emergencies and the critical elements planning should include.
    - Encourage multiple agencies and groups to provide consistent and accurate information for their communities that reflects the diversity of communities, landscapes, languages, and cultures.
- Support means to assist individuals with Access and/or Functional needs in planning for all hazards.

The MJHMP has identified several action items to address equity concerns in Sonoma County. The full MJHMP action item list is available at https://permitsonoma.org/longrangeplans/proposedlong-rangeplans/hazardmitigationupdate.

6.3.6 Agricultural and Service Industry Workers

- Encourage and support coalitions to educate workers on their rights to safe working conditions, and community safety observers who monitor compliance.
- Development of wildfire safety and evacuation literature in a variety of languages and formats.
- Provide indigenous language training, hazard pay, and disaster insurance.
- Require or encourage owner operator of farm worker housing to maintain emergency preparedness plans and account for their reliance on external, employer transportation, including for evacuation purposes.

6.3.7 Air Quality/Smoke

- Increased education about the health effects of smoke, and measures residents can take to protect themselves from exposure.
- Assistance for residents to access devices that will improve indoor air quality.

- Establish sheltering or "clear air" centers throughout the county for all residents.
- Encourage and support a coalition to educate workers on their rights to safe working conditions.
- Offer free N95 masks for all workers, especially outdoor, and monitor use.

6.3.8 Animal Evacuation

- Improve means for people to get accurate animal resource information, request help, and procedures during and before incidents.
- Increased outreach and education in multiple languages across a variety of written, spoken, print, social and mainstream media communication platforms to encourage pre-planning and preparation for large and small animal evacuation. Consistent messaging is essential.
- Increased training, capacity and coordination for volunteers who help with animal evacuation, and integration of trained, well-equipped volunteers during emergencies.
- Improving communications channels with incident command regarding loading and transport of livestock on large rigs on narrow roads.
- Early activation of county registered transport and shelter volunteer resources to encourage early animal evacuation.
- Increased availability of "co-located" and "co-habitated" shelter facilities where owners stay with and care for their animals, including staffing, veterinarians to assure animal and human health and safety, equipment, supplies and volunteers. Securing reliable funding streams to support these and other community-based organization programs is vital.
    - An exhaustive list of resources for animal and human needs during evacuation can be seen in Appendix H.

6.3.9 Codes, Ordinances and Enforcement

- Encourage dialogue to explore potential of expanding application of California Building Code Chapter 7A ("WUI Building Code") to the entire County (currently only applies in State Responsibility Areas and in areas where local jurisdiction has adopted).

- Explore potential of creating a single Defensible Space Ordinance that can provide identical standards for State or Local Responsibility areas County-wide.
- Increase funding for Defensible Space Inspections by local and state agencies.
- Increase funding for enforcement and abatement of non-compliant properties.
- Continue and enhance efforts to ensure that all access roads and homes are identified with reflective signs as described in County Code Chapter 13.

6.3.10 Water Supply

- Encourage property owners to develop supplementary, accessible water supply for firefighting, especially development of systems which capture and store rainwater.
- Develop a water supply or water source map and/or database for firefighting personnel that could include large supplies, such as ponds, and smaller supplies, such as residential pools, tanks, etc.
- Create a formal Blue Dot Program that identifies and marks water sources.

6.3.11 Planning

- Encourage robust dialogue on how and where we put new construction and rebuild after fire events to discuss how new or expanded development might impact local communities, fire districts, and evacuation planning.
- County-wide Structure Assessment: funding should be sought to develop appropriate datasets to allow for a more robust assessment on structure vulnerability in Sonoma County.
- Ensure wildfire hazards are appropriately considered in land use decisions.
- Implement training programs for planning and building officials and code enforcement staff across jurisdictions regarding wildfire risk and mitigation.

6.3.12 CWPP Update and Annual Reporting Recommendations

- Ensure regular and consistent funding and other resources to implement annual and 5-year CWPP updates.[60]
- Maintain and update Project Entry Portal and Sonoma County CWPP Project List. Continue efforts to integrate new tools and technology as developed.
- Develop County-wide Structure Assessment that considers all buildings in the county.
- Maintain and update appendices.

6.3.13 Local CWPP Recommendations

Many local *Fire Safe Councils* (FSCs), or other community groups such as Citizens Organized to Prepare for Emergencies (COPE) and Community Emergency Response Team (CERT), have developed local CWPPs in which they have identified and prioritized their own list of projects.

- Develop consistent minimum standards and best practices for local CWPP development so they can be integrated with neighboring CWPPs and the county-wide CWPP.
- Funding and capacity to provide assistance, training, and resources to local FSCs and community groups developing CWPPs or seeking Firewise USA® program designation.
- Funding and capacity to coordinate annual meetings to receive updates and incorporate local CWPP project priorities into Countywide CWPP.
- Encourage local CWPPs to consider structure assessments for each building in their designated CWPP Boundary.

[60] On page 19, the CLEE report lists several investment priorities, one of which states: Provide technical assistance and financial support for Resource Conservation Districts (RCDs) and other local/community organizations.

7. Prioritization and Implementation

7.1 Alignment with Federal, State and Local plans

The 2003 Healthy Forests Restoration Act emphasized the importance of a collaborative CWPP process to determine priorities and recommend projects that can be implemented successfully. Increasingly, federal and state funding agencies are requiring that projects be listed in a CWPP to be considered for funding.

The California Wildfire and Forest Resilience Action Plan includes an expansion of the Regional Forest and Fire Capacity (RFFC) Program to "increase local and regional governments' capacity to build and maintain a pipeline of forest health and fire prevention projects."[61]

The California Natural Resources Agency and Department of Conservation has tasked the North Coast Resource Partnership with administering the Regional Forest and Fire Capacity Program for the region that includes Sonoma County. The North Coast Resource Partnership has released a draft plan entitled *A Vision for North Coast Resilience: Priorities for Enhancing Watershed, Forest and Community Resilience in the North Coast Region*, available for public comment as of November 2022. This draft plan represents a shared vision for watershed, forest, and community resilience in the North Coast region of California. Resilience includes the capacity of communities and ecosystems to recover from extreme events such as wildfire, floods, and drought, as well as impacts from climate change, economic, and health disruptions. The draft plan and an adaptive planning and prioritization framework can be seen on their website at https://rffc.eclipse-dev.com/.

7.1.1 CAL FIRE Sonoma-Lake-Napa Unit (LNU) Priorities

Most of Sonoma County's areas at risk to wildfire are in State Responsibility Areas, where CAL FIRE has primary jurisdiction for wildfire prevention and suppression. Every CAL FIRE unit writes a yearly plan that identifies the prevention activities for the Unit. The *Sonoma-Lake-Napa Unit 2022 Strategic Fire Plan*

[61] *CALIFORNIA'S WILDFIRE AND FOREST RESILIENCE ACTION PLAN: Recommendations of the Governor's Forest Management Task Force*, 2021, p. 8. https://www.fire.ca.gov/media/ps4p2vck/californiawildfireandforestresilienceactionplan.pdf

"prioritizes projects that enhance life safety, reduce ignition and fire spread, and improve structure resilience over any projects that address tactical containment and control of wildfires." [62]

A. LNU Project Priorities
   1. Public arterial and collector road fuel reduction projects
   2. Supporting defensible space and home hardening efforts
   3. WUI community fuel breaks
   4. Landscape level fuel reduction
   5. Emergency responder incident response planning and ingress progress
   6. Tactical ridgetop fuel breaks[63]

7.1.2 Insurance

The costs and availability of Homeowners Insurance are increasingly difficult issues in Sonoma County. The requirements of insurance providers will become a primary driver in implementation of defensible space and ignition resistant construction and retrofit.

The California Department of Insurance has launched the "Safer From Wildfires Partnership," an interagency partnership including the Insurance Commissioner and emergency response and readiness agencies. "The ultimate goal is protecting consumers by reducing wildfire risk in their communities, making insurance available and affordable for all Californians."[64] To do this, they suggest a "ground up" approach for wildfire resilience that prioritizes:

1. **Protecting the structure** (ignition resistant building materials and techniques, likely using standards such as those developed by the Insurance Institute for Business and Home Safety Wildfire Prepared Home program[65]).

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[62] *Sonoma-Lake-Napa Unit 2022 Strategic Fire Plan*, p. 23. https://osfm.fire.ca.gov/media/s1vdava4/2022-sonoma-lake-napa-solano-yolo-colusa-unit-fire-plan.pdf

[63] *Ibid*

[64] https://www.insurance.ca.gov/01-consumers/200-wrr/saferfromwildfires.cfm, accessed 8/29/2022.

[65] https://wildfireprepared.org/, accessed 9/12/2022

2. **Protecting the immediate surroundings** (near-home combustibles and defensible space).
3. **Working together as a community** (a local risk assessment, evacuation preparation, participation in a program such as Firewise USA® [66] designation).

Within Sonoma County, a partnership is under development including representatives from the insurance industry, the County of Sonoma, local government agencies, fire agencies, and Non-Governmental Organizations (NGOs). The focus of this group is to develop or identify standards acceptable to insurance carriers that, if fulfilled by the property owners, will help them keep existing coverage, find a carrier, or provide for discounted premiums.

7.1.3 County Plans

The County of Sonoma has completed the *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021* (MJHMP), which is an all-risk plan. Listed below is an abridged list of identified projects most pertinent to the CWPP. You can see the complete MJHMP Hazard Mitigation Action Plan tables for each participating jurisdiction, including the County of Sonoma, here: https://permitsonoma.org/longrangeplans/proposedlong-rangeplans/hazardmitigationupdate.

Figure 24: Table, MJHMP Hazard Mitigation Action Plan wildfire projects

Action	Description	Priority	CWPP integration
Action SC-13	Conduct a systematic fire safety analysis of all County-owned assets that are known to be in wildland fire zones and identify site-specific mitigation actions to improve wildland fire resistance.	Medium	CWPP and Wildfire Hazard and Risk Indices
Action SC-26	Develop and implement a hazardous fuels-reduction program within two miles of homes and communities identified to be at risk to wildfires.	High	Hazardous Fuels Reduction Project Permit Sonoma - Underway
Action SC-30	Wildfire-Resilient Sonoma County—Nature-based Mitigation to Adapt in an Era of Mega-fires. This wildfire mitigation project will reduce or prevent	Medium	BRIC funding pending. Permit Sonoma

[66] https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA, accessed 9/15/22

	regional property loss by employing the following techniques and methods: • Defensible space implementation around 100% of homes throughout the State Responsibility Area • Structure hardening • Landscape-level fuel breaks, including parks and green spaces around population-dense areas of the county. By working at the regional level this project will reduce wildfire risk throughout the county, while at the same time providing other community benefits such as recreation and wildlife habitat.		
Action SC-31	Where appropriate, support retrofitting, purchase, or relocation of structures located in hazard areas, prioritizing those that have experienced repetitive losses and/or are located in high- or medium-risk hazard areas.	Medium	WIldfire Adapted Sonoma County Project: Permit sonoma - Underway
Action SC-32	Integrate the hazard mitigation plan into other plans, ordinances, and programs that dictate land use decisions in the community, including the County General Plan, Emergency Operations Plan, Climate Adaptation Plan, Community Wildfire Protection Plan, etc.	High	CWPP and MJHMP fully integrated.
Action SC-40	Partner with fire districts and others on road right of way fuels clearance. "Roadside Hazard Abatement Program"	High	Permit Sonoma Fire Prevention
Action SC-41	Create a plan for other lands managed by Transportation & Public Works to be maintained for fire resilience. Property such as the Healdsburg Transfer Station (grant applied for) can be maintained as a fuel break for the City of Healdsburg. "Debris Management Plan"	High	

7.1.4 CLEE Report

In March 2021, the Berkeley Center for Law, Energy and the Environment (CLEE) published a report to the Sonoma County Board of Supervisors. This report titled, *Priorities for Sonoma County's Wildfire Settlement Vegetation Management Funds*[67], convened with selected stakeholders with expertise in climate science, natural resource management, and public finance from across California and a range of Sonoma County ecosystem management, forest protection, fire mitigation, and government to identify priority uses for Sonoma County's

[67] Full report available at this link: https://www.law.berkeley.edu/wp-content/uploads/2021/03/Priorities-for-Sonoma-Countys-Vegetation-Management-Funds-March-2021.pdf (accessed on 3/13/2022).

expenditure of PG&E wildfire settlement funds[68] designated for vegetation management purposes.

The CLEE report provided both principles and priorities for vegetation management fund allocation. The principles identified in the CLEE report target investment priorities, public engagement, the decision-making process, and identified sustainable funding. The priorities identified in the CLEE report target centralizing governance and project coordination, community outreach and education, the identification of immediate vegetation management activities, the need for data, planning, and mapping, labor, and workforce development, and lastly, long-term financial sustainability of any widespread vegetation management within Sonoma County.

7.2 Prioritization

For fire agencies, operational activities are prioritized as follows:

1. Protection of human life and safety
2. Protection of property (such as homes) and critical infrastructure
3. Protection of natural and cultural resources.

The CWPP Risk Reduction Priorities, outlined in Section 6.2, strike a balance between fire agencies' operational priorities, while reflecting and incorporating the implementation and funding readiness factors identified in the MJHMP, and the priorities identified during the CWPP engagement process. For projects seeking to be included in the CWPP, the priorities described in 6.2 will be used to describe proposed projects. The process for adding projects to the Sonoma County CWPP Project List is described below in Section 7.3.

Projects that improve conditions and ecosystem services in natural areas overall are clearly of high priority, especially given the critical role functional ecosystems play in climate change, and availability of critical resources, such as water quality and quantity. Often, all three fire agencies' operational priorities shown above can (and should) be addressed simultaneously. However, priorities

[68] PG&E Settlement Allocation and Vegetation Management website: https://sonomacounty.ca.gov/CAO/Policy-Grants-and-Special-Projects/PGandE-Settlement/ (accessed on 3/13/2022).

also depend on the organization promoting a given project. For example, for an organization whose first priority is protecting threatened species, protection of natural resources would be the highest priority.

These nuances are well represented in the following model, developed from the National Cohesive Fire Strategy. In this model, all three priorities (Fire Adapted Communities, Resilient Landscapes, and Safe, Effective Wildfire Response) come together in the center, always guided by the application of best available science.

Figure 25: Priority matrix developed by the National Cohesive Strategy

7.3 CWPP Project Entry Portal, Project List and Map

The CLEE Report suggests the need "…to create in parallel a landscape-level tool and web-based multi-benefit mapping resource. These tools will be designed to complement the Sonoma County Community Wildfire Protection Plan (CWPP) and to inform agency and land manager decision-making."[69]

A goal of the CWPP is to map and track projects across the county to ultimately help identify potential grant funding or provide technical assistance to support

[69] https://www.law.berkeley.edu/research/clee/research/climate/california-climate-action/priorities-for-sonoma-countys-vegetation-management-funds/, p. 14

efforts to reduce the threat of wildfire and improve the health of our natural landscapes. The Sonoma County CWPP Project Entry Portal, located on the CWPP Hub Site[70], provides a central place where wildfire resilience project proponents and stakeholders, including agencies, non-governmental organizations, landowners, etc., can enter information about proposed wildfire resilience projects. Projects entered by stakeholders into the CWPP Project Entry Portal form the basis for a county-wide map and list of wildfire risk reduction projects for which funding has been or may be sought.

The following steps form the basis for creating the County-wide Project List:

1. Stakeholders enter basic information about wildfire risk reduction project(s) they have created and map them in the Sonoma County CWPP Project Entry Portal on the CWPP Hub Site.
2. All entered projects will be queued for screening for basic requirements. Screening includes analysis of the project's alignment with the Risk Reduction Priorities in CWPP Chapter 6, other existing plans, the overall risk in the project areas, and potential for successful implementation (e.g., if landowners for a project area include public agencies, those agencies must have agreed to include the project on the CWPP Project List).
3. The screening process may identify projects eligible for technical assistance in project design, grant writing, or environmental review consultation from a variety of agencies, including Sonoma County Agricultural Preservation and Open Space District and Fire Safe Sonoma.
4. Screened projects that meet the requirements will be added to Appendix 1 of the CWPP and will be viewable on the County-wide map of prospective projects.

The resulting county-wide map allows those interested in wildfire risk reduction to see county-wide activity, project types, and potential opportunities to collaborate. For example, if similar projects have been submitted in the same geographic footprint, increased collaboration between groups can be encouraged. Additionally, the map may help identify areas with high risk for

[70] https://sonoma-county-cwpp-hub-site-sonomacounty.hub.arcgis.com/

which there are no prospective grant projects in development and help identify leads to create those projects. Grant Applications are increasingly requiring that projects submitted for funding are listed in a CWPP, so the having their project listed on the CWPP Project List is a critical component for grant seekers.

Please visit the CWPP Hub Site for important information, criteria, annual deadlines, and instructions for project entry.

7.3.2 Annual Updates to the CWPP Project List and Appendices

All projects listed in the CWPP Project List should be updated on a yearly basis by the applicants. New and updated projects will be considered for inclusion in Appendix A of the CWPP annually.

8. Appendices

A. 2021 Current CWPP Project List

This Appendix and Figure 26 represent projects submitted by community members and agencies for inclusion in the CWPP Project List in 2021. The annual update of the CWPP Project List will follow the screening process outlined in Chapter 7. The projects listed below have not yet been screened.

See the CWPP Hub Site (https://arcg.is/1vSPb10) Project Entry Portal for additional detail about projects entered, criteria, annual deadlines, and instructions for project entry.

Note: The Sonoma County CWPP neither guarantees funding nor is it regulatory. Its purpose is to delineate wildfire risks across the County and to identify and prioritize potential solutions so that when funding is sought to address issues, there is a comprehensive overall plan from which to start. The Sonoma County CWPP is a working document that will coordinate fuel treatment in a manner that protects communities and landscapes from wildfire and encourages enhancement of environmental values. Appendices to the plan should be updated yearly, and as local communities write their own CWPPs, they will be appended to the plan.

Figure 26: Table, Projects submitted through the Sonoma County Project Ranking Tool (2021) – Unscreened

Supervisor District	Project Title	Project Acres	Project Type
D4	Pepperwood Adaptive Management Plan	4,052	Wildland_Fuels_Treatment, Education_and_Outreach, Post_Fire_Restoration
D4	Pine Flat Briggs Ranch Road Collaborative	5,310	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D1	Diamond Mountain Mark West Fire Prevention Planning	60,000	Defensible_Space, Harden_Structures, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Education_and_Outreach, Planning_and_Preparedness,

Supervisor District	Project Title	Project Acres	Project Type
			Hazardous_Fuel_Reduction, Fire_Prevention_Education, Fire_Prevention_Planning, Post_Fire_Restoration
D1	Shaded Fuel Break St. Helena Rd Improve Access	802	Roadside_Fuels_Treatment, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D1	Maintain Fire Break on Hog's Back	247	Hazardous_Fuel_Reduction, Post_Fire_Restoration
D1	Shaded Fuel Break Calistoga Road Improve Access	56	Roadside_Fuels_Treatment, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D1	Shaded Fuel Break Improve Access Gates Rd	6	Roadside_Fuels_Treatment, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D4	Passalacqua Road	19	Roadside_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Transfer Station Shaded Fuel Brake	125	Hazardous_Fuel_Reduction
D4	Ida Clayton Fuel Break	198	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Lower Knights Valley Fuel Break	144	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	West Geyserville Avenue Roadside Clearance	14	Roadside_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Pocket Peak to Geyser Peak Fire Road	168	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D1	Maze Evacuation	724	Planning_and_Preparedness
D1	100' Defensible Space for 55 homes	208	Defensible_Space, Harden_Structures, Education_and_Outreach, Planning_and_Preparedness
D4	Mountain View Ranch Road Prescribed Burn	153	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	TBD - Prescribed Fire	500	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	TBD - Prescribed Fire	49	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D5	Bohemian Highway Community Emergency Alert System and Evacuation Plan	10,846	Planning_and_Preparedness
D5	Safe Road Access: Vegetation	417	Roadside_Fuels_Treatment

Supervisor District	Project Title	Project Acres	Project Type
	Management and Road Infrastructure (Parts 1 and 2)		
D5	Camp Meeker Safe Neighborhoods	276	Education_and_Outreach, Planning_and_Preparedness
D4	South Big Ridge Shaded Fuel Break	154	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D4	A Handbook of Principles & Practices for Vegetation Management in Sonoma County	12	Wildland_Fuels_Treatment, Education_and_Outreach, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Fire_Prevention_Planning
D4	The Bishop's Ranch Shaded Fuel Break	358	Defensible_Space, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Cooley Ranch Prescribed Burning	12,560	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Northeast Geyserville Prescribed Grazing	3,151	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D1	Bartholomew Park Fuel Breaks	122	Defensible_Space, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Education_and_Outreach, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D5	Lake Sonoma West Long Term Wildland Fire Management Plan	40,482	Defensible_Space, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Education_and_Outreach, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Fire_Prevention_Education, Fire_Prevention_Planning, Post_Fire_Restoration
D5	EARLY WARNING COMMUNICATION PROTOCOLS	13,579	Education_and_Outreach, Planning_and_Preparedness, Fire_Prevention_Education, Fire_Prevention_Planning

Supervisor District	Project Title	Project Acres	Project Type
D5	FIRE & EMERGENCY PREPAREDNESS AWARENESS	14,947	Education_and_Outreach, Planning_and_Preparedness, Fire_Prevention_Education, Fire_Prevention_Planning
D5	FUELS REDUCTION ON LARGE CONNECTED PROPERTIES	15,869	Defensible_Space, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction, Fire_Prevention_Planning
D5	HOME AND PROPERTY HARDENING	15,399	Defensible_Space, Harden_Structures, Education_and_Outreach, Planning_and_Preparedness, Fire_Prevention_Education, Fire_Prevention_Planning
D5	PROJECT: ALTERNATE EVACUATION ROUTE DEVELOPMENT AND MAINTENANCE	16,775	Wildland_Fuels_Treatment, Education_and_Outreach, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Fire_Prevention_Education
D1	Brush Creek Villas Fire Mitigation and Education Project	27	Defensible_Space, Harden_Structures, Education_and_Outreach, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Fire_Prevention_Education, Fire_Prevention_Planning
D1	Glen Oaks Ranch Right of Way Clearing	6	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment
D1	Live Oaks Ranch Stewardship for Fire Resilience	434	Wildland_Fuels_Treatment, Education_and_Outreach, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D4	Laufenburg Ranch Stewardship for Fire Resilience, 17104 Spencer Lane, Calistoga, CA	174	Wildland_Fuels_Treatment, Education_and_Outreach, Hazardous_Fuel_Reduction, Post_Fire_Restoration
D4	CFPD Pilot Roadway (P05) McNair/Kerry Road	0	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	CFPD Pilot Roadway (P02) Henry Road	15	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	CFPD Pilot Roadway (P03) Hot Springs Road	48	Defensible_Space, Roadside_Fuels_Treatment,

Supervisor District	Project Title	Project Acres	Project Type
			Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	CFPD Pilot Roadway (P04) Highland Ranch Road, Cloverdale, CA	26	Defensible_Space, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	CFPD Pilot Roadway (P06) Riverfront	1	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D5	Coast Ridge Forest Counsel Evacuation Route and Hazardous Fuels Reduction Project	11,851	Defensible_Space, Harden_Structures, Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Education_and_Outreach, Planning_and_Preparedness, Hazardous_Fuel_Reduction, Fire_Prevention_Education, Fire_Prevention_Planning, Post_Fire_Restoration
D4	Tertiary Roads West, Cloverdale	136	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Fire Roads East Cloverdale	285	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Fire Roads West Cloverdale	84	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D4	Fuel Breaks East Cloverdale	104	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D5	Little Black Mountain/Pole Mountain CalVTP	538	Roadside_Fuels_Treatment, Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D1	Montini Open Space Preserve Fuel Reduction and Biochar	110	Wildland_Fuels_Treatment, Hazardous_Fuel_Reduction
D1	Glen Oaks and Stuart Creek Hill Prescribed Fire	99	Defensible_Space, Wildland_Fuels_Treatment, Education_and_Outreach, Hazardous_Fuel_Reduction, Fire_Prevention_Education, Fire_Prevention_Planning, Post_Fire_Restoration

B. List of Local CWPPs Within Sonoma County

This appendix contains online links to all the currently completed (and publicly available) local CWPPs in Sonoma County as listed on the Fire Safe Sonoma website. If your completed CWPP is not listed here, please contact Fire Safe Sonoma through their website at https://www.firesafesonoma.org/.

Figure 27: Table, Current Local CWPPs in Sonoma County with completion date (DMS, 2021)

CWPP Title	Completed/*Expected*	Online Link
Bennett Ridge CWPP	2018	Link
Camp Meeker CWPP	2021	Link
Cloverdale CWPP	2022	Link
Fitch Mountain CWPP	2019	Link
Fort Ross Area CWPP	2019	Link
Gehricke Road Local Area CWPP	***2023***	
Geyserville (Northeast) CWPP	2020	Link
Glen Ellen CWPP	***2023***	
Grove Street Area CWPP	2020	Link
Healdsburg Area CWPP	***2023***	
Hollydale/Canyon/Terrace Area CWPP	***2023***	
Mayacamas Community CWPP	2019	Link
Mill Creek Area CWPP	2020	Link
Occidental CWPP	2020	Link
Santa Rosa (City of Santa Rosa) CWPP	2020	Link
The Sea Ranch CWPP	2019	Link
The Springs	***2023***	
Upper Mark West Area CWPP	2018	Link

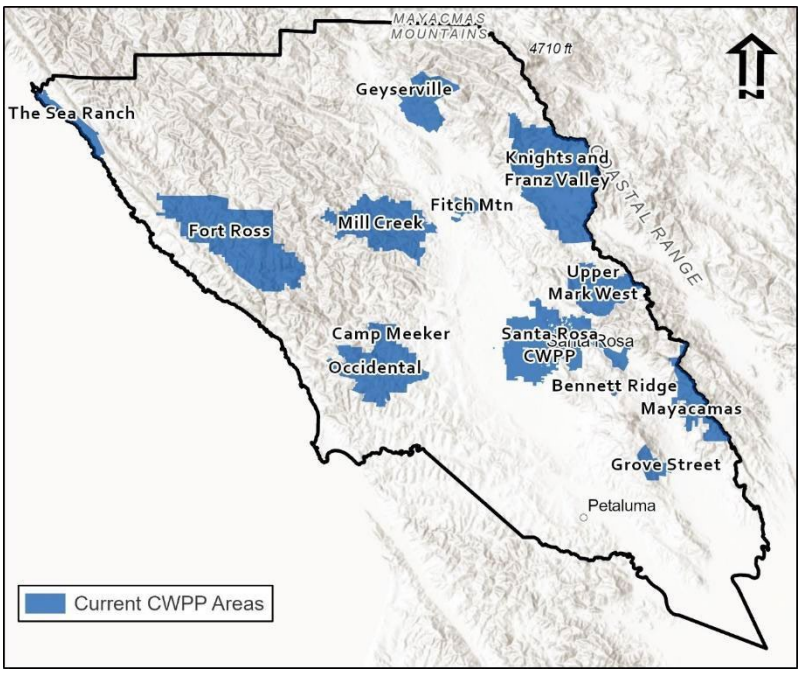

Figure 28: Current Local CWPP areas in Sonoma County (DMS, 2021)

C. Wildfire Risk and Hazard Assessments: Report

Regionally, there are several efforts underway to develop fire risk assessments for both Sonoma County and surrounding counties. These local efforts are spearheaded by Sonoma Water and the North Coast Resource Partnership.

Sonoma Water's effort will develop a dynamic assessment model that will allow a user to consider and weight different factors to determine relative risk in any given area in Sonoma County. Some of the work included in this CWPP will be integrated into their online tool, the Wildfire Resilience Planner.

The North Coast Resource Partnership risk assessment will be based on the nationally accepted Quantitative Wildfire Risk Assessment[71] methodology. In addition, they will be developing Potential Operational Delineations (PODs). PODs are spatial units or containers defined by potential control features, such as road and ridge tops, within which relevant information on forest conditions, ecology and fire potential can be summarized.

In addition to these local efforts, there are also statewide and national yearly efforts to assess wildfire hazard and risk.

To minimize confusion and redundancy, the wildfire assessment developed for this CWPP was completed with the best available data resource, but with efficiency and compatibility in mind.

For this update to the Sonoma County CWPP, to quantify and assess the hazard and risk posed by wildfire, we utilized newer data sources to develop a simple Wildfire Hazard Index (WHI) and a vector-based hexagonal Wildfire Risk Index (WRI), which can be easily consumed by other assessments or can be easily updated with the results from other risk assessments.

The WHI quantifies relative wildfire hazard, that is, the inherent wildfire hazard on the landscape due to available fuels, weather potential, potential ignition sources, and suppression difficulty.

The WRI adds to the WHI three additional components:

[71] Quantitative Wildfire Risk Assessment Fact Sheet: https://iftdss.firenet.gov/landing_page/pdfs/qwra_release_flyer_july2020.pdf (accessed on 11/18/2021).

1. The likely areas embers will accumulate in the event of a wildfire,
2. The presence of structural assets,
3. The relative usability of the road network.

Both the WHI and WRI are explained in detail below.

Wildfire Hazard Index[72]

In 2020, as part of Sonoma County's Multi-Jurisdictional Hazard Mitigation planning, a WHI was developed to quantify relative wildfire hazard. The WHI took into consideration predicted flame length, transmission line location, suppression difficulty, and fire weather potential (see figure below for data sources).

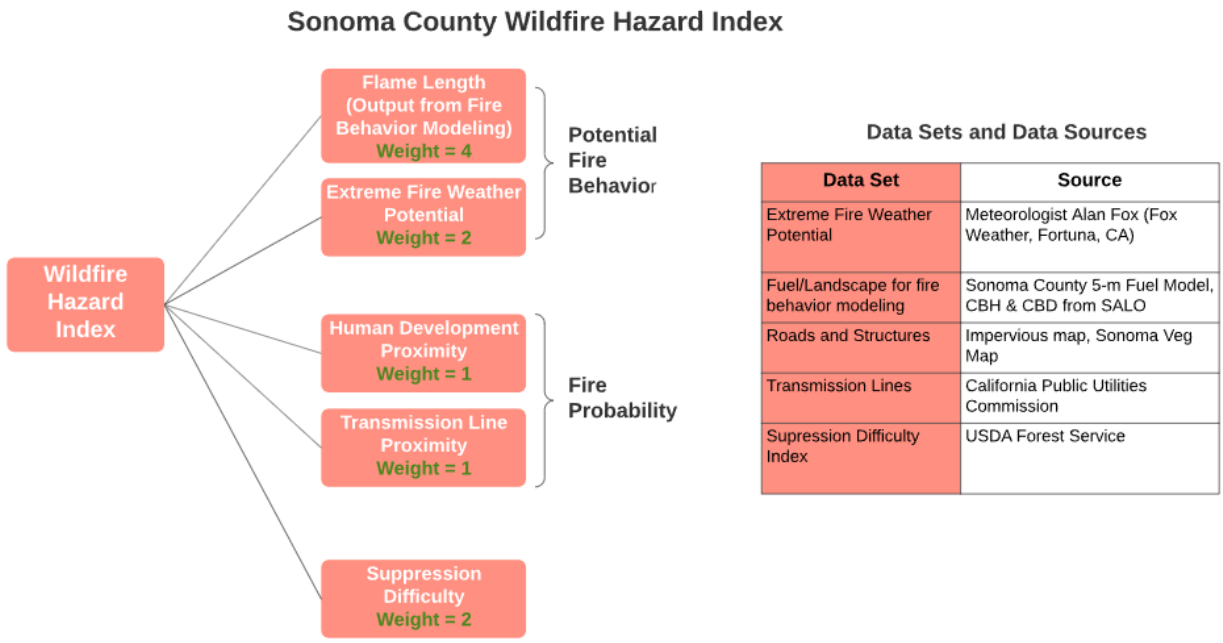

Figure 29: Schematic showing data layers used to develop the 2020 Sonoma County Wildfire Hazard Index (Tukman, 2020)

The WHI inputs were curated from best available data sources for Sonoma County. The following discussion provides information on each input dataset, its

[72] Information regarding the Sonoma County Wildfire Hazard Index is also available online at this link: https://arcg.is/0qynPj (accessed on 11/11/2021), developed by Tukman Geospatial in 2020 for the *Sonoma County Multijurisdictional Hazard Mitigation Plan Update 2021*.

sources, and the methods used to create it.

Flame Length

FLAMMAP is a fire behavior prediction software that spatially simulates flame lengths and other characteristics of fire behavior.[73] Flame length simulations were run for "worst case" fire conditions – 97th percentile live fuel moistures under maximum fire spread conditions. The simulation was run using the Sonoma County 5-meter fuel model and landscape files.[74] The resulting flame length layer, with values ranging from 0 to over 100 feet, was binned into the following five classes:

Figure 30: Table, Classified range of values for predicted flame lengths in Sonoma County

Original Value Ranges	Hazard Value
No predicted fire	Very Low (0)
Less than 4 feet	Low (1)
4–8 feet	Moderate (2)
8–12 feet	High (3)
Over 12 feet	Very High (4)

[73] More information about the software can be found online here: https://www.firelab.org/project/flammap (accessed on 11/11/2021).

[74] More information on the development of this landscape file is available online here: https://www.arcgis.com/home/item.html?id=2d194202dfee4ab5b157e978cd0e4901 (accessed on 11/11/2021).

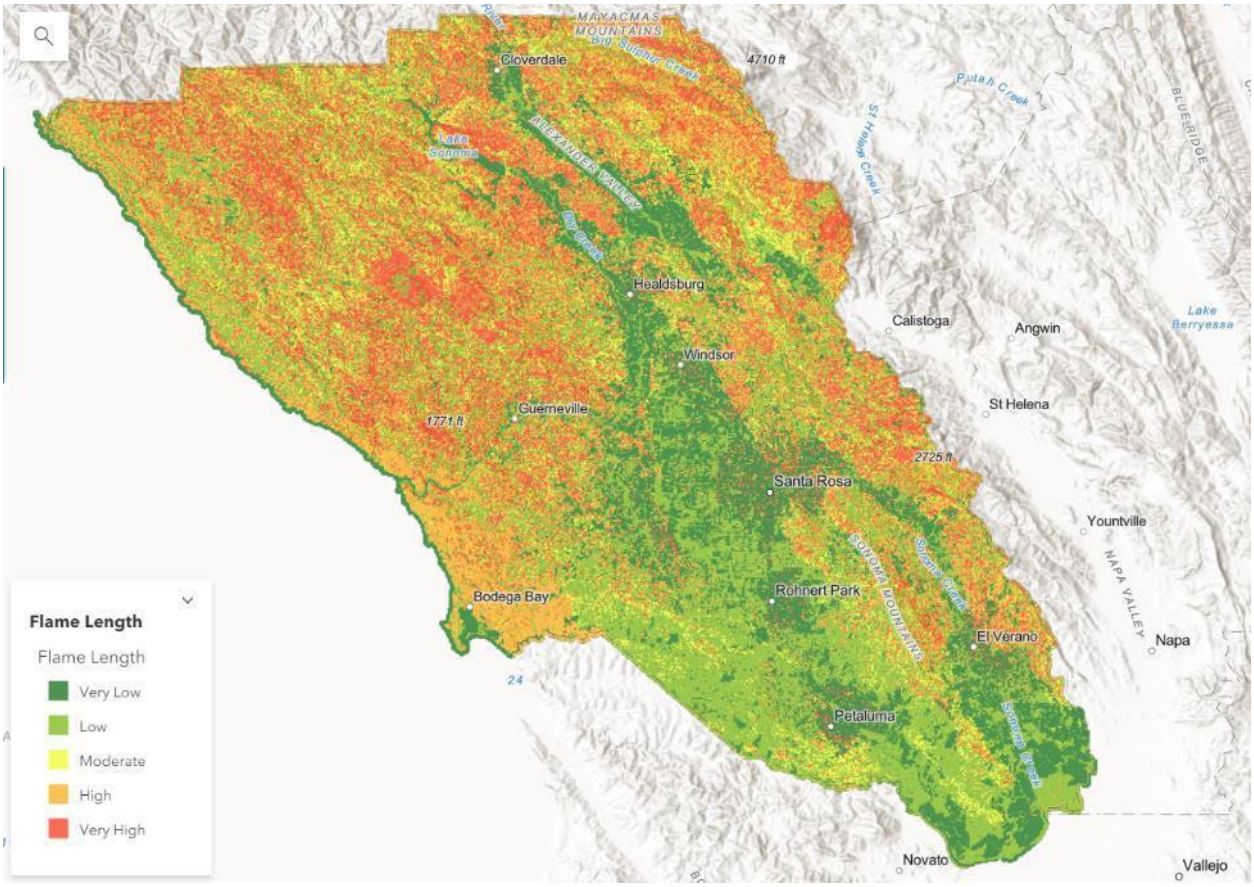

Figure 31: Resulting flame length input used in the Sonoma County Wildfire Hazard Index (Tukman, 2020)

Extreme Fire Weather Potential

Extreme fire weather potential was created by Alan Fox (Fox Weather LLC) and Tukman Geospatial. Extreme fire weather potential represents the relative potential across the county for very windy and very dry weather.

The raw data for this analysis is from NOAA's North American Regional Reanalysis (NARR). Fox Weather processed the NARR data (32 km resolution) using the Weather Research and Forecasting Model (WRF) to downscale it to 4 km resolution. The 4 km data from WRF were then downscaled to 1.5 km using Fox Weather's proprietary MtnRT software.

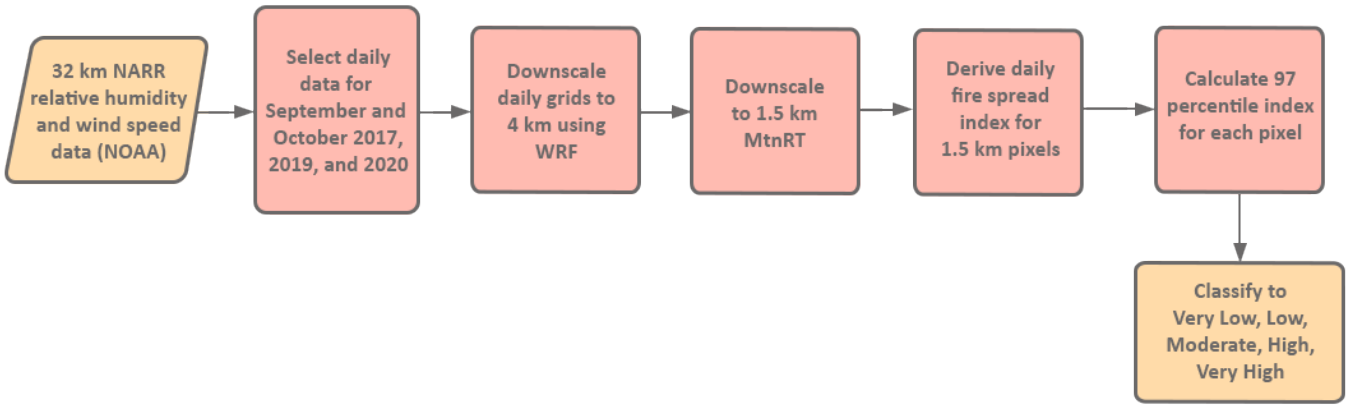

Figure 32: Workflow to create the extreme fire weather potential index for Sonoma County

The fire weather potential layer was created using a fire spread index that includes relative humidity, fuel moisture (seasonally adjusted), and wind speed. The fire spread index was calculated as per Nelson (1964).[75] Maximum daily index values were calculated for each pixel in a 1.5-kilometer pixel-resolution, county-wide raster for each day of September and October of 2017, 2019, and 2020. For each pixel, the 97th percentile index value was found for these 180 days. The resulting data was classified into 5 classes: Very Low (0), Low (1), Moderate (2), High (3), and Very High (4).

[75] Nelson, R.M., 1964. The National Fire Danger Rating System: Derivation of Spread Index for Eastern and Southern States, U.S. Forest Service Research Paper SE-13. September 1964, pp. 1-37. Pages of relevance for this report are pp. 26-34.

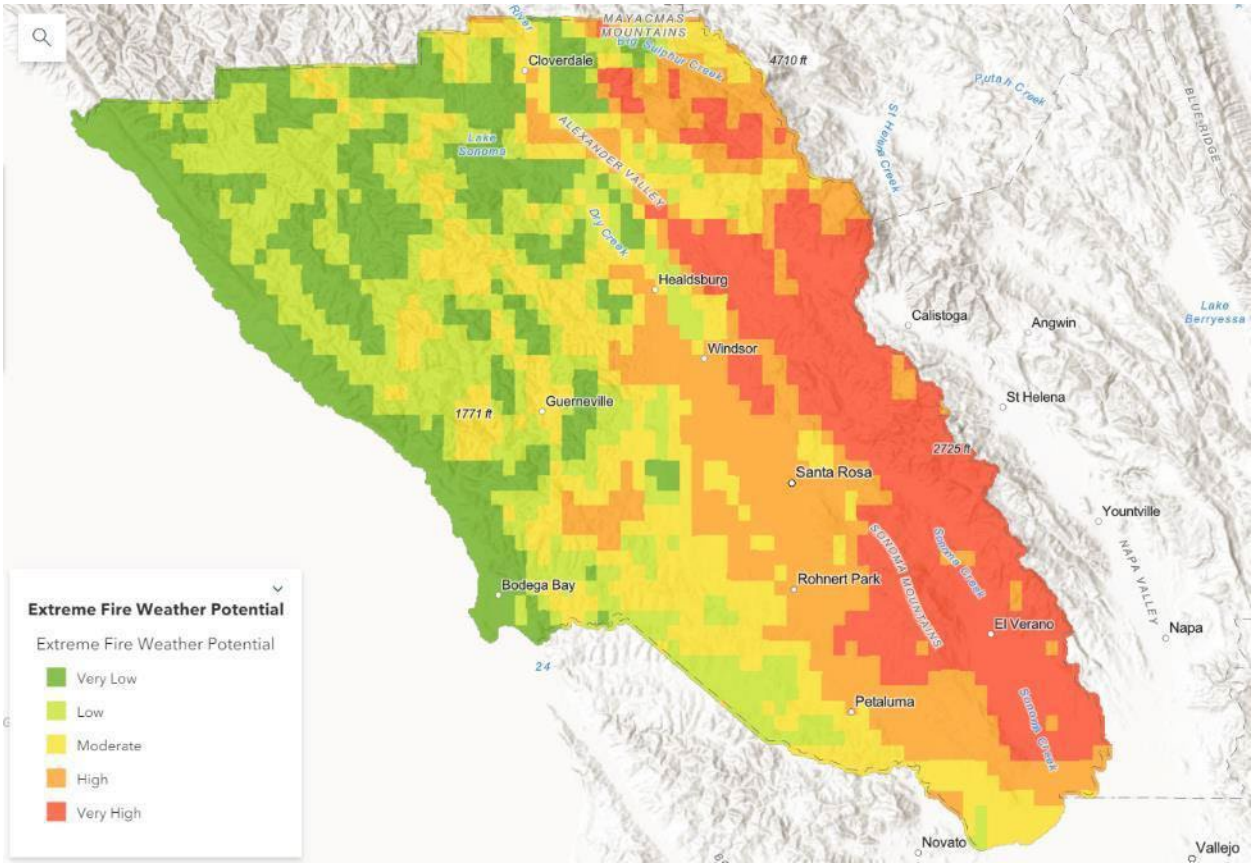

Figure 33: Resulting fire weather potential input used in the Sonoma County Wildfire Hazard Index (Tukman, 2020)

Human Development Proximity

Proximity to human development such as roads, structures, and other infrastructure increases the chance a fire will occur since many wildfires are sparked in and around these areas.

Human development proximity was derived from the 2013 Sonoma Veg Map impervious surfaces map, a fine-scale polygon map of buildings, roads, other paved areas (like parking lots), and other dirt impervious areas. Human development proximity was classified from the impervious map as follows:

Figure 34: Table, Classification for human development proximity

Distance from Impervious Feature	Class	Value
Less than 50 feet	Very High	4
50 to 200 feet	High	3
200 to 500 feet	Moderate	2
500 to 1,000 feet	Low	1
Greater than 1,000 feet	Very Low	0

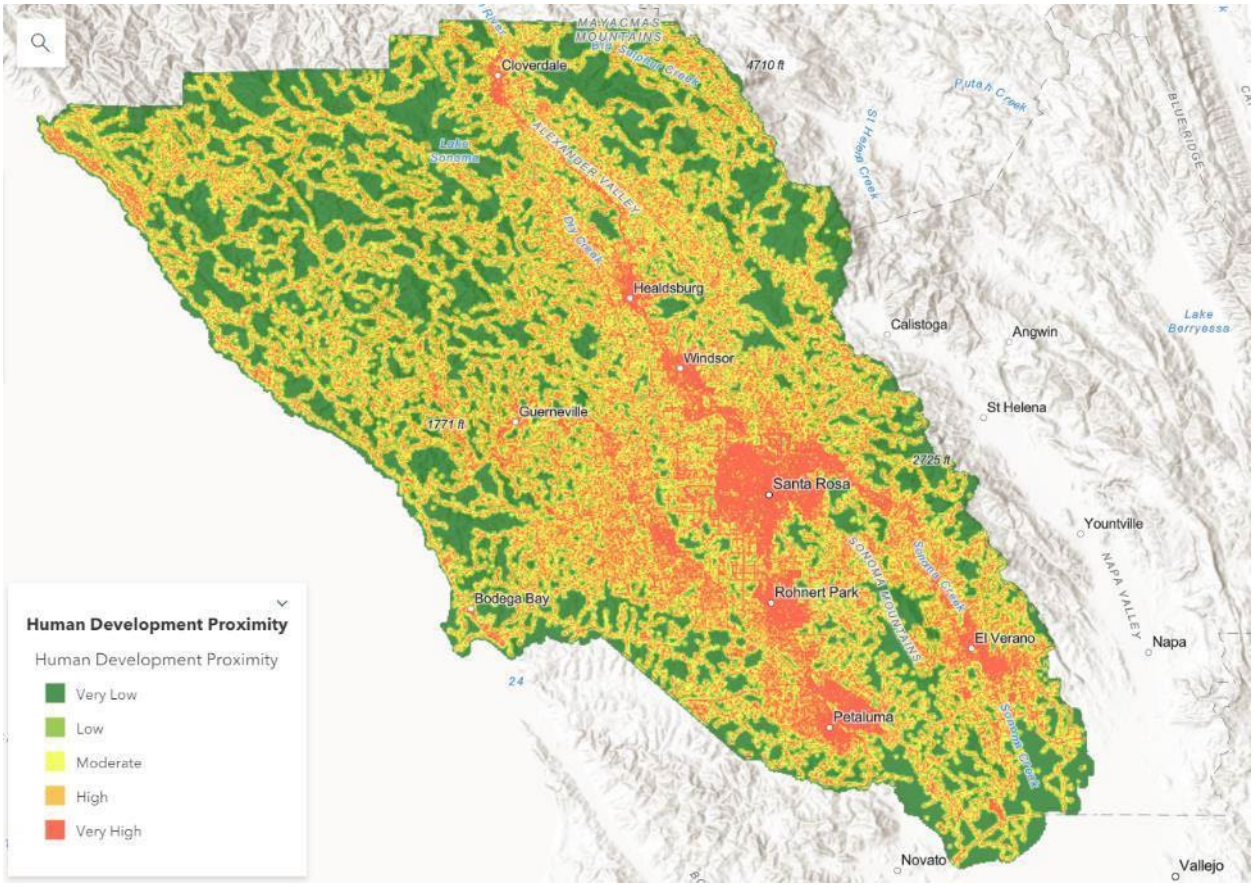

Figure 35: Resulting human development proximity input used in the Sonoma County Wildfire Hazard Index (Tukman, 2020)

Transmission Line Proximity

Proximity to transmission lines increases fire probability since some wildfires are sparked by transmission lines, especially during wind events. Higher voltage lines (greater than 100 kV) typically do not cause wildfires in Sonoma County. It is often the lower voltage transmission lines and distribution lines that spark wildfires. As power safety shut offs continue, transmission and distribution lines will likely play lesser roles in sparking wildfires, but we have still included proximity to lower voltage transmission lines (< 100 kV) as an input to the Hazard Index. Distribution line data was requested from but not provided by PG&E. Transmission line data was acquired by the California Public Utilities Commission (2018).[76] Proximity to transmission lines less than 100 kV was classified in the same manner as for human development proximity (figure below).

Figure 36: Resulting transmission line proximity input used in the Sonoma County Wildfire Hazard Index (Tukman, 2020)

[76] Geospatial data source link: https://cecgis-caenergy.opendata.arcgis.com/datasets/260b4513acdb4a3a8e4d64e69fc84fee_0 (accessed in early 2020).

Suppression Difficulty

To determine fire suppression difficulty in Sonoma County, the Suppression Difficulty Index from the USDA Forest service analysis was used. From the USDA website[77]:

(Suppression Difficulty) factors in topography, fuels, expected fire behavior under severe fire weather conditions, firefighter line production rates in various fuel types, and accessibility (distance from roads/trails) to assess relative suppression effort. For this dataset severe fire behavior is modeled with 15 mph up-slope winds and fully cured fuels. SDI has a continuous value distribution from 1-10.[78]

Their data highlight the areas in Sonoma County where it would be difficult to suppress a fire with hand crews.

Like the other inputs, we binned the suppression difficulty data into 5 classes: Very Low (0), Low (1), Moderate (2), High (3), and Very High (4).

[77] Spatial data and metadata available online here: https://www.arcgis.com/home/item.html?id=3d4a174dd1634e8e948880340f5c454 (accessed in early 2020).

[78] Rodríguez y Silva, F., J. R. M. Martínez, et al. (2014). "A methodology for determining operational priorities for prevention and suppression of wildland fires." *International Journal of Wildland Fire* 23(4): 544-55.

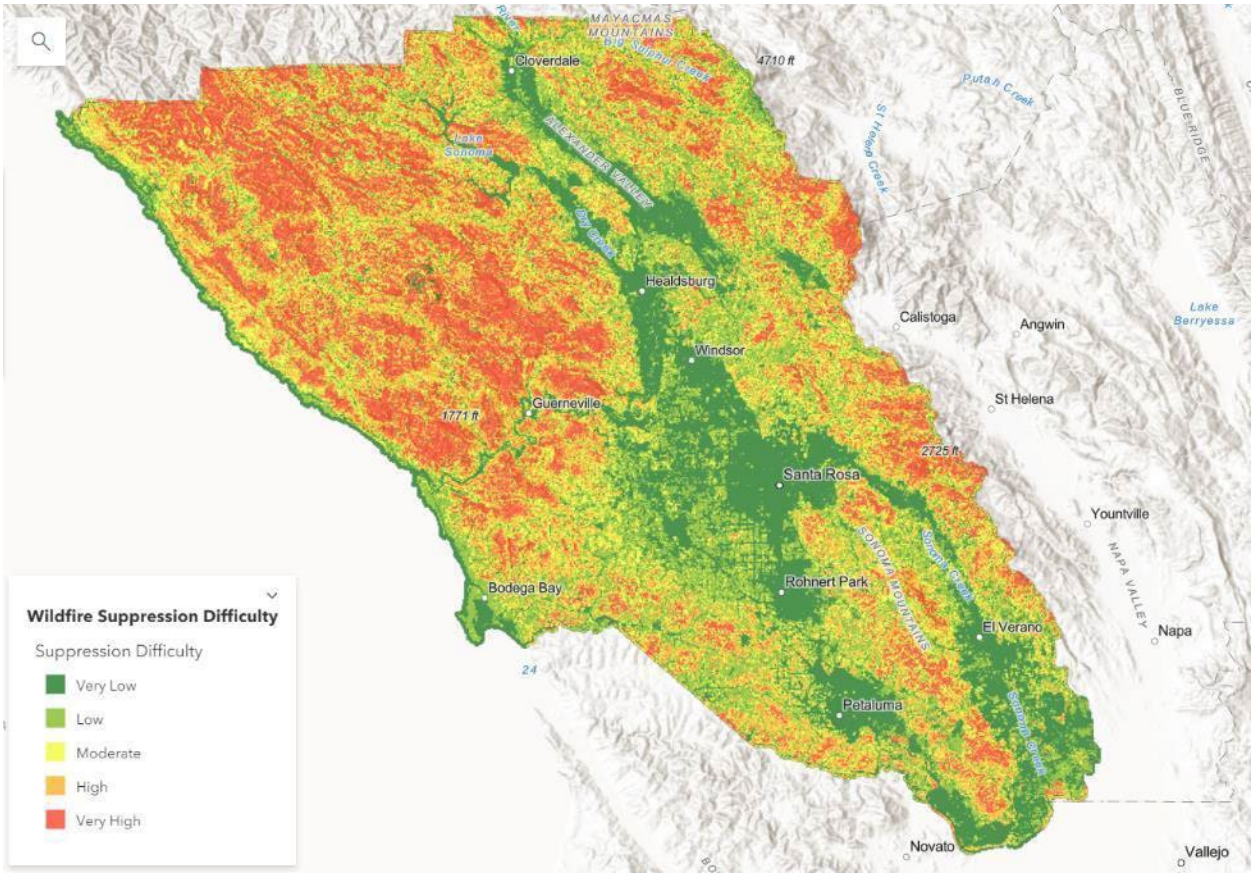

Figure 37: Wildfire Suppression Difficulty Index used in the Sonoma County Wildfire Hazard Index (USDA, 2019)

Calculating the Wildfire Hazard Index

Relative wildfire hazard was calculated by weighting the inputs and adding up the weighted inputs. Flame length was assigned a weight of 4, extreme fire weather potential and suppression difficulties were assigned weights of 2, and the other inputs a weight of 1. The highest possible index value was 40, but the highest value actually assigned to a pixel was 39. The figure below shows how a theoretical pixel value of 40 would be assigned if all inputs had a "Very High (4)."

Figure 38: Table, Theoretical maximum pixel value for the Sonoma County Wildfire Hazard Index (Tukman, 2020)

Flame Length	Extreme Fire Weather Potential	Human Development Proximity	Transmission Line Proximity	Suppression Difficulty	Wildfire Hazard Index
4 * 4 = 16	4 * 2 = 8	4 * 1 = 4	4 * 1 = 4	4 * 2 = 8	16 + 8 + 4 + 4 + 8 = 40

The resulting raster, with possible pixel values from 0 to 40, was binned into 5 classes, with class 1 representing the lowest relative hazard and class 5 the highest. The figure below shows how the reclassification occurred.

Figure 39: Table, Classification of the 0–40 wildfire hazard index into 5 classes (Tukman, 2020)

Final Hazard Class	Final Value	Unclassified Wildfire Hazard Index Value Range
Very Low Relative Hazard	1	Less than 10
Low Relative Hazard	2	10 – 15
Moderate Relative Hazard	3	15 – 20
High Relative Hazard	4	20 – 25
Very High Relative Hazard	5	Greater than 25

The map below shows the classified relative hazard index. Dark green is very low relative hazard (class1), light green is low relative hazard (class 2), yellow is moderate relative hazard (class 3), orange is high relative hazard (class 4), and red is very high relative hazard (class 5).

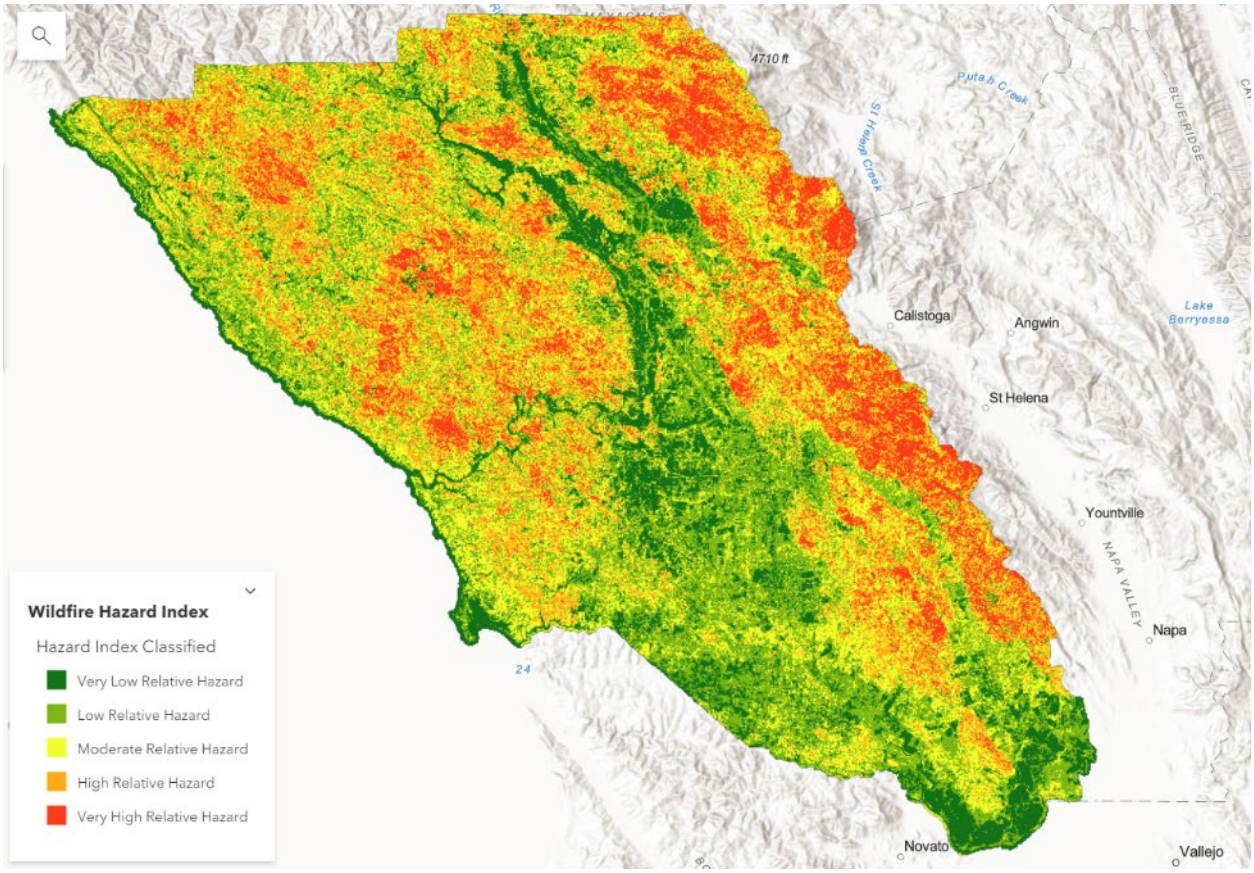

Figure 40: Sonoma County Wildfire Hazard Index (Tukman, 2020)

Wildfire Risk Index[79]

In brief, the Wildfire Risk Index (WRI) is a model that predicts **relative** wildfire risk. The index is a sum of the rankings of different wildfire hazard layers across Sonoma County. Higher index values represent a higher relative risk of wildfire.

To map the component parts of the WRI, first we broke the county into hexagons of 100-acres. This allows for an evaluation of wildfire risk at a landscape scale across the county. Each data layer used to calculate the WRI was integrated through averaging or summing the values of the layer within these 100-acre hexagons.

Conditions may vary significantly across the area of each polygon—areas of relatively low risk could exist within a polygon whose overall risk is high. For parcel level analysis, "ground truthing" to verify data and conditions is necessary. The value of the WRI is to identify overall trends, which then can be used to suggest the need for and nature of measures that can be taken to reduce risk to acceptable levels. The WRI should be viewed as a high-level analysis and is not appropriate for parcel level detail.

[79] Information regarding the Sonoma County Wildfire Hazard Index is also available online at this link: https://arcg.is/jnDTe (accessed on 11/11/2021), developed by Digital Mapping Solutions (DMS) in 2021 for the Sonoma County CWPP Update.

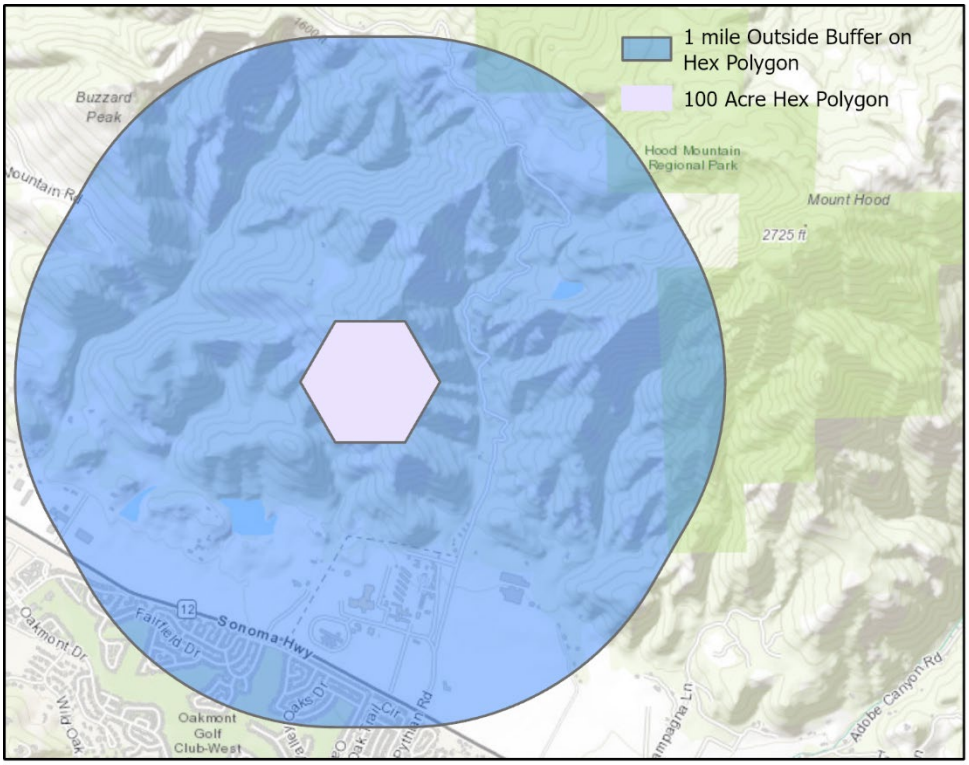

Figure 41: Buffered polygon within 1 mile of hexagon example

Additionally, an analysis was conducted for the area within 1 mile of each hexagon. This neighborhood analysis was conducted because part of what makes an area susceptible to wildfire is the susceptibility of the area that surrounds it. Therefore, the calculation of WRI is calculated by combining wildfire hazard within each 100-acre hexagon and wildland risk data for hexagons within one mile of each original hexagon. This was done by creating 1-mile 'outside only' buffer on each 100-acre hexagon, and calculating the mean Wildfire Hazard Index, Ember load index, and summed number of structures for each of the buffered polygons around the hexagons (see figure above for a sample buffer).

Many different factors contribute to wildfire risk. For this analysis, the following seven factors were considered:

1. The calculated wildfire hazard (from the Sonoma County WHI) within a hexagon.
2. Calculated wildfire hazard within 1 mile of a hexagon.

3. The likely areas embers will accumulate in a hexagon in the event of a wildfire.
4. The likely areas embers will accumulate within 1 mile of a hexagon in the event of a wildfire.
5. The presence of structural assets within a hexagon.
6. The presence of structural assets within 1 mile of a hexagon.
7. Relative usability of the road network in Sonoma County.

The figure below shows each layer, the range of values for the WRI, the index of what the values represent numerically, and the data source and date. It is important to note that while the WRI inputs were curated from best available data sources for Sonoma County, not all data sources reflect current conditions in recent fire footprints or landscape changes.

Figure 42: Table, Values assigned to original values from source layers used in the WRI

Layer	Range of Values for WRI	Indexed (Classed) Values	Data Source
Average Wildfire Hazard Index within Hexagon	1 - 5	From original Sonoma Hazard Index (SHI)	Tukman Geospatial, 2017
Average Wildfire Hazard Index with 1 mile	1 - 5	From original SHI	Tukman Geospatial, 2017
Average Ember Load Index within Hexagon	1 - 5	1 = 0.0 - 0.010938 embers 2 = 0.010939 - 0.049328 3 = 0.049329 - 0.115828 4 = 0.115829 - 0.309938 5 = 0.309939 - 4.243569	Pyrologix, 2019
Average Ember Load Index within 1 mile	1 - 5	1 = 0.000007 - 0.020741 2 = 0.020742 - 0.056753 3 = 0.056754 - 0.118581 4 = 0.118582 - 0.324956 5 = 0.324957 - 3.788691	Pyrologix, 2019
Number of Structures within Hexagon (indexed)	0, 1 - 5	0 = 0 (no structures) 1 = (not assigned) 2 = 1 – 3 structures 3 = 4 - 10 4 = 11 - 37 5 = 38 - 582	Microsoft, 2019-2020
Number of Structures within 1 mile (indexed)	0, 1 - 5	0 = 0 (no structures) 1 = 1 - 8 structures 2 = 9 - 38 3 = 39 - 138 4 = 139 - 565 5 = 566 - 9806	Microsoft, 2019-2020

Layer	Range of Values for WRI	Indexed (Classed) Values	Data Source
Road Network Rank	1 - 5	From county data original layer	Sonoma County, 2020

The following describes each layer in detail.

Wildfire Hazard Index

As discussed in the previous section, the WHI takes into consideration the available wildland fuels to burn, the potential for extreme weather, the proximity to ignition sources, and the relative suppression difficulty.

For each 100-acre hexagon in Sonoma County, the average WHI was assigned. In addition, the average WHI surrounding each hexagon up to 1 mile was assigned to each hexagon.

The average WHI in each 100-acre hexagon and in the hexagons 1 mile buffer are classed into five categories: 1 (green) is low hazard, 2 (yellow) is moderate hazard, 3 (orange) is high hazard, 4 (orange/red) is very high hazard, and 5 (red) is extreme hazard.

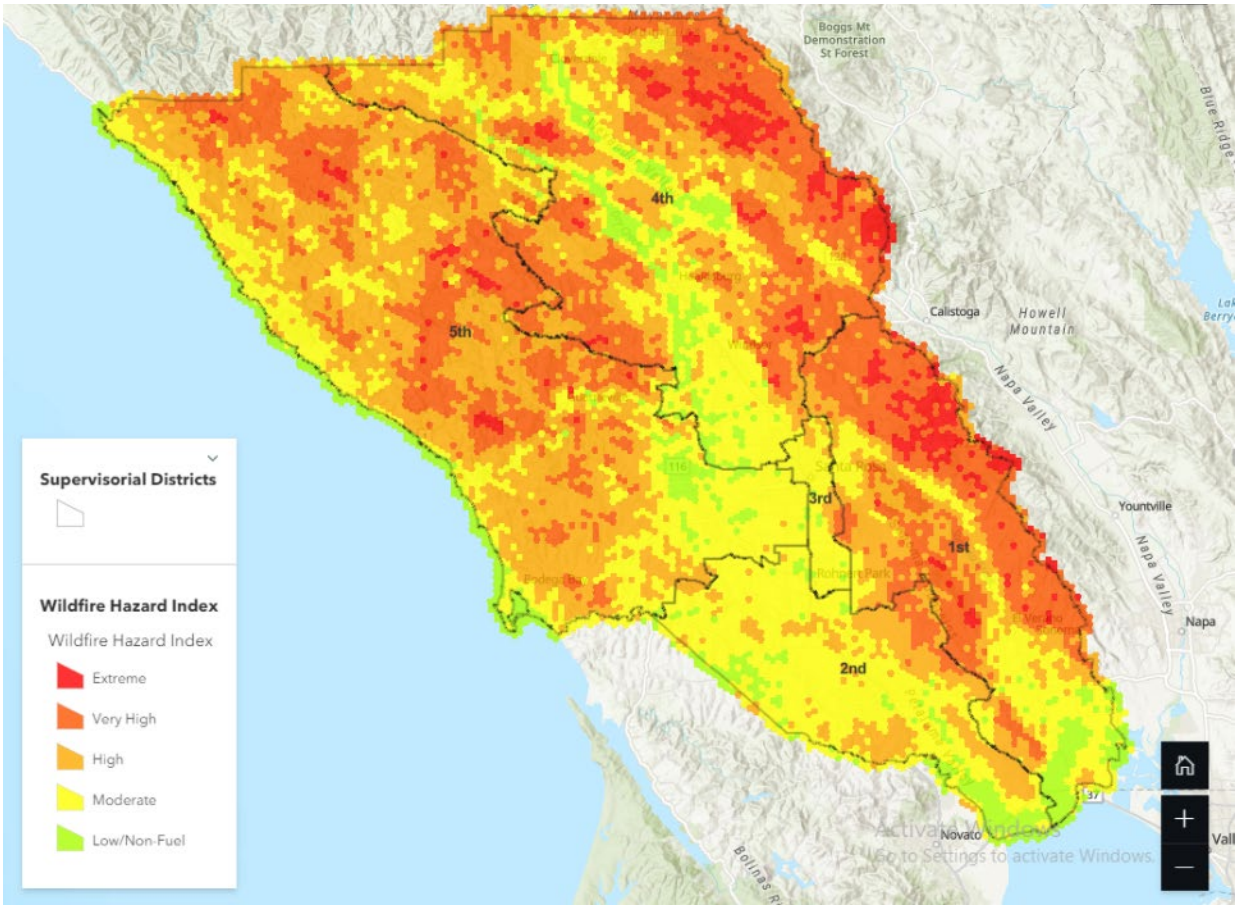

Figure 43: Wildfire Hazard Index assigned to 100-acre hexagons in Sonoma County (DMS, 2021)

Ember Load Index

Developed by Pyrologix for the entire state of California, the Ember Load Index[80] (ELI) is based on surface and canopy fuel characteristics, climate, and topography and incorporates downwind ember travel. The index also incorporates burn probability.

The model can only estimate embers created by trees and brush (wildland) fuels. To date, a good model of embers produced by burning structures is not available. In urban areas, the embers produced by burning buildings will have

[80] Vogler, Kevin C., et. al., Contemporary Wildfire Hazard Across California, prepared by Pyrologix for the Pacific Southwest Region, USDA Forest Service. Online link: http://pyrologix.com/reports/Contemporary-Wildfire-Hazard-Across-California.pdf (accessed on 11/11/2021).

the potential to influence fire spread, yet this value is not represented in this model.

The ELI can help identify priority areas where hardening buildings may be needed to resist ignition, yet recent fire behavior indicates that it is important for *all* Sonoma County residents to undertake structure hardening, regardless of the ELI.

Even so, this layer was included to help quantify where in the county embers would accumulate. The lower the value, less accumulated embers and a lower burn probability are expected. The higher the value, more accumulated embers and a higher burn probability are expected.

This layer is also classed into five categories: 1 (brown) is low representing 0-0.01938 embers, 2 (orangish) is moderate representing 0.010939 - 0.0493283 embers, 3 (yellow/orange) is high representing .049329 - 0.115828 embers, 4 (teal) is high representing 0.115829 - 0.309938 embers, and 5 (dark teal) is extreme representing 0.309939 - 4.243569.

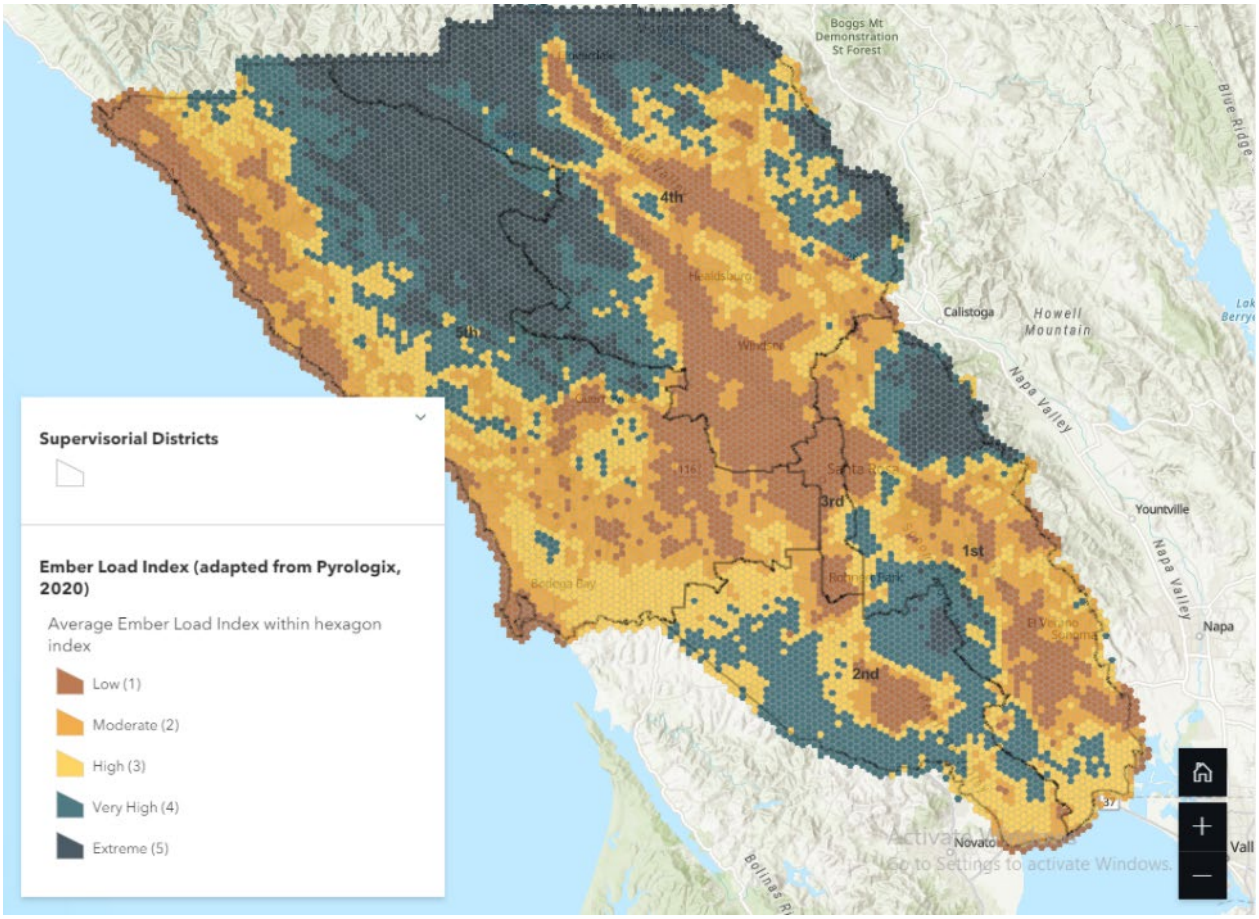

Figure 44: Ember Load Index from Pyrologix assigned to 100-acre hexagons in Sonoma County (DMS, 2021)

Structure Density

The structure density is a count of all structures found within each 100-acre hexagon. The counts were then classed into five quantiles and assigned a number from 1 through 5.

These classes represent the following number of structures: 0 (no color) represents no structures were found within the 100-acre hexagon, 2 (light cyan) 1 to 3 structures were found, 3 (dark yellow) 4 - 10 structures were found, 4 (light brown) 11 to 37 structures were found, and 5 (dark brown) represents over 38 structures were found.

Like the ELI and WHI layers, structure density for hexagons within 1 mile was also calculated. The number of structures within hexagons within 1 mile were

summed and assigned a number from 0 to 5. 0 represents no structures, 1 represents 1-8 structures, 2 represents 9-38 structures, 3 represents 39-138 structures, 4 represents 139- 565 structures and 5 represents 566 structures and greater.

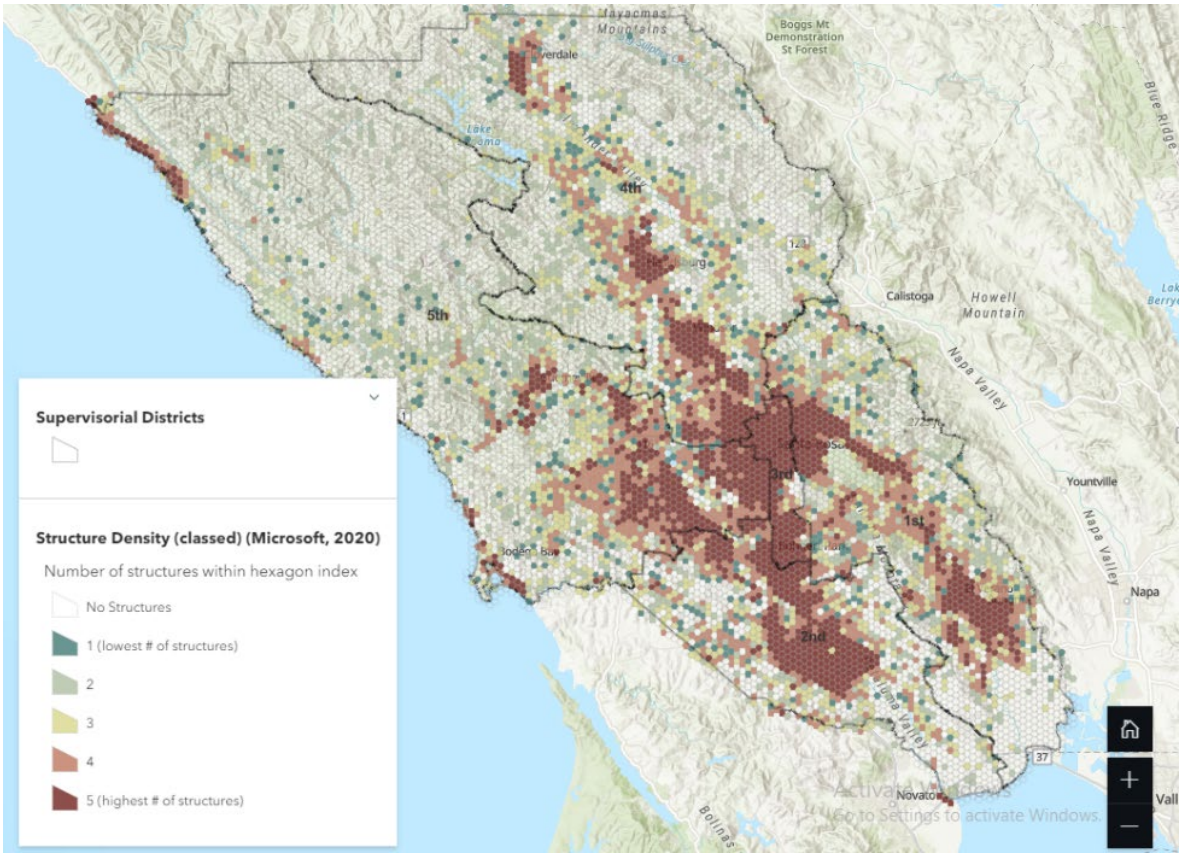

Figure 45: Structure count classified, and values assigned to each 100-acre hexagon in Sonoma County (DMS, 2021)

Road Network Rank

Lastly, we included a Road Network Rank developed by Sonoma County's GIS department in which they analyzed street network data in order to quantify the street accessibility within the county.

These values are based on road density, number of roads into and out of a community, and speed limits. The road network rank was developed by Kevin

Lacefield of Sonoma County's ISD for a preliminary evacuation analysis (completed in 2019).[81]

To incorporate Road Network Rank into the WRI, we took the Road Network layer and averaged the mean value of pixels within each hexagon and divided up the resulting index from the original layer. 5 represents the lowest accessibility of roads and 1 represents areas with the highest accessibility of roads.

Note that the road network rank does not impact an individual property's or project's compliance with Sonoma County Fire Safe Standards (Chapter 13, Section V) or Board of Forestry Fire Safe Regulations. The road network rank provides a high-level analysis, whereas the local standards and state regulations govern site-specific parameters and access.

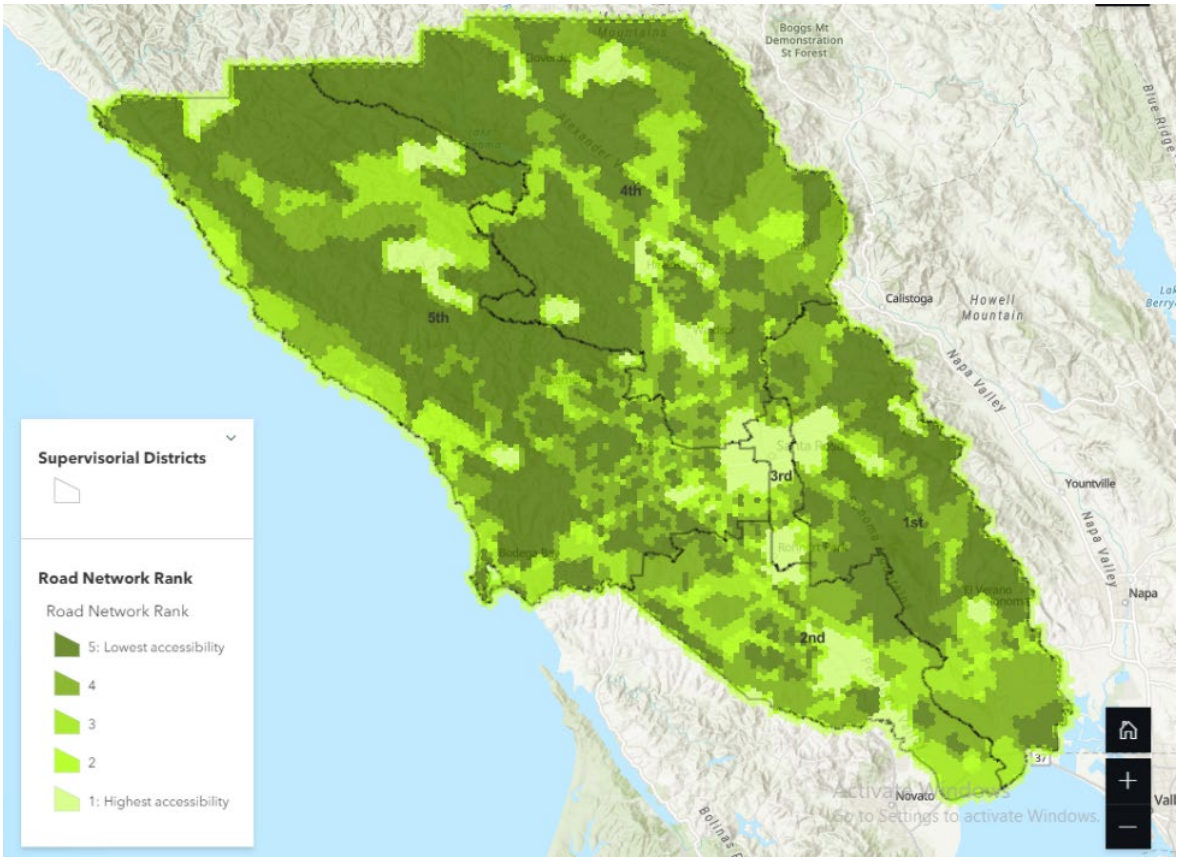

Figure 46: Road network rank assigned to each 100-acre hexagon in Sonoma County (DMS, 2021)

[81] Online data source link: https://sonomacounty.maps.arcgis.com/apps/webappviewer/index.html?id=b7503e404065421e8fd53ca17cbb9c21 (accessed in August 2021).

Calculating Wildfire Risk

Relative wildfire hazard was calculated by simply adding up all nine inputs. Each was classed from 1 to 5 for a total range of 1 to 45. No hexagons got a 1 ranking (lowest is 7) and none got a 45 ranking (highest is 43).

The average WHI in each 100-acre hexagon in Sonoma County are classed here into five categories: 1 (green) is low hazard, 2 (yellow) is moderate hazard, 3 (orange) is high hazard, 4 (orange/red) is very high hazard, and 5 (red) is extreme hazard.

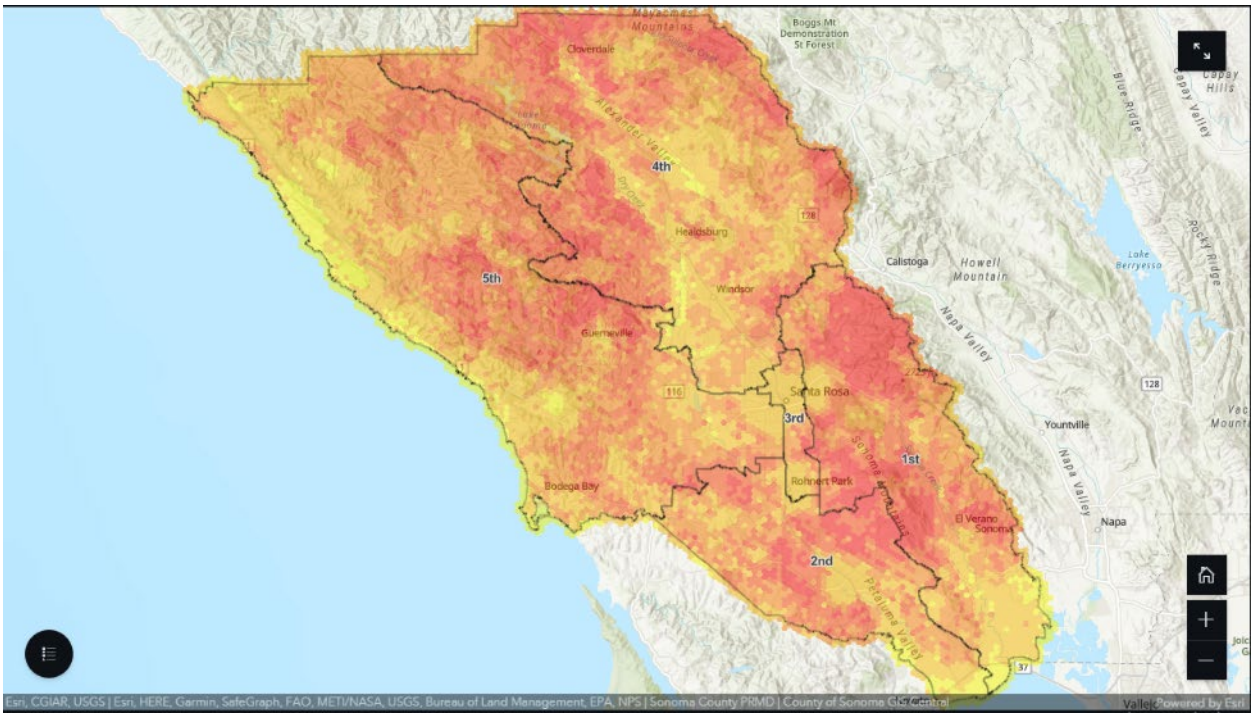

Figure 47: Wildfire Risk Index developed for Sonoma County based on the Wildfire Hazard Index and other factors (2021)

The most at-risk areas are concentrated in the Mayacamas Mountains, both in the northern and southern parts of the county along the county boundary as well as areas surrounding Cloverdale and Lake Sonoma. In addition, the Sonoma Mountain area ranked high as did areas north of the Russian river and southwest of Petaluma.

This result, the WRI, can be used to help prioritize projects within Sonoma County as part of the CWPP Project List.

Ember Load Index

This section details the development of Pyrologix's Ember Load Index (ELI) data layer.[82]

To estimate wildfire characteristics across California, Pyrologix used a scripted geospatial modeling process called WildEST (for Wildfire Exposure Simulation Tool). WildEST uses the command-line version of FlamMap to perform 216 basic deterministic simulations of fire behavior characteristics for a range of weather types (combinations of wind speed, wind direction, fuel moisture content). Additionally, they integrate the dead fuel moisture conditioning feature of FlamMap, so dead fuel moisture content is sensitive to canopy cover and topography (slope, aspect, and elevation). Pyrologix also uses pre-calculated Wind Ninja grids representing terrain-adapted wind speed and direction. These grids were generated at 120-m resolution then up-sampled to 30-m resolution before use in FlamMap. Rather than weighting the 216 results solely according to the temporal relative frequencies (TRFs) of the weather types, the WildEST process integrates results by weighting them according to their weather type probabilities (WTP), which gives higher weight to high-spread conditions into the calculations.

The majority of WildEST results apply to the head of the fire. However, for use in fire-effects calculations, WildEST also generates Flame-Length Probability rasters (FLPs) that incorporate non-heading spread directions[83], for which fire intensity is considerably lower than at the head of the fire. These "fire-effects FLPs" or "NVC FLPs" are analogous to FLP produced by FSim. Pyrologix used this weather type probability (WTP) weighting process in WildEST to produce headfire characteristics (e.g., mean flame length), fire-type probability, ember characteristics, and non-heading characteristics (for use in an effects analysis). Together, these data are useful for mapping the fire behavior that characterizes each pixel on the landscape.

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[82] Copied directly from http://pyrologix.com/reports/Contemporary-Wildfire-Hazard-Across-California.pdf (accessed on 11/11/2021).

[83] Scott, Joe H. 2020. "A deterministic method for generating flame-length probabilities. Proceedings of the Fire Continuum: Preparing for the future of wildland fire"; 2018 May 21-24; Missoula, MT. U.S. Forest Service RMRS P-78.

Ember Characteristics

The WildEST modeling contains a module for producing indices of conditional and expected ember production and load.

The Conditional Ember Production Index (cEPI) is an index of the relative number of embers lofted at a given landscape pixel given the fire environment there, given that a fire occurs. Ember Production Index (EPI) is the expected value of cEPI; it is the expected annual relative number of embers lofted from a given landscape pixel.

The Conditional Ember Load Index (cELI) is a relative index of the relative number of embers that land at a given landscape location, including non-burnable pixels. Finally, Ember Load Index combines the conditional ELI and the likelihood of that ember load occurring. All ember characteristics are based on headfire behavior.

Ember Load Characteristics

The ember load indices represent relative ember load at a pixel. Similar to ember production, ember load is also based on surface and canopy fuel characteristics, climate, and topography at the pixel. Ember load incorporates downwind ember travel. The conditional Ember Load Index (cELI) does not account for burn probability and can be used to identify where on the landscape hardening buildings to resist ember ignition may be needed. The Ember Load Index (ELI) incorporates burn probability; however, ELI is not simply the multiplication of condition ember load (cELI) and burn probability (BP). Rather, BP is incorporated into calculations of the ember production before the distribution of embers across the landscape to determine ember load. Given that ELI incorporates burn probability, this index can be used to identify where on the landscape hardening buildings may be needed to resist ignition and the priority for doing so according to the likelihood of the area being visited by fire.

D. CWPP Process, Public Workshops and Meeting Notes

This appendix contains online links to the meeting summaries and notes from the public outreach and engagement activities conducted for this CWPP Update. Also included are links to the Steering Committee meeting recordings and minutes (if available).

Public Outreach and Engagement

Figure 48: Table, Public input workshop and CWPP review events and dates

Meeting Title	Date Held	Meeting Summary
Public Kick-off Meeting	2/16/2021	Link
Public Input Workshop – District 1	4/7/2021	Link
Public Input Workshop – District 2	4/14/2021	Link
Public Input Workshop – District 3	4/22/2021	Link
Public Input Workshop – District 4	5/12/2021	Link
Public Input Workshop – District 5	5/6/2021	Link
Public CWPP Review – District 1	1/20/2022	Link
Public CWPP Review – District 2	1/13/2022	Link
Public CWPP Review – District 3	1/19/2022	Link
Public CWPP Review – District 4	1/26/2022	Link
Public CWPP Review – District 5	1/27/2022	Link
Public CWPP Review – Spanish Speaking	2/16/2022	N/A

Zoom recordings of most meetings are available upon request.

Values at Risk Detail

Because the data were so varied, subtypes were designated for further categorization, and are described below.

1. Safety and Security – described as Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
    a. Fire Stations
    b. Water Storage

2. Food, Water, Shelter, Agriculture
    a. Agriculture
    b. Community (i.e., entire communities, businesses, or key community facilities)
    c. Historic Feature
    d. Homes and People
    e. Infrastructure
    f. Livestock
    g. Pets
    h. Schools
    i. Vulnerable Populations (i.e., persons of advanced age, assisted-care facilities, persons without a home, persons with a disadvantage, etc.)
    j. Wastewater Infrastructure
    k. Water Infrastructure
    l. Winery
3. Health and Medical – including Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
4. Energy – including Power Grid and Fuels
5. Communications – including Infrastructure, Responder Communications, Alerts, Warnings, and Messages, Finance, 911 and Dispatch
6. Transportation – including Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
    a. Aviation
    b. Bridges
    c. Fire Roads
    d. Roads
    e. Trains
7. Hazardous Material - Facilities, HAZMAT, Pollutants, Contaminants
8. Natural Resources
    a. Watershed
    b. Forest Health
    c. Ecosystem Health
    d. Wildlife Habitat

This further categorization shows that while Homes and People were highly valued (as expected), Watershed, Community, and Roads got over 50 votes each. This shows that participants highly valued the watershed/forest/wildlands itself and were equally concerned about access.

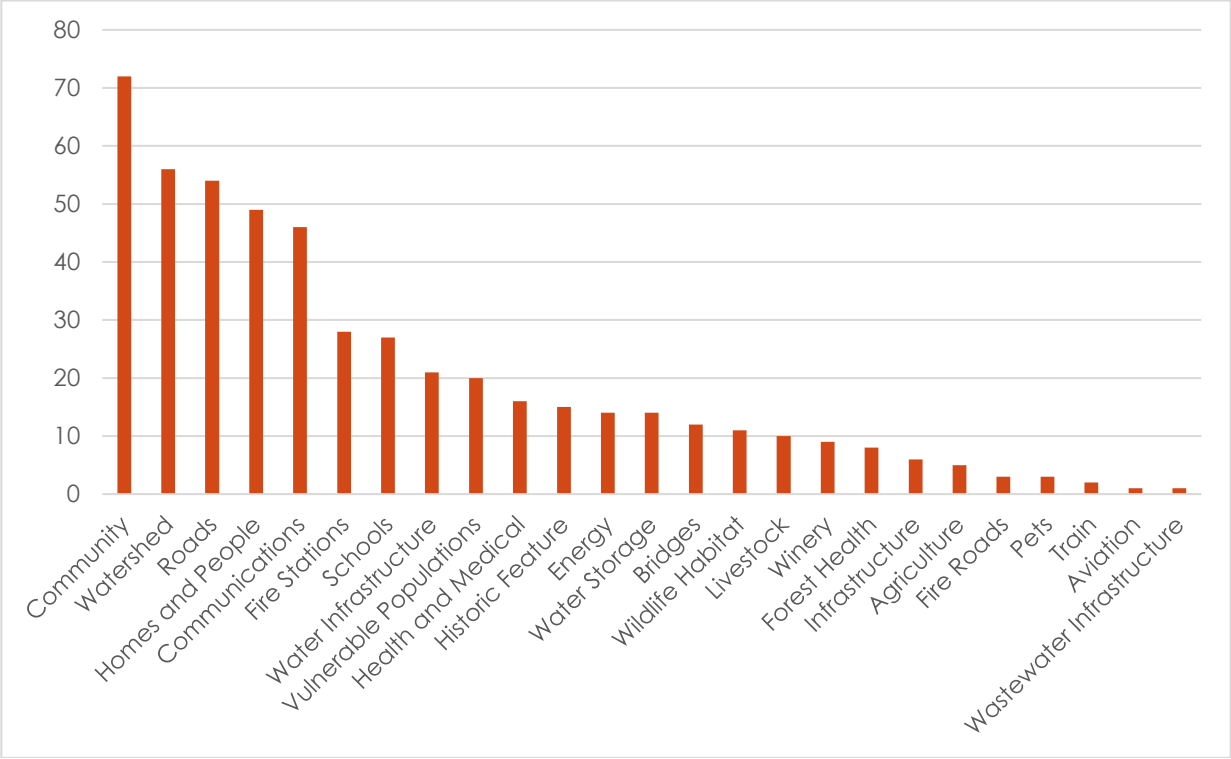

Figure 49: Tally of votes by sub-type category for each value identified during the Sonoma County CWPP public workshops

Recommendations by Supervisory District

During the development of this CWPP, we solicited input from community members at 11 virtual public-input workshops. Most of the concerns and values expressed during these meetings were incorporated into the following recommendations.

District 1

- Community meetings in all neighborhoods, including AFN and low-income.
- Additional educational resources in languages used by AFN and low-income residents.

- Home-hardening resources for AFN and low-income residents.

District 2

- Bilingual outreach materials for ranchers and workers.
- Additional educational resources in languages used by AFN and low-income residents concerning safe fuels reduction (time of day, equipment use).
- Easily accessible mapping of evacuation egress routes.
- Home-hardening resources for AFN and low-income residents.

District 3

- Structure hardening and house-retrofitting resources for AFN and low-income residents.
- Education and outreach using a variety of media platforms (i.e., radio).
- Protection of vulnerable populations including the disabled, elderly, low-income, and AFN.

District 4

- Home-hardening education and resources in multiple languages.
- Better public notification of evacuation routes.
- Improved cell service in shadow areas.
- Evacuation plans and drills for all residents.

District 5

- Local communication efforts with the community (i.e., grassroots radio groups, more county support for all residents).
- Community board or email list for sharing resources among neighbors.

The equity concerns raised by workshop attendees were incorporated into the

Project Ranking Tool. An extra point is given to projects that consider demographic trends of residents, persons with disabilities, AFN, and low-income populations, increasing the project's priority. Specific CWPP recommendations were added to address equity disparities in education and resource availability.

Steering Committee

Figure 50: Table, Steering Committee meeting events and dates

Meeting Title	Date Held	Meeting Agenda	Meeting Minutes
Steering Committee Kick-off Meeting	1/14/2020	Link	Unavailable
Steering Committee Meeting 1	3/1/2021	Available Upon Request	Available Upon Request
Steering Committee Meeting 2	6/3/2021	Available Upon Request	Available Upon Request
Steering Committee Meeting 3	10/28/2021	Available Upon Request	Available Upon Request
Steering Committee Meeting 4	Feb 2022	Available Upon Request	Available Upon Request
Steering Committee Meeting 5	Apr 2022	Available Upon Request	Available Upon Request
Steering Committee Meeting 6	10/24/2022	Available Upon Request	Available Upon Request

Zoom recordings of most meetings are available upon request.

E. Wildfire History

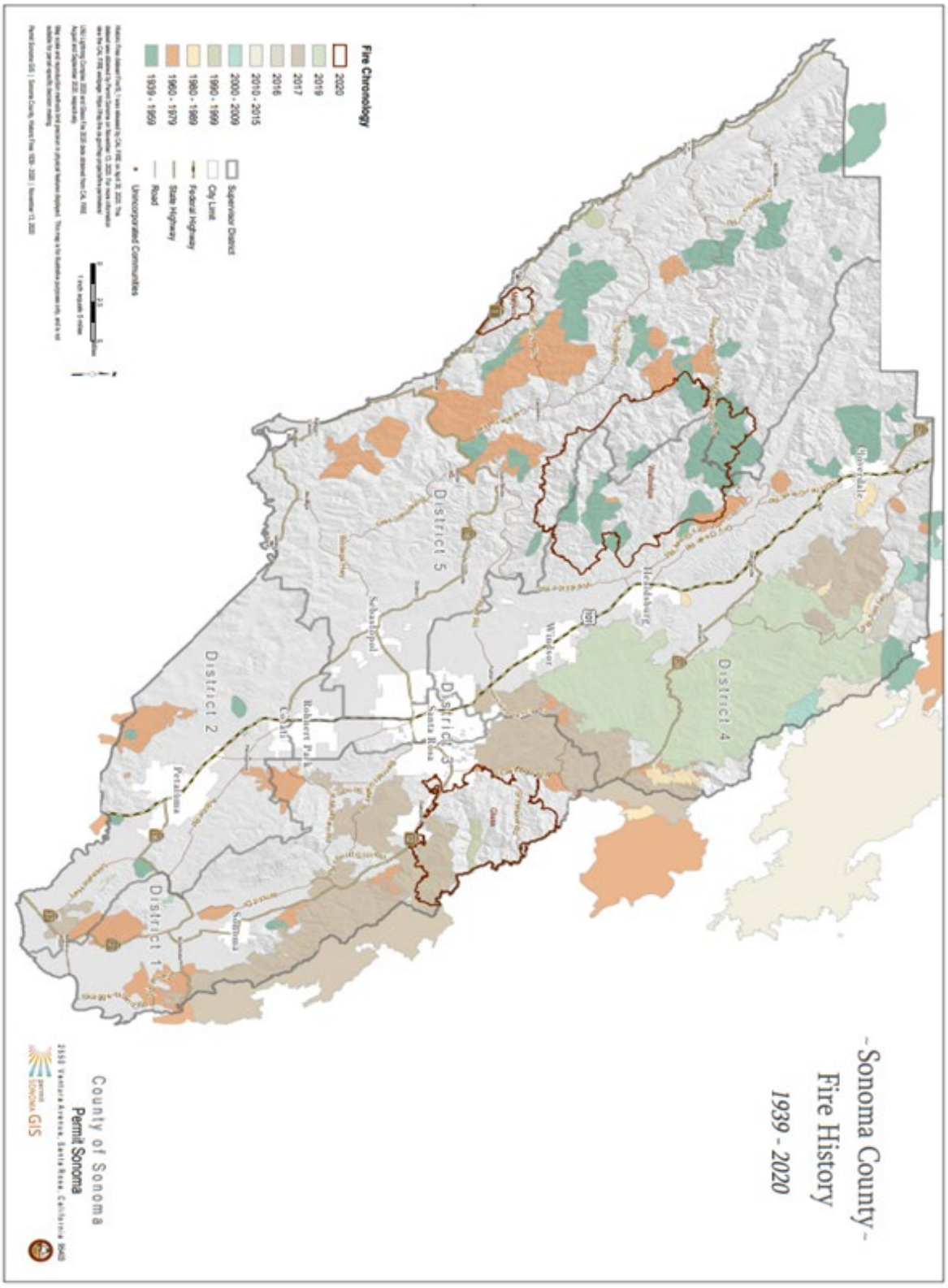

Figure 51: Sonoma County fire history, 1939-2020

1964 Nuns Canyon Fire

The Nuns Canyon fire in the Sonoma Valley started on the same day as the Hanley fire and burned for six days. By the third and fourth days, the fire had burned 9,500 acres and reached Highway 12 and Boyes Hot Springs. By the sixth day, when the fire was brought under control, it had destroyed 27 homes and affected more than 10,000 acres.

1964 Hanley Fire

The Hanley fire started on September 19, 1964, on the Hanley property off Highway 29 on the slopes of Mt. St. Helena in Napa County. By the end of the next day, firefighters had contained the fire, but late in the night, winds drove the flames down the slopes to encircle Calistoga on two sides. Several homes on the perimeter of town were burned. On the third day, an ember ignited a spot fire on the ridge west of Highway 128 between Calistoga and Kellogg, in Sonoma County. The fire then raced into Knights Valley and turned southward into Franz Valley. By nightfall, the fire, driven by 70-mph winds, headed down Mark West Canyon toward Santa Rosa. The Sonoma County Hospital on Chanate Road was threatened, with embers falling on the rooftop, and 40-foot-high flames in nearby trees. To the east, the fire burned over the hills and down into the Rincon Valley area, where it was again stopped. The fire was not brought under control until the morning of September 26. The 52,000-acre fire destroyed 84 homes and 24 summer cabins, a number which seems very small in comparison with the thousands lost when fire burned in a nearly identical footprint in 2017. No human lives were lost during the Hanley fire.

2004 Geysers Fire

A number of fires have ignited in the area known as the Geysers. A fire on Labor Day weekend 2004 burned 12,500 acres in the Mayacamas Mountains in Sonoma and Lake counties over a five-day period, cost more than $14 million to suppress, and caused over $10 million in property damage. The fire consumed six cabins and destroyed equipment and vehicles belonging to several

companies operating in the area, including Calpine Corp., PG&E, and AT&T. Firefighters were able to save pumping stations and geothermal power plants worth hundreds of millions of dollars. The 2004 *Sonoma-Lake-Napa Fire Management Plan* indicated that vegetation management was one of the primary reasons the geothermal facilities were not destroyed.

2015 Valley Fire

The Valley fire was located mainly in southern Lake County but moved into Sonoma County, where it burned 5,000 acres near the Geysers and destroyed four steam-cooling towers at the Calpine geothermal facility. Starting on September 12, 2015, the fire burned 76,067 acres and destroyed 1,958 structures, An additional 93 structures were damaged. There were four civilian fatalities, and four firefighters were injured.

2017 Sonoma Complex Fires – Tubbs, Nuns, and Pocket

On October 8, 2017, an historic wind event led to the worst firestorms in Sonoma County history, followed by almost three weeks of fire. In total, the Nuns, Tubbs, Pocket, and Young fires (together comprising the 2017 Sonoma Complex fire) claimed 24 lives, burned over 110,700 acres in Sonoma, Napa, and Lake counties, and destroyed 6,997 structures with total direct losses exceeding $7.8 billion. The following sections describe the three main fires in the complex that affected Sonoma County.

Tubbs Fire

The Tubbs fire was the most destructive wildfire in California history when it occurred, burning parts of Napa, Sonoma, and Lake Counties. The worst fatalities and property losses were in the cities of Santa Rosa and Windsor. Starting on October 8 near Calistoga, the Tubbs fire was one of more than a dozen large fires that broke out in early October 2017 and simultaneously burned in eight northern California counties. Though containment was not achieved until October 31, the worst losses occurred within 4 to 6 hours of

ignition, as extreme winds pushed the fire from Calistoga through Windsor and eastern Santa Rosa, ultimately crossing four lane Highway 101 to destroy much of the Coffey Park area in western Santa Rosa. Estimated to have burned 36,810 acres, the fire destroyed more than 5,643 structures, half of which were homes in Santa Rosa. Santa Rosa's economic loss from the Tubbs fire was estimated at $1.2 billion, with 5% of the city's housing stock destroyed. The fire incurred $100 million in fire-suppression costs.

Nuns Fire

The Nuns fire broke out in a field in the community of Glen Ellen when strong winds knocked an alder tree into a powerline conductor. It merged with five other fires that together burned an area larger than the city of Oakland. It burned 56,556 acres and destroyed about 1,527 structures before being contained on October 31, 2017.

Pocket Fire

The Pocket fire started on October 9, 2017 and was contained on October 31, 2017. It burned 17,357 acres within Sonoma County.[84] Starting as a vegetation fire near Pocket Ranch Road east of the community of Geyserville, the fire was reported to have destroyed six structures and damaged two others.[85]

2019 Kincade Fire

The Kincade fire started northeast of Geyserville in the Mayacamas Mountains on October 23, 2019 and burned 77,753 acres and 371 structures before it was fully contained on November 6, 2019. The fire threatened over 90,000 structures and caused widespread evacuations (198,785 residents) throughout Sonoma County, including the communities of Geyserville, Healdsburg, and Windsor. The

[84] Wildfire Today, 2018. Gabbert, B., *One year later, looking at the disastrous Northern California wildfires*. Online article: https://wildfiretoday.com/tag/pocket-fire/ (accessed on 12/5/2021).
[85]CAL FIRE, 2017. CAL FIRE Investigation Report, 17 CALNU 010057, Incident investigator: Jeremy Ward. Online report: http://s1.q4cdn.com/880135780/files/doc_downloads/2019/05/LE-80-17CALNU010057_Redacted.pdf (accessed on 12/5/2021).

majority of Sonoma County and parts of Lake County were under evacuation warnings. The fire was the largest of the 2019 California wildfire season, and the largest ever in Sonoma County.

2020: LNU Lightning Complex Fire

Early on August 16, 2020, following a series of very hot days, thunderstorms hit California. Within the next 72 to 96 hours, over 12,000 lightning strikes were recorded over Northern California. These lightning strikes sparked up to 585 wildfires, many of which grew to be very large at a rapid pace due to parched conditions.[86]

The Sonoma Lightning Complex, consisting of the Walbridge fire (55,209 acres) and Meyers fire (2,616 acres), burned 61,875 acres and 303 structures within Sonoma County. At the same time, in the Sonoma-Lake-Napa CAL FIRE Unit (LNU), the Hennessey fire consumed 305,651 acres and caused six fatalities. Firefighting resources were so stretched by the more than 500 wildfires burning across the state during the 2020 lightning siege that each engine company assigned to the fires in Sonoma County was responsible for more than 700 acres.[87]

2020 Glass Fire

The 2020 Glass fire burned 67,484 acres and 616 structures in Sonoma County, threatening urban neighborhoods in eastern Santa Rosa, and prompting large-scale evacuations from Santa Rosa to Glen Ellen. The Glass fire sparked in Napa Valley early on Sunday, September 27, 2020, growing at a rate of around 1 acre every five seconds between Sunday night and Monday morning, according to satellite images from the National Oceanic and Atmospheric Administration. An

[86] Wikipedia, 2021. "August 2020 California lightning wildfires." Wikipedia website page accessed at https://en.wikipedia.org/wiki/August_2020_California_lightning_wildfires.

[87] Nicholls, Ben. 2020. Personal communication with CAL FIRE West Division Chief Ben Nicholls. November 12, 2020.

estimated 70,000 people were under evacuation orders in the region surrounding the Glass fire.

F. Sonoma County Fire Agencies

Due to ongoing consolidation efforts, the following list may not represent current fire service coverage.	**In any emergency, dial 911.**
State Agency	
CAL FIRE	2210 West College Ave Santa Rosa, CA 95401
County Agency	
Permit Sonoma Fire Prevention Division	2300 County Center Drive, Suite B 220 Santa Rosa, CA 95403
Fire Districts, Municipal, and Volunteer Departments	
Cazadero Community Service District	P.O. BOX 508 Cazadero, CA 95421
Cloverdale Fire Protection District	451 South Cloverdale Blvd Cloverdale, CA 95425
Gold Ridge Fire Protection District	4500 Hessel Road Sebastopol, CA 95472
Graton Fire Department	P.O. Box A Graton, CA 95444
Healdsburg Fire Department	601 Healdsburg Ave. Healdsburg, CA 95448
Kenwood Fire Protection District	P.O. Box 249 Kenwood, CA 95452
Monte Rio Fire Protection District	P.O. Box 536 Monte Rio, CA 95462
North Sonoma Coast Fire Protection District	P.O. Box 386 The Sea Ranch, CA 95497
Northern Sonoma County Fire	P.O. BOX 217 Geyserville, CA 95441
Occidental Community Service District	P.O. Box 157 Occidental, CA 95465
Petaluma Fire Department	198 D Street Petaluma, CA 94952
Rancho Adobe Fire Department	P.O. Box 1029 Penngrove, CA 94951
Santa Rosa Fire Department	2373 Circadian Way Santa Rosa, CA 95407-5439
Sonoma County Fire District - Serving the Communities of:	P.O. Box 530 8200 Old Redwood Hwy Windsor, CA 95492-0530
Bellevue	
Bennett Valley	
Bodega Bay	
Forestville	
Fulton/Larkfield/Wikiup	
Guerneville/Rio Nido	
Windsor	
Rohnert Park Department of Public Safety	500 City Hall Drive Rohnert Park, CA 94928
SCHELL-VISTA Fire Protection District	22950 Broadway Sonoma, CA 95476
Sebastopol Fire Department	7425 Bodega Avenue Sebastopol, CA 95472
Sonoma Valley Fire District	630 2nd St. West Sonoma, CA 95476
Timber Cove Fire Protection District	30800 Seaview Road Cazadero, CA 95421

Tracen Fire Department-Coast Guard Training Ctr	599 Tomales Rd., Bldg. 201 Petaluma, CA 94952
Volunteer Fire Departments / North Bay Fire, Administered by Gold Ridge Fire Protection District	4500 Hessel Road Sebastopol, CA 95472
Bloomfield VFD	6600 Bloomfield Road, P.O. Box 395 Valley Ford, CA 94972
Bodega VFD	17184 Bodega Hwy, P.O. Box 28, Bodega, CA 94922
Camp Meeker VFD	5240 Bohemian Hwy, P.O. Box 511, Camp Meeker, CA 95419
Fort Ross VFC	24110 Fort Ross Road, P.O. Box 129 Cazadero, CA 95421
Lakeville VFD	5070 Lakeville Hwy, P.O. Box 7033 Petaluma, CA 94955
Two Rock VFD	7618 Valley Ford Rd., Petaluma, CA 94952
Valley Ford VFD	P.O. Box 327, 14445 Hwy 1, Valley Ford, CA 94972
Wilmar VFD	3825 Bodega Ave., Petaluma, CA 94952

G. Financial Resources

In this section, we provide information regarding local, state, and federal programs that are available to help offset the costs associated with fire preparation and recovery. These programs are available to individuals, communities, non-profits, and businesses. Programs vary from compensation, cost-share, loans, to tax relief.[88]

Local Financial Resources

- **Sonoma County Agriculture and Open Space Vegetation Management Grant Program** – The County of Sonoma has created the Vegetation Management Project Grant Program to support near-term vegetation management activities in high-risk areas and near key ecosystems. This funding is targeted to support the work of local fire districts, schools, communities with Community Wildfire Protection Plans (CWPPs), Resource Conservation Districts, community groups, non-profit organizations, licensed foresters, and technical advisors.

  For the 2021 and 2022 wildfire seasons, the Board of Supervisors approved $3,722,160 in grant funding for 20 vegetation management projects throughout Sonoma County. In addition, another seven projects in the Russian River area have been conditionally approved for future funding pending the completion of outstanding project design and California Environmental Quality Act (CEQA) work.

  The grant application period is currently closed, but there will be future opportunities to apply for this funding. If interested in applying during future funding cycles, learn more about this program at this online

[88] Augmented and adapted from the University of California Cooperative Extension 'Fire in California – Financial Resources' webpage: https://ucanr.edu/sites/fire/Contact/Funding/ and the Wine Institute's Wildfire Risk Reduction Grants webpage: https://wineinstitute.org/our-work/compliance/wildfires/wildfire-risk-reduction-grants/ (both accessed on 10/26/2021).

website: https://www.sonomaopenspace.org/our-impact/vegmanagement/?locale=en.

- **North Bay Forest Improvement Program** – The North Bay Forest Improvement Program (NBFIP) is an incentives program funded through CAL FIRE's Proposition 68 Wildfire Resilience and Forestry Assistance Grant. Resource Conservation Districts (RCDs) in Sonoma, Mendocino and Napa Counties have partnered with Rebuild North Bay Foundation and the Clear Lake Environmental Research Center (CLERC) to form the North Bay Forest Improvement Program (NBFIP) to help private non-industrial small forest landowners (between 5 and 500 acres) implement non-commercial forest improvement activities such as thinning, planting, pruning, and fuel hazard reduction. In 2020, North Bay Forest Improvement Program was awarded $1.5 million from a CAL FIRE Wildfire Resilience and Forestry Assistance grant, which will provide three years of funding to develop and manage an incentives program to mitigate wildfire risk and improve forest health.

  In total, the partnership will support forest stewardship activities across at least 40 projects in the four counties. At least 20% of the program dollars will benefit AFN and low-income communities identified in the 2010 census as earning median incomes less than 80% of the state median. Possible treatments include planting site preparation, tree planting and protection, forest thinning, pruning, and woody fuels reduction. Forest management plans should be in place and environmental impacts review completed in order to participate. If you need a plan, contact your local RCD. Projects will occur on forestland consisting of oak woodland, redwood forests, mixed evergreen and ponderosa pine.

  For more information on how to apply, please visit this website: https://afterthefireusa.org/our-programs/before-the-fire/nbfip-intro/nbfip-how-do-i-apply/

- **California IBank** – Low interest and state-guaranteed business loans and microloans affected by the fires. Small businesses, including small farms, nurseries, agriculture-related enterprises, and nonprofits that have suffered an economic loss and/or physical damage may apply for the Disaster Relief Loan Guarantee Program (DRLGP) which offers loans up to $1 million for Disaster Relief Borrowers. IBank is offering micro loans from $500 to $10,000 to businesses in declared disaster and emergency areas through its Jump Start Loan Program. Find out more at this online site: http://sonomaedb.org/Press-Releases/IBank-Approves-New-Disaster-Relief-Loan-Programs-for-Sonoma-County/

State Financial Resources

- **California Forest Improvement Program (CFIP)** – Provides private forestland owners with between 20 – 5,000 acres of forestland cost-share funding to improve their forests and address long-term forest management infrastructure that support society's values of clean water, wildlife, fiber production and watershed protection, and fuels management. CFIP has a higher reimbursement rate for fire recovery than for preparation. Forestland is defined as having at least 10% of the area occupied by trees native to California or formerly having that level of tree cover. Interested landowners should consult a local RPF and can apply for the program through CAL FIRE. Neighbors cannot collaborate to meet acreage requirements. More information about the program can be read here: https://www.fire.ca.gov/grants/california-forest-improvement-program-cfip/

- **Forest Health Program** – This program funds larger projects across multiple properties to increase the health and resiliency of forests. Local governments, special districts, Resource Conservation Districts, Fire Safe Councils, other NGOs, as well as private landowners are eligible to apply for the grant funding. Projects must cover at least 800 acres and cost between $750,000 and $5 million. The program is funded with Greenhouse Gas Reduction Fund money and, therefore, must show a reduction in greenhouse gas emissions. More information about the program can be

found here: https://www.fire.ca.gov/grants/forest-health-grants/

- **Fire Prevention Grant Program** – This program provides funding for local projects and activities that address the risk of wildfire, reduce wildfire potential, and increase community resiliency. Qualifying projects for the grant include those related to hazardous fuel reduction and removal of dead, dying, or diseased trees, fire prevention planning, and fire prevention education. This program is aimed at funding larger projects across multiple properties. Local governments within or adjacent to State Responsibility Areas, other government agencies, tribes, and 501(c)(3) organizations are eligible to apply for grant funding. The program is funded with Greenhouse Gas Reduction Fund money and, therefore, must show reduction in greenhouse gas emissions. More information about the program can be found here: https://www.fire.ca.gov/grants/fire-prevention-grants/

- **Wildfire Resilience and Forestry Assistance Grant** – This program provides funding for eligible entities to provide technical and financial assistance to forestland owners. The program allows grantees the ability to provide a program of financial and technical forestry assistance to nonindustrial forest landowners, where the grantee serves as the supervising entity, receives the grant from CAL FIRE and then provides outreach and/or technical/financial assistance to landowners so they can conduct forest restoration or management activities on their property. The program is aimed not at private landowners, but at organizations who can assist private landowners to improve the health of their forests. The North Bay Forest Improvement Program mentioned above makes use of this funding opportunity. For more information, please explore this site: https://www.fire.ca.gov/programs/resource-management/resource-protection-improvement/landowner-assistance/forest-stewardship/

- **California Fire Safe Council** – The California Fire Safe Council administers the U.S. Forest Service State Fire Assistance Grant Program, which provides funding to mitigate fuel hazards, assist communities in wildfire planning efforts, and assists communities develop fire prevention and mitigation

education programs. The grant application process generally opens in May of each year. The grant requires a dollar-for-dollar cost share for awarded grants, but they can include in-kind contributions. More information can be found here: https://cafiresafecouncil.org/grants-and-funding/21-sfa-grant-program/

- **CA Department of Social Services** – the State Supplemental Grant Program (SSGP) provides grant assistance for fire recovery/social service benefits. Details can be found on this website: http://www.cdss.ca.gov/Disaster-Assistance

- **State of California** – Tax Relief/Extension for fire recovery. Most qualify for tax extension and relief for home, structure, agricultural, and timber loss or damage. More information can be found here: https://www.ftb.ca.gov/individuals/disaster.shtml

Federal Financial Resources

- **Environmental Quality Incentives Program** – The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) manages the Environmental Quality Incentives Program (EQIP), which provides cost share assistance to agricultural and forest landowners and managers to implement conservation practices on their properties. EQIP provides funding to assist landowners in improving forest health, including reducing fuel loads, as well as recovering from catastrophic fires. Funding for prescribed grazing on agricultural or forestland to reduce fuel loads is also eligible for EQIP payments. For post recovery fire assistance, landowners are eligible up to 36 months post fire. To be eligible, participants must have an average adjusted gross income of less than $900,000 and payment limits are up to $450,000 over the life of the Farm Bill. For more information, contact your local NRCS office or visit this website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/ca/programs/financial/eqip/

- **USDA Catastrophic Fire Recovery EQIP Fund Pool** – The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) also manages the Catastrophic Fire Recovery EQIP Fund Pool. This is a cost-share program for working landscapes that can address fire recovery. Fire recovery may be cost-shared up to 90%, often on parcels 1 acre or more, or smaller parcels with natural resource concerns. Neighbors can collaborate to meet acreage requirements. More details on the program can be found here: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/programs/financial/eqip/?cid=stelprdb1247015

- **Emergency Forest Restoration Program** – The U.S. Department of Agriculture's Farm Service Agency (FSA) manages the Emergency Forest Restoration Program (EFRP), which provides cost share payments to eligible owners of nonindustrial private forest land (NIPF) to restore lands damaged by natural disasters. Cost share rates are up to 75% of the cost of the approved restoration practices with a maximum distribution of $500,000 per person or legal entity per disaster. This factsheet provides more information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/emergency_forest_restoration_program-fact_sheet.pdf

  To apply, contact your local FSA office.

  SONOMA COUNTY FARM SERVICE AGENCY
  5401 OLD REDWOOD HIGHWAY, SUITE 100
  PETALUMA, CA 94954
  (707) 794-1242 Ext. 3
  (844) 206-7015 Fax

- **Emergency Conservation Program** – The U.S. Department of Agriculture's Farm Service Agency (FSA) manages the Emergency Conservation Program, which provides technical and cost share assistance to farmers to rehabilitate farmland damaged by natural disasters. Cost share rates are up to 75% to restore property. Payments are capped at $500,000 per person or legal entity per disaster. This factsheet provides more information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/emergency-conservation-program-ecp-

fact_sheet.pdf

- **Tree Assistance Program** – The U.S. Department of Agriculture's Farm Service Agency (FSA) manages the Tree Assistance Program, which provides financial assistance to replace vines lost in excess of 15% mortality. Payments are up to 65% of the cost to replant or 50% of the cost to rehabilitate. Applications must be submitted within 90 days of the natural disaster or the date when damage becomes apparent. The program is available to wine/grape growers with an adjusted gross income under $900,000. This factsheet provides more information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/tree_assistance_program-tap-fact_sheet.pdf

  Tree Assistance Program (TAP) financial compensation to eligible orchardists and nursery tree growers to replant or rehabilitate eligible trees, bushes, and vines lost by natural disasters.

- **Assistance to Firefighters Grants Program** – The Federal Emergency Management Agency (FEMA) manages the Assistance to Firefighters Grants Program, which provides funds to firefighting agencies to equip and train emergency personnel, enhance efficiencies, and support community resilience. Included in the program is the Fire Prevention and Safety Grant Program, which provides funds to local firefighting agencies to help reduce injuries, deaths, and property damage from fires with specific focus on high-risk populations. Both of these programs can be accessed via this website: https://www.fema.gov/grants/preparedness/firefighters

- **USDA Rural Development** – Low-interest loans for low-income individuals, communities, and nonprofits to make their homes, community centers, or offices more fire resistant or to rebuild and restore homes, community centers, or offices after fire. More information: https://www.rd.usda.gov/programs-services

- **USDA FSA Emergency Loan Program** – offers help to producers for recovery from production and physical losses due to drought, flooding, other natural disasters, or quarantine. More information available here: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2017/emergency_loan_program_oct2017.pdf

- **Small Business Association's (SBA) Disaster Loans** – Three step process to obtaining a very low interest loan for homeowners, renters, and businesses. Free to apply, no obligation to take out a loan if approved, but if the deadline is missed, you won't have an opportunity to re-apply. Pro tip: apply for the loan and if you need it, it will be there. Apply online at SBA's secure website. SBA is a federal program. Not available for ag enterprises. More information available here: https://www.sba.gov/sites/default/files/files/Three_Step_Process_SBA_Disaster_Loans.pdf

- **Uninsured Crop Disaster Assistance Program** (NAP) – Financial compensation to producers of non-insurable crops to protect against natural disasters that result in lower yields or crop losses or prevents crop planting. More information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/noninsured_crop_disaster_assistance_program-nap-fact_sheet.pdf

- **Livestock Indemnity Program** (LIP) – Livestock deaths in excess of normal mortality caused by eligible loss conditions, including eligible adverse weather, eligible disease, and eligible attacks. More information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/livestock_indemnity_program_lip-fact_sheet.pdf

- **Livestock Forage Disaster Program** (LFP) – Grazing losses due to a qualifying drought condition during the normal grazing period for the county. More information: https://www.fsa.usda.gov/programs-and-services/disaster-

assistance-program/livestock-forage/index

- **Emergency Assistance for Livestock, Honeybee and Farm Raised Fish** (ELAP) – Losses due to disease, adverse weather, or other conditions, such as blizzards and wildfires, not covered by other agricultural disaster assistance programs. More information: https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/emergency-assist-for-livestock-honey-bees-fish/index

- **Internal Revenue Service** – Tax Relief/Extension for fire recovery. Most qualify for tax extension and relief for home, structure, agricultural, and timber loss or damage. Please see this site for specific California Wildfire assistance: https://www.irs.gov/newsroom/tax-help-for-california-wildfire-victims

H. Emergency Planning for Animals

Resources for Planning for Animal Evacuation and preparedness. Current resources include:

- ResQFAST, LLC - Rescue, Fire, Animal, & Safety Training: https://www.resqfast.com/
- HALTER Project - grass-roots program: https://www.halterproject.org/
- Sonoma CART - Sonoma Community Animal Response Team: https://www.sonomacart.org/
- NorCal Livestock Evacuation: https://www.facebook.com/NorcalEvac/
- North Sonoma County CERT - Community Emergency Response Team: https://www.nosococert.org/
- Sonoma County Community Organizations Active in Disaster (SoCo COAD): https://www.sonomacountycoad.org/fire-resources/
- Residents Organized to Prepare for Emergencies (COPE) groups in Sonoma County:
    - COPE Santa Rosa Fire Department: https://srcity.org/461/Residents-Organized-to-Prepare-for-Emerge
    - COPE Oakmont: https://oakmontvillage.com/article/ufaqs/residents-organized-to-prepare-for-emergencies-cope/
    - COPE Northern Sonoma County: https://copenorthernsonomacounty.com/
    - Cope Windsor: https://www.townofwindsor.com/1293/COPE-of-Windsor
    - COPE Rancho Adobe Fire District & Petaluma Fire Departments (PDF): http://petalumacrc.org/wp-content/uploads/2018/08/COPE-booklet-Petaluma-1.pdf
- Youth AG programs such as 4H and Future Farmers of America.
- Local and Mutual Aid Veterinarians:
    - California Veterinary Medical Reserve Corps (CVMRC): https://cvma.net/resources/disaster-response-program-2/california-veterinary-medical-reserve-corps-cavmrc/california-veterinary-medical-corps-cavmrc-information/
    - UC Davis Veterinary Emergency Response Team (VERT): https://ohi.vetmed.ucdavis.edu/disaster-preparedness-response/vert
- Sonoma County Ag Commissioner Animal Damage Control Program (ADCP): https://sonomacounty.ca.gov/Agriculture-Weights-and-Measures/Agriculture-Division/Services/Animal-Damage-Control-Program/
- Sonoma County Animal Services: https://sonomacounty.ca.gov/health/animal-services/

- Humane Society of Sonoma County: https://humanesocietysoco.org/
- Sonoma County Farm Bureau (Ag Pass): https://sonomafb.org/are-you-ready-for-disaster/
- Sonoma County Horse Council: https://www.sonomacountyhorsecouncil.org/
- UCCE: https://cesonoma.ucanr.edu/
- Nuestra Comunidad: https://nc707.org/
- Sonoma Valley Vintners and Growers Alliance: https://www.sonomavalley.com/listing/sonoma-valley-vintners-%26-growers-alliance/92/
- La Luz Center: https://www.laluzcenter.org/
- Guide Dogs for the Blind: https://www.guidedogs.com/
- Canine Companions for Independence: https://canine.org/

I. Success Stories

The **Sonoma Valley Wildlands Collaborative (SVWC)** is a group of six conservation organizations and land management agencies (Audubon Canyon Ranch, Sonoma County Agricultural and Open Space District, Sonoma County Regional Parks, Sonoma Land Trust, Sonoma Mountain Ranch Preservation Foundation, and California State Parks) that is coordinating the management of 18,000 acres of natural lands in the Sonoma Valley region in Northern California. The SVWC aims to maintain and improve ecosystem health, increase resilience to wildfires and climate change, and reduce future impacts of wildfire to communities in the Sonoma Valley.

The SVWC came together in the wake of the 2017 Nuns Fire that had devastating consequences for the communities of the Sonoma Valley and surrounding hills. They work closely with CAL FIRE to develop a long-term strategy on a landscape scale. By managing their lands for ecological health and resilience, the SVWC is doing their part to help protect the communities of the Sonoma Valley in the event of future wildfires. They are using proven strategies to achieve forest health and to help prevent fires. These include ecologically appropriate thinning in forests and woodlands, reducing ladder fuels, installed shaded fuel breaks, clearing roads to improve access for emergency personnel, and providing safer evacuation routes in the event of wildlife, and controlled burning. Public outreach and education are core values of the SVWC. More info at: https://www.svwildlandscollaborative.com/

The **Sonoma Ecology Center** has a long history of managing lands in the county. Since 2017, this group has stepped up its fire-related education materials and outreach. Work at the Van Hoosear Wildflower Preserve included a prescribed burn with support from Audubon Canyon Ranch's Fire Forward team. A prescribed burn in 2020 at the Pepperwood Preserve made a good start at reducing Medusahead and other invasives.

Prescribed burns in 2017-2021 at the Bouverie Preserve near Glen Ellen, and in 2016 and 2017 at Pepperwood Preserve, successfully reduced Medusahead and surface fuels and reduced the burn intensity during the 2017 fires. A controlled burn within a forested portion of the privately owned Monan's Rill property in 2019 appears to have reduced the intensity of the Glass Fire when it

moved through this area in 2020. These efforts help educate county personnel and residents in methods to sustain our environmental resources and create resilient landscapes that will withstand future fires.

Prescribed fires such as those described above require significant collaboration and coordination. While prescribed/cultural burning is one of the most effective and environmentally appropriate means to reduce fuels in wildlands, there are associated risks. Careful planning by qualified individuals is critical. Collaborative public/private partnerships might include a coordinating entity, such as Fire Forward, the property owners, certified "burn boss," numerous trained volunteers to help with the burn, along with other interested groups such as local fire departments, State and County Parks, and organizations such as Open Space districts, land trusts, environmental groups, and others.

The Sea Ranch Association and their FSC in northern-western Sonoma County makes extensive use of prescribed grazing to reduce grasses in large grassland areas adjacent to and/or below homes to reduce fire hazard. They have a herd of sheep that move around The Sea Ranch with electric fences to reduce coastal prairie and shrubland fuels.

These resulting grazed areas are more difficult for fires to ignite, and, if a fire does ignite, it would be much slower across the grazed land. The removal of shrubs in the grassland also reduces the chance for torching and ember production. In addition, the reduction in grass height reduces the chance of a fire burning into the crowns of adjacent wooded areas. In addition, livestock grazing decreases the chance of shrub invasion of grassland areas, as livestock would browse or trample new shrub shoots or resprouts.

Sonoma County Regional Parks

Foothill Regional Park is a success story of a partnership that helped to manage recreation, defensible space, and natural resources in response to wildfire. In October 2019, Foothill Regional Park was the frontline in the fight to contain the Kincade Fire, the second wildfire in three years to threaten Sonoma County. Firefighters snaked miles of hoses through the park's woodlands and bulldozed

fire breaks in its open spaces. Their efforts kept the fire from burning through adjacent subdivisions and into the Town of Windsor. However, 95% of the park was burned or damaged, including 4 miles of trails, 8 trail bridges, and a 40-foot bridge that provides access to the park's backcountry. In response, Regional Parks worked with Sonoma Fire, CALFIRE, the Sonoma County Regional Parks Foundation and the Town of Windsor to rebuild the park to withstand future fires and protect adjacent communities by hardening infrastructure, realigning trails, establishing shaded fuel breaks, and implementing seasonal grazing. Much of the work was funded by a grant from the Kaiser Foundation.

California State Parks

California State Parks conducts ongoing wildfire and forest resilience activities and discrete projects in park units throughout the County. Through the Sonoma Valley Wildlands Collaborative and recent statewide Wildfire and Forest Resilience funding, State Parks has been able to increase the scale of this work since the 2017 fires. State Parks resiliency work includes:

- Broadcast burning to achieve ecological and other benefits, including reducing invasive species cover, maintaining habitat diversity, and reducing fuels in areas impacted by decades of fire suppression.
- Removal of diseased trees impacted by Sudden Oak Death and pine pitch canker
- Roadside brushing and thinning of vegetation to improve firefighter access and potentially reduce impacts of wildland fire suppression
- Careful removal of understory vegetation to create shaded fuel breaks in strategic areas to moderate fire behavior
- Removal of non-native, woody, pyrophytic (fire-promoting) vegetation such as eucalyptus
- Removal of some Douglas fir and coyote brush to promote plant community and habitat diversity in the absence of fire.

J. Glossary

- **1-Hour Fuel:** See Fuel Description table.
- **10-Hour Fuel:** See Fuel Description table.
- **100-Hour Fuel:** See Fuel Description table.
- **Access and Functional Needs (AFN):** Includes individuals with disabilities, seniors, children, limited English proficiency, and transportation disadvantaged residents.
- **Access Roads/Routes:** Roads that allow entrance into and out of a property. Routes available for fire trucks and equipment to approach and defend areas or structures, including roads or driveways.
- **Adaptive Resilience:** In an ecological context, adaptive resilience refers to actively or passively supporting species compositions and fuel structures that are better adapted to a warming, drying climate with more wildfire. This is accomplished by recognizing the limited impact of past fuels management, acknowledging the important role of wildfire in maintaining many ecosystems and ecosystem services, and embracing new strategies to help human communities live with fire.
- **All-Risk Fire Protection:** Protection associated with fire response that may include fire protection, Emergency Medical Services (EMS), hazardous materials (HazMat), and rescue.
- **Aloft Winds:** See Winds Aloft.
- **Anchor Point:** The point at which firefighters begin fireline construction, usually blocked from the spreading fire to protect firefighters from harm.

- **Annexation:** The addition of a territory into a jurisdiction, such as a city or special district.

- **Anthropogenic:** An adjective for something that is the result of human activities or the influence of humans on nature.

- **Apparatus:** Fire apparatus includes firefighting vehicles of various types. For the purposes of the CWPP, fire apparatus includes wildland fire engines, rescue vehicles, ladder and aerial trucks, engines, and water tenders.

- **Aspect:** The cardinal direction toward which a slope faces north, south, east, west, etc. This has an effect on fire behavior and intensity. South-facing slopes dry out faster and have less moisture available for plants. North-facing slopes tend to have denser vegetation because there is more moisture available for plants. While north slopes may not burn as frequently as south slopes, they can burn with more intensity because there can be more fuel.

- **Assessment:** The evaluation and interpretation of measurements, intelligence, and other information to provide a basis for decision-making.

- **Assets at Risk:** Those things that are important to quality of life that can be threatened with destruction or loss from wildfire. These include homes, businesses, infrastructure, cultural sites, wildlife habitat, natural resources, air quality, recreational facilities and areas, historical structures, and any other important attribute that individual communities rely on for their well-being.

- **Automatic Aid Agreement:** An agreement between two or more agencies whereby such agencies are automatically dispatched simultaneously to predetermined types of emergencies in predetermined areas.

- **Backburn:** See Blackline.

- **Backfire:** A technique used in certain locations to direct fire spread against the wind while doing prescribed burns.

- **Basic Life Support (BLS):** The level of medical care used for victims of life-threatening illnesses or injuries until they can be given full medical care at a hospital. It can be provided by trained medical personnel, including emergency medical technicians, paramedics, and by laypersons who have received BLS training. BLS is generally used in the pre-hospital setting and can be provided without medical equipment.

- **Basins:** See Watershed.

- **Best Management Practices (BMPs):** In this context, fire safety activities that effectively reduce wildfire risk while limiting potential negative environmental impacts. BMPs can range from reducing impacts on specific wildlife species, to maintaining or enhancing ecosystem functions and processes.

- **Benefit Assessment:** Benefit Assessments are used by local governments to pay the costs of providing fire suppression, flood control, and other services to a particular community. These charges are based on the concept of assessing only those properties that directly benefit from the services or improvements financed. Because these charges are based on specific benefits, they are not subject to Proposition 13 limitations.

- **Big Red Truck Program:** A community fire-safe education program where representatives from fire departments visit local residences and help landowners identify priority areas for hazard mitigation attention, such as high fuel loads and one-way-in, one-way-out roads. This program can help identify locations that are difficult for a fire truck to access.

- **Biochar:** Organic matter that is burned slowly with limited oxygen until it becomes charcoal, which is then used as a soil amendment; biochar helps retain moisture in the soil, and it replenishes exhausted or marginal soils with organic carbon and fosters the growth of soil microbes essential for nutrient absorption. Biochar is also used as a means of carbon sequestration.

- **Biodiversity:** The abundance and variety of plant, fungi, and animal species found in an ecosystem, including the diversity of genetics, species, and ecological types.

- **Biomass:** The total weight of living matter in a given ecosystem. May also be defined as the total weight of plant debris that can be burned as fuel.

- **Biomass Utilization/Recovery:** The harvest, sale, offer, trade, or utilization of woody biomass to produce bioenergy and the full range of bio-based products including lumber, composites, paper and pulp, furniture, housing components, round wood, ethanol and other liquids, chemicals, and energy feedstocks.

- **Bioregional/Bioregion:** The characteristic features of an area (bioregion) constituting a natural ecological community of contiguous geographic terrain, delineated by natural rather than artificial borders; the region's climate, local aspects of seasons, particular landforms, watersheds, soils, native plants, and animals. Humans are also an integral aspect of a bioregion's life.

- **Biotic:** A term referring to all living things, organisms, or their materials; of life, of living things.

- **Blackline:** Pre-burning, or backburning, of fuels adjacent to a control line before igniting a prescribed burn (controlled burn).

- **Blue Dot Program:** A community fire-safety program which identifies the location of firefighting water sources by marking them with a blue reflective circle. This program also ensures that tanks and water systems are outfitted with fittings compatible with firefighting equipment and in some cases maps the location of these water sources.

- **Broadcast Burning:** A controlled burn, where the fire is intentionally ignited and allowed to proceed over a designated area within well-defined boundaries for the 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.

- **Brushing:** Clearing or "cleaning up" brushy vegetation in an area.

- **Brushfire:** A fire burning in vegetation that is predominantly shrubs, brush, and/or scrub growth.

- **Bucket Dipping:** A method of delivering water for aerial firefighting in which a specialized bucket is suspended on a cable from a helicopter, which dips the bucket into an open water source and carries water to the site of the fire.

- **Buffer Zone:** An area of reduced vegetation that creates a barrier separating wildlands from vulnerable residential or business developments; this barrier is similar to a greenbelt in that it is usually used for another purpose, such as agriculture, recreation, parks, or golf courses.

- **Building Code:** The building or construction code adopted by the local jurisdiction.

- **Built Environment:** Human-made structures as opposed to the natural environment.

- **Burn:** (1) An area burned over by wildland fire. (2) A reference to a working fire. (3) To be on fire. (4) To consume fuel during rapid combustion. (5) A fire in progress or under investigation.

- **Burning Conditions:** The state of the combined factors of the environment – such as winds, temperature, fuel moistures, and humidity—that affect fire behavior in a specified fuel type.

- **Burning Period:** That part of each 24-hour period when fires spread most rapidly, typically from 10:00 a.m. to sundown.
- **Burn-Out Times:** The length of time in which flaming and smoldering phases occur in a given area or for the whole fire.

- **Call Downs:** Community telephone networks, such as phone trees, used to dispatch help and distribute or relay information in emergency situations.

- **Cambium:** The growing layer of a tree, located between the bark and wood of the stem.

- **Candle or Candling:** A single tree or a very small clump of trees burning from the bottom up.

- **Canopy:** The top layer of a forest, tree, or low-growing stand of shrubs, which is formed by leaves, needles, and branches creating a continuous cover.

- **Canopy Density:** A term used to describe the amount of vegetative cover in the top layer of a forest; among other things, the canopy density influences the amount of light penetration, understory composition, surface reflectance, and rainfall interception in a forest landscape.

- **Catastrophic Fire:** Wildland or wildland-urban interface fire with a fast-moving front, extending over a large area (300+ acres) and/or highly destructive to lives, property, or natural resources.

- **California Environmental Quality Act (CEQA):** (Chapters 1 through 6 of Division 13 of the Public Resources Code). A state statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

- **Chaparral:** A shrubland or heathland plant community associated with Mediterranean climates consisting primarily of highly flammable, drought-tolerant plants with hard, evergreen leaves. These communities provide habitat for many different species.

- **Chimney:** (1) Steep narrow draw or small canyon that draws fire up in the same manner a flue draws heat from a fireplace. (2) Vertical or nearly vertical passageways for conveying flue gasses to the outside.

- **Chipping Program/Chipping Days:** A program where several individuals or communities share the resources associated with processing debris from fuel-reduction activities, including the chipper (the machine that creates the chips), staff, insurance, etc.

- **Climax:** A theoretical, ecological notion intended to describe a relatively stable community that is in equilibrium with environmental conditions, and occurring as the terminal, end-point of succession.

- **Coarse Woody Material:** Large-dimension wood, usually 20 inches in diameter or larger, found on the ground from fallen trees or downed branches.

- **Collaborative:** An open, inclusive process that assumes all participants have valuable knowledge and opinions and all of their comments are heard and considered; collaboration does not mean consensus or

ownership.

- **Combustible:** Any material that, in the form in which it is used and under the conditions anticipated, will ignite, and burn.

- **Combustion:** The rapid oxidation of fuel in which heat and - usually - flame are produced. Combustion can be divided into four phases: pre-ignition, flaming, smoldering, and glowing.

- **Community:** A body of people living in one place or district and considered a whole; a neighborhood, subdivision, small town, village, or township with boundaries defined by the residents or by regulatory jurisdiction.

- **Community at Risk:** Wildland-urban interface (see definition below) communities that are at high risk of damage from wildfire. (See list in Federal Register, January 4, 2001). The original list, at the request of Congress, included only those communities neighboring federal lands. The list has since been expanded through a collaborative process between the 50 states and five federal agencies.

- **Community Emergency Response Team (CERT):** The CERT program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help. CERT members also are encouraged to support emergency response agencies by taking a more active role in emergency preparedness projects in their community.

- **Community Services District (CSD):** Sometimes called "junior districts," authorized under §61000 et seq. of the California Government Code.

CSDs can provide a broad range of municipal services (primarily to unincorporated areas), including fire protection. CSDs are normally governed by a five-member elected Board of Directors and can receive revenue from taxes and fees. In cases where a CSD is responsible for fire protection in Sonoma County, services are provided by a volunteer fire department with facilities and funding provided by the CSD.

- **Community Wildfire Protection Plan (CWPP):** As defined by the Healthy Forests Restoration Act, a plan for a community at risk to wildfire that fulfills the following criteria:
    A. The plan was developed within the context of the collaborative agreements and the guidance established by the Wildland Fire Leadership Council and agreed to by the applicable local government, local fire department, and state agency responsible for forest management, in consultation with interested parties and the federal land management agencies managing land in the vicinity of the at-risk community.
    B. The plan identifies and prioritizes areas for hazardous fuels reduction treatments and recommends the types and methods of treatment on federal and non-federal land that will protect one or more at-risk communities and essential infrastructure.
    C. The plan recommends measures to reduce structural ignitability throughout the at-risk community.

    Community Wildfire Protection Plan: A plan developed in the collaborative framework established by the Wildland Fire Leadership Council and agreed to by state, tribal, and local government, local fire department, other stakeholders and federal land management agencies managing land in the vicinity of the planning area. A Community Wildfire Protection Plan (CWPP) identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment on Federal and non-Federal land that will protect one or more at-risk communities and essential infrastructure and recommends measures to reduce structural ignitability throughout the at-risk community. A CWPP may address issues such as wildfire

response, hazard mitigation, community preparedness, or structure protection - or all of the above (NWCG, 2021).

- **Composite Decking:** Deck boards manufactured from wood fiber and plastic to form a profile that requires less maintenance and generally has a longer lifespan than natural wood.

- **Composition:** The percentage of each species that together comprise the biota present in a given area.

- **Condition Class:** A landscape designation based on a relative measure describing the degree of departure (low, moderate, or high) from the historical natural fire regime.

- **Conduction:** Heat transfer through a material from a region of higher temperature to a region of lower temperature.

- **Conflagration:** A raging, destructive fire. Often used to connote such a fire with a moving front as distinguished from a firestorm.

- **Conifer Forest:** A stand of trees that are usually evergreen, cone-bearing, and with needle, awl, or scale-like leaves, such as pine, spruce, fir, and cedar; often referred to as "softwood."

- **Contain a Fire:** A situation where a fuel break around the fire has been completed. This may include natural barriers and/or manually or mechanically constructed firebreaks.

- **Containment:** The process of completely surrounding a fire with natural or man-made firebreaks.

- **Contour Falling:** Cutting and placing trees along the slope contour. This is a treatment that utilizes positioned logs to help control erosion from water flow. Logs are offset on the slope contour to slow water by creating a

meandering travel path.

- **Control a Fire:** To complete a control line around a fire, any spot fires, and any interior islands to be saved; burn out any unburned area adjacent to the fire side of the control lines; and cool down all hotspots that are immediate threats to the control line, until the lines can reasonably be expected to hold.

- **Controlled Burning (or Prescribed Fire):** A vegetation management practice that uses fire to improve habitat and/or reduce hazardous fuels.

- **Convection:** (1) The transfer of heat by the movement of a gas or liquid; convection, conduction, and radiation are the principal means of energy transfer. (2) As specialized in meteorology, atmospheric motions that are predominantly vertical in the absence of wind (which distinguishes this process from advection), resulting in vertical transport and mixing of atmospheric properties.

- **Convection Column:** Heat generated from a fire that rises in a column to varying heights above the flames, depending on the size of the burn.

- **County Service Area (CSA):** Authorized under §25210.1 of the CA Government Code, CSAs are generally single purpose, dependent special districts governed by the County Board of Supervisors. CSAs are means of providing expanded service levels to unincorporated areas where residents are willing to pay for the extra services; services may include extended police protection, fire protection, park and recreation facilities, libraries, low-power television and translation facilities and services. CSAs also may provide other basic services such as water and garbage collection if they are not already performed on a county-wide basis.

- **Cover:** Any plants or organic matter that hold soil in place and/or grow over and create shade that provides wildlife with an area to reproduce

and find protection from predators and weather.

- **Critical Habitat:** A specific geographic area, designated by the U.S. Fish and Wildlife Service, which is essential for the conservation of a threatened or endangered species, and may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery.

- **Crown Density:** A measurement of the thickness or density of the foliage of the treetops (crown) in a stand.

- **Crown Fire (Crowning):** A fire that spreads through the top of the vegetative canopy; characteristic of hot fires and dry conditions. Crown fires become more or less independent from the surface fire and are generally more complex to control than surface fires.

- **Crown Scorch:** When a fire or a convection column burns a portion or the entire crown of a tree or shrub.

- **Cultural Burning:** A contemporary term used to define the traditional practice of burning for various cultural, ecological, and practical reasons. Burning has historically been, and is still practiced, by many indigenous groups to achieve various outcomes, which can include encouraging the growth of plants used for food, medicine, basket-weaving, and other purposes; driving out pests and disease; managing fuel loads; enhancing forage for game; and facilitating travel and hunting.

- **Dead Fuels/Dead Plant Matter:** Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

- **Debris Burning:** Any fire originally set for the purpose of clearing land or for burning rubbish, garbage, range, stubble, or meadow burning.

- **Decision Point:** Established prior to tactical engagement and once reached, forces or "triggers" firefighters to re-evaluate their situational awareness and tactical progress and effectiveness, and to make critical decisions regarding their safety.

- **Defensible Space or Defensible Space Zone:** An area, either natural or manmade, where material capable of causing a fire to spread has been treated, cleared, reduced, or changed in order to provide a barrier between an advancing wildland fire and the loss to life, property, or resources. Generally, defensible space is defined as an area 100 feet or to the property line, whichever comes first, around a structure that is cleared of flammable brush or vegetation. Distance from the structure and the degree of fuels treatment vary with vegetation type, slope, density, and other factors.

- **Detection:** The act or system of discovering and locating fires.

- **Direct Attack:** Any treatment of burning fuel, such as by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.

- **Direct Protection Area (DPA):** That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the firefighting agent.

- **Dispatch:** The implementation of a command decision to move a resource or resources from one place to another.

- **Disturbance:** Various activities that disrupt the normal state of the soil, such as digging, erosion, compaction by heavy equipment, etc.

- **Diurnal:** Belonging to or active during the day.

- **Dominant:** The species or individual that is the most abundant or influential in an ecosystem. For example, a dominant tree is one that stands taller than the rest and receives full sun, or the shrub species most abundant in the local understory.

- **Downed Woody Debris:** The remains of dead trees, branches, and various woody brush that sit on the ground; generally, refers to trunks of downed trees.

- **Draft:** Using suction to draw water from ponds, swimming pools, or other bodies of water. This technique utilizes a partial vacuum formed by a suction pump and atmospheric pressure. The water is then moved where it is needed (for fire protection, for example).

- **Drafting Site:** A location, such as a pond, river, or swimming pool, from which water may be drawn with a suction pump to be used for the purposes of fire protection.

- **Drip Line:** The boundary of a tree's canopy, generally estimated by the extent of the tree's outermost limbs and the circular moisture line formed when rainfall drips from the limb tips.

- **Duff:** The layer of decomposing organic materials located below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil.

- **Drainage(s):** See Watershed.

- **Draw-Down Level:** The level where the success of extinguishing a fire with initial attack forces is compromised.

- **Downed Fuel:** See Fuel Description table.

- **Eave(s):** The projecting overhang(s) at the lower edge of a roof.

- **Ecosystem:** A community of organisms that makes up a specific area. Examples of ecosystem types include a pond or a forest.

- **Ecosystem Functions:** The processes and interactions that occur between organisms and the physical environment.

- **Ecotone:** The area where two or more ecosystems meet. The change in ecosystems may be due to elevation, soil type, disturbance, or other factors.

- **Egress:** A means of exiting an area.

- **Embers:** Burning (or glowing) particles of vegetation from tree branches, parts of shrubs or chaparral, or other combustible materials that ignite and burn during a wildfire and are carried in wind currents to locations in front of the wildfire (also known as firebrands).

- **Emergency Dispatch:** See Dispatch.

- **Endangered Species:** A population of organisms classified as such by the state or federal government as being at risk of becoming extinct because it is few in number and/or threatened by changing environmental or predation parameters.

- **Environmental Compliance:** Conforming to environmental laws, regulations, standards, or other requirements imposed by local, state, or

federal jurisdictions.

- **Environmentally Significant Habitat Area (ESHA):** An area protected from human activities or development due to the existence of rare or especially valuable and/or vulnerable plants, animals, and habitats.

- **Erosion:** The removal of soil over time by weather, wind and/or water, such as rain or water runoff from roads.

- **Escapes:** Wildfires that cannot be contained with the first attempts at suppression.

- **Estuary:** A partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. The inflow of both seawater and freshwater provides high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world.

- **Evacuation:** An organized, phased, and supervised withdrawal, dispersal, or removal of residents from dangerous or potentially dangerous areas, and their reception and care in safe areas.

- **Evacuation Route:** A path or road that has been pre-planned for getting out of harm's way in a fire situation. The route should be well understood in advance of a crisis by all participants. If there is any unclear direction, the path should be marked.

- **Evacuation Site:** A place where the public can go in cases of emergency evacuation; oftentimes, temporary shelters are established, and food, water, and medical supplies are distributed at these locations.

- **Evacuation Shelter:** An Evacuation Shelter serves the general population in an existing facility (or facilities), such as a school, community center, convention center, or church that the Authority Having Jurisdiction has

temporarily converted for use as a shelter for disaster survivors.

- **Exotic Species:** Plant or animal species that have been introduced into an area where they do not occur naturally; non-native species.

- **Exposure:** (1) Property that may be endangered by a fire burning in another home or by a wildfire; (2) Direction in which a slope faces, usually with respect to cardinal directions; (3) The general surroundings of a site with special reference to its openness to winds.

- **Extreme Fire Behavior:** "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, or a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically and/or dangerously.

- **Exurban:** A region lying beyond the suburbs of a city.

- **Feather-Out Treatment:** When reducing hazardous fuels, thinning heavily near the structure or area in need of protection and then thinning less as you move away from it.

- **Federal Responsibility Area (FRA):** Areas within which a federal government agency has the financial responsibility of preventing and suppressing fires. These lands are generally protected by the Department of Agriculture: Forest Service, or the Department of the Interior: Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, or the Bureau of Indian Affairs. See also State Responsibility Area and Local Responsibility Area.

- **Fee:** Also termed "exaction." A direct charge or dedication collected on a one-time basis as a condition of an approval being granted by the

local government. The purpose of the fee or exaction must directly relate to the need created by the development. In addition, its amount must be proportional to the cost of improvement. Includes development impact fees, permit and application fees which cover the cost of processing permits and development plans, and regulatory fees.

- **Felling:** The process of downing individual trees; in hand felling, an axe, saw, or chainsaw is used to drop a tree, followed up by limbing, hewing, and cutting the tree into logs.

- **FEMA Lifelines:** See https://www.fema.gov/emergency-managers/practitioners/lifelines. A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security, including Safety and Security, Food, Water and Shelter, Health and Medical, Energy, Communications, Transportation, Hazardous Materials.

- **Fine (Light, Flashy) Fuels:** Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than ¼-inch in diameter and have a time-lag constant of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

- **Fire:** Rapid oxidation, usually with the evolution of heat and light. Requires interaction of heat, fuel, and oxygen.

- **Fire-Adapted Ecosystem:** Where plant species have, over time, assumed certain traits or characteristics that enable them to respond favorably to reoccurring fire events specific to the part of the ecosystem in which they inhabit, allowing them to survive and/or regenerate.

- **Fire Behavior:** The manner in which a fire reacts to the influences of fuel, weather, and topography. Common terms used to describe behavior include: smoldering, creeping, running, spotting, torching, and crowning.

- **Firebrand:** A piece of wood or coal that is hot and glowing from fire activity, often dispersed by wind ahead of a fire. Also called embers.

- **Firebreak:** A strip of land that has been cleared of vegetation to help slow or stop the spread of wildfire. It may be a road, trail, or path cleared of burnable material; a stream may also serve as a firebreak. See Fuelbreak for the difference between the two terms.

- **Fire Company:** See Volunteer Fire Company.

- **Fire Danger Operating Plan:** See Unit Fire Weather Plan.

- **Fire Department:** See Volunteer Fire Department.

- **Fire-Dependent:** Plants, vegetation communities, and specific habitat types that have evolved to rely on fire in order to exist and/or thrive.

- **Fire Ecology:** The study of fire and its relationship to the physical, chemical, and biological components of an ecosystem.

- **Fire-Evolved Landscapes:** See Fire-Adapted Ecosystem.

- **Fire Flow:** The flow rate of a water supply expressed in gallons per minute (gpm), measured at 20 pounds per square inch (psi) residual pressure, that is available for firefighting.

- **Fire-Flow Requirement:** A measure comparing the amount of heat a fire is capable of generating (based on building construction and occupancy) versus the amount of water required for cooling the fuels below their ignition temperature.

- **Fire Frequency:** General term referring to the recurrence of fire in a given area over time.

- **Fire Front:** The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smoldering combustion.

- **Fire Hazard:** A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.

- **Fire Hazard Mitigation:** Various methods by which existing fire hazard can be reduced in a certain area, such as fuel breaks, noncombustible roofing, spark arrestors, etc.

- **Fire Hazard Severity Zone (FHSZ):** Any geographical area designated pursuant to California Public Resource Code Section 4201 to contain the type and condition of vegetation, topography, weather, and structure density to increase the possibility of conflagration fires. Areas are zoned as Very High, High, or Moderate by evaluating applicable risks and hazards.

- **Fire History:** The known frequency and intensity of fires that have occurred in a given area over a period of time.

- **Fire Intensity:** Amount of heat released by a fire in an area in any given time period. Fire intensity is usually related to the flame lengths of a fire.

- **Fire Interval:** Number of years between two successive fire events for a given area. Also referred to as fire-free interval or fire-return interval.

- **Fire Ladders:** See Fuel Ladders.

- **Fireline:** See Firebreak.

- **Fire Management:** Activities required for the protection of burnable wildland assets from fire, and/or the use of prescribed fire to meet land

management objectives.

- **Fire Management Plan:** A strategic plan that defines a program to manage wildland and prescribed fires. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.

- **Fire Occurrence Interval:** See Fire Interval.

- **Fire Perimeter:** The entire outer edge or boundary of a fire. Note that while acreage of a fire is determined or estimated by the fire's perimeter, it is possible that some substantially smaller acreage may have actually been burned within that perimeter.

- **Fire Planning:** Systematic technological and administrative management process of design, organization, facilities, and procedures, including fire use, to protect wildland from fire.

- **Fire Prevention:** Activities such as public education, community outreach, law enforcement, and reduction of fuel hazards, intended to reduce wildland fire and the risks it poses to life and property.

- **Fire Protection:** Firefighting tactics used to suppress wildfires. Firefighting efforts in wildland areas require different techniques, equipment, and training from the more common structural firefighting tactics used in populated areas.

- **Fire Protection Districts (FPD):** Formal jurisdictional areas with some type of tax support authorized under §13800 et seq. of the California Health and Safety Code to provide fire protection and emergency medical services.

- **Fire-Protection Water:** Water stored, designated, or used specifically for the purposes of fire suppression and protecting people, structures, and

natural resources from fire damage.

- **Fire Regime:** Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects, in a given area or ecosystem.

- **Fire Resilient/Resiliency:** The ability of an ecosystem to maintain its native biodiversity, ecological integrity, and natural recovery processes following a wildfire disturbance.

- **Fire Resistant Building:** Construction designed to increase protection against fire.

- **Fire Resistive:** Refers to properties or designs to resist the effects of any fire to which a material or structure can be expected to be subjected.

- **Fire Retardant:** Any substance except plain water that, by chemical or physical action, reduces flammability of fuels or slows their rate of combustion.

- **Fire-Return Interval:** See Fire Interval.

- **Fire Risk:** The combination of vegetation, topography, weather, ignition sources, and fire history that leads to fire and/or ignition potential and danger in a given area.

- **Fire Safe:** For the purposes of this plan, this term is defined as: Action(s) that moderate the severity of a fire hazard to a level of "acceptable risk," as discussed in the Safety Element of the County General Plan. In a broader context, this term describes the state of lessened severity or action(s) that moderate the severity of a fire hazard or risk, while protecting structures and surrounding property from fire, whether fire is inside the structure or is threatening the structure from exterior sources.

- **Fire Safe Council:** Public and private organizations that comprise a council intended to minimize the potential for wildfire damage to communities and homeowners, while also protecting the health of natural resources. Goals are achieved by distributing fire prevention materials, organizing fire safety programs, implementing fuel-reduction projects, and more. Visit www.firesafecouncil.org.

- **Fire-Safe Standards:** Standards adopted by ordinance for the purpose of establishing a set of standards that will result in fire-safe development within a specified area.

- **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 Sensitive:** A species of tree or other plant that is relatively more susceptible to fire damage. Sensitivity may be due to thin bark or easily ignitable foliage.

- **Fire Service:** Organized fire protection service; its members, individually and collectively; allied organizations assisting protection agencies.

- **Fire Severity:** Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

- **Fire Spread:** The movement of fire from one place to another.

- **Fire Storm:** Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls. Also known as blowup or extreme fire behavior.

- **Fire Suppression:** All the work and activities connected with control and fire-extinguishing operations, beginning with discovery, and continuing until the fire is completely extinguished.

- **Fire Weather:** Weather conditions that influence fire ignition, behavior, and suppression, such as high temperature, low precipitation/humidity, and high winds.

- **Firewise®/Firewise Communities/USA® Recognition Program:** (1) A national, multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. (2) Firewise® offers a series of practical steps that individuals and communities can take to minimize wildfire risks to people, property, and natural resources. It emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home evacuation and design, landscaping, and maintenance.

- **Firewise® Construction:** The use of materials and systems in the design and construction of a home to safeguard against the ignition from a wildfire.

- **Firewise® Landscaping:** Vegetative management that removes flammable fuels from around a home to reduce ignition exposure from radiant heat. The flammable fuels may be replaced with green lawn, gardens, certain individually spaced green, ornamental shrubs, individually spaced and pruned trees, decorative stone, or other non-flammable or flame-resistant materials.

- **Flame Height:** The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. If flames are tilted due to wind or slope, this distance is less than the flame length.

- **Flame Length:** The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.

- **Flame Resistant:** A material or surface that does not propagate flame once the external source of flame is removed.

- **Flaming Front:** The zone of a moving fire where the combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front. Also called fire front.

- **Flammability:** The degree to which a substance is likely to catch fire, be easily ignited, burn quickly, and/or have a fast rate of spreading flames.

- **Flash/Flashy Fuels:** Fine fuels, such as grass, leaves, pine needles, ferns, mosses, and some kinds of slash, which ignite readily and are consumed rapidly by fire when dry.

- **FLASH (Fire-Adapted Landscapes and Safe Homes) Program:** A rebate program that reimburses property owners for hazardous vegetation management completed around their homes, along access routes, and in particularly hazardous areas.

- **Foëhn Events/Winds:** A wind that blows warm, dry, and generally strong, creating extremely dry fuel and dangerous fire potential.

- **Forest Stand Enhancement:** A combination of silvicultural thinning practices and other forest restoration activities (such as controlled burning) that aim to increase the health, resiliency, and vigor of tree communities within a forest ecosystem.

- **Free Burning:** The condition of a fire or part of a fire that has not been slowed by natural barriers or by control measures.

- **Fuel(s):** Combustible structures and vegetative materials. Includes dead plants, parts of living plants, duff, and other accumulations of flammable vegetation, such as grass, leaves, ground litter, shrubs, and trees that feed a fire. See Surface Fuels.

- **Fuel Bed:** An array of fuels usually constructed with specific loading, depth, and particle size to meet experimental requirements; also, commonly used to describe the fuel composition in natural settings.

- **Fuel-Bed Depth:** Average distance from the bottom of the litter layer to the top of the layer of fuel, usually the surface fuel.

- **Fuel break (or fuelbreak):** Pursuant to PRC § 4528(e), a strip of modified fuel to provide a line from which to work in the control of fire.

- **Fuel Characteristics:** Factors that make up fuels such as compactness, loading, horizontal continuity, vertical arrangement, chemical content, size and shape, and moisture content.

- **Fuel Class:** Part of the National Fire Danger Rating System (NFDRS). Group of fuels possessing common characteristics. Dead fuels are grouped according to 1-, 10-, 100-, and 1000-hour time lag. Living fuels are grouped as herbaceous (annual or perennial) or woody.

Fuel Class	Material	Diameter
Fine	Needles, leaves, etc.	
1 Hour	Woody material, generally drying out within 1 hour.	<1/4"
10 Hour	Woody material, generally drying out within 10 hours.	1/4"-1"
100 Hour	Woody material, generally drying out within 4 days.	1-3"
1000 Hour	Woody material, generally drying out within 40 days.	3"+
Downed	Fuel on the ground.	
Heavy	Large logs and snags.	

- **Fuel Continuity:** The amount of continuous fuel materials in a fire's path that allows the fire to extend vertically toward the crowns of trees or horizontally into nearby fuels.

- **Fuel Complex:** The volume, type, condition, arrangement, and location of fuels.

- **Fuel Compositions:** The makeup of combustible materials, such as grass, leaves, plants, shrubs, and trees, in a collective area; the mixture of these materials, how they interact, and their respective percentages within the whole influence the area's flammability.

- **Fuel Ladder:** A ladder of vegetation from the ground into the canopy (or upper branches) of the trees that allows fire to climb upward.

- **Fuel Levels:** Amounts of burnable materials, including but not limited to, living or dead vegetation, structures, and chemicals that feed a fire.

- **Fuel Load:** The amount of available and potentially combustible material, usually expressed as tons/acre.

- **Fuel Loading:** The volume of fuel present expressed quantitatively in terms of weight of fuel per unit area.

- **Fuel Management:** Act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological, or manual means, or by fire in support of land management objectives.

- **Fuel Model:** (1) A standardized description of fuels available to a fire, based on the amount, distribution and continuity of vegetation and wood. (2) Simulated fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical

rate of spread model have been specified.

- **Fuel Modification:** Manipulation or removal of fuels to reduce likelihood of ignition and/or lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling, and burning). Also known as Fuel Treatment.

- **Fuel Moisture (Fuel-Moisture Content):** The amount of water in a material divided by its oven-dry mass, expressed as a percentage. Moisture content is a key factor in determining how a fuel will burn, along with such factors as density and surface-to-volume ratio.

- **Fuel Reduction:** Manipulation (including combustion and/or removal of fuels) to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

- **Fuel Treatment:** See Fuel Modification.

- **Fuel Type:** An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement; or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

- **Geographic Information Systems (GIS):** A technology used for digitally viewing, storing, analyzing, and manipulating geographical information. Layers of information can create a better understanding of how data is interrelated. Useful for landscape-level planning.

- **Girdling:** A technique used to kill trees by cutting through the cambium and sapwood layer around the circumference of the tree. The flow of water and nutrients is broken and the tree eventually dies.

- **Global Positioning System (GPS):** A system of navigational satellites operated by the U.S. Department of Defense and available for civilian

use. The system can track objects anywhere in the world with a high degree of accuracy.

- **Goodwill Service:** Fire protection services provided by a fire district to a location that is outside of the district's jurisdictional boundaries and for which no compensation is provided, either through direct payment nor a tax base.

- **Greenbelt:** Largely undeveloped, natural, or agricultural land surrounding or neighboring developed areas that is often protected from development and construction for environmental reasons and is usually used for agriculture, recreation, parks, or golf courses; can act as a fuel break.

- **Ground Disturbing:** An action that interrupts the natural condition of the ground, such as digging and compaction from heavy equipment.

- **Ground Fire:** Fire that consumes organic material beneath surface ground litter, such as a peat fire.

- **Ground Fuel:** All combustible materials below the surface litter (including duff, tree or shrub roots, punchy wood, peat, and sawdust) that normally support a glowing combustion without flame.

- **Habitat:** An ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism.

- **Hand Crews:** Diverse teams of career and temporary wildland firefighters.

- **Hardened Homes:** Improving a building's resistance to fire, such as updating a roof with noncombustible roofing material; the goal is to increase the structure's ability to survive a fire.

- **Hazard:** Any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

- **Hazard Assessment:** Assessment of fuel hazards to determine fire risks; assessing the impact of each hazard in terms of potential loss, cost, or strategic degradation based on probability and severity.

- **Hazard Reduction/Mitigation:** Any treatment of living or dead fuels that reduces the threat of ignition and fire intensity or rate of spread.

- **Hazardous Fuels/Fuel Loads:** Accumulations of burnable materials, including but not limited to, living or dead vegetation, structures, and chemicals that can feed a fire.

- **Hazardous Fuel Reduction:** Any treatment that reduces the amount of hazardous fuels.

- **Hazardous Materials (HazMat):** Materials (such as those that are flammable or poisonous) that present a danger to life and the environment if not managed properly or released without precaution.

- **Hazardous Vegetation Management:** Any treatment that reduces the amount of hazardous fuels.

- **Healthy Forests Restoration Act: A** portion of the 2003 President's Healthy Forests Initiative intended to reduce hazardous fuels on public and private lands. Establishes Community Wildfire Protection Plans and sets standards for those plans.

- **Heart-Rot Decay:** Fungus-caused decay of a tree's heartwood (interior wood). Trees are infected when fungal spores enter tree wounds or dead branch stubs and encounter conditions favorable for spore germination.

- **Heat Output:** The total amount of heat that a fire releases in a specific area during the passing of the flaming front.

- **Heat Transfer:** Process by which heat is imparted from one body to another, through conduction, convection, and radiation.

- **Heavy Fuels:** Fuels of large diameter (such as snags, logs, and large limb wood) that ignite and are consumed more slowly than flashy (fine, light) fuels.

- **Helibase:** The main location within a general incident area for parking, fueling, maintaining, and loading helicopters. The helibase is usually at or near the incident base.

- **Herbaceous Fuels:** Non-woody plants that die back in the winter.

- **High Pruning:** Cutting of both dead and live branches 10 to 15 feet up from the base of the tree. This is done on larger trees to separate the fuel continuity from the ground to the crown of a tree.

- **Historic Natural Condition:** The climax environmental condition of a property/area that occurred in the past before fire suppression and industrial activities. Old photos, elders' oral history, settlers' journals, and clues on the property (such as old stumps) may be helpful in identifying the historical natural condition of an area.

- **Home Assessment:** Evaluation of a dwelling and its immediate surroundings to determine its potential to escape damage by an approaching wildland fire. Includes the fuel and vegetation in the yard and adjacent to the home, roof environment, decking and siding materials, prevailing winds, topography, fire history, etc., with the intent of mitigating fire hazards and risks.

- **Home Density:** The density of homes is determined by lot size, home arrangement, and number of homes per lot. This density affects the overall exposure, spread and intensity of wildfire.

- **Home Ignition Zone:** The home and area out to approximately 100 feet, where local conditions affect the potential ignitability of a home during a wildfire.

- **Home-to-Home Ignition:** The event of combustion initiation that creates fire as embers pass from one home to another. The action of one home igniting adjacent homes.

- **Hydrology:** The science that describes the waters of the Earth, including movement, distribution, seasonal patterns, and conservation.

- **Hydrophobic Soils:** Literally meaning "water-fearing;" refers to soil that will no longer absorb water.

- **Ignitability:** The susceptibility to ignite or catch on fire.

- **Ignition:** The event of combustion initiation that creates fire.

- **Ignition Factor:** The conditions, subsequent actions, and sequence of events that bring a competent ignition source into contact with the materials first ignited. Also referred to as the cause of fire.

- **Ignition Management:** A program that includes fire-prevention program activities that are aimed at preventing the ignition of wildland fires and/or reducing damage from fires. Components include law enforcement, public education, engineering, fuels modification, and fire-safe planning.

- **Ignition Potential:** Chance that a firebrand will cause an ignition when it lands on receptive fuels.

- **Ignition Resistant:** (1) Possessing properties that serve to slow or prevent possible ignition in order to slow the rate of fire spread. Can apply to vegetation or structural components. (2) The California Building Code defines ignition resistant in a specific way that is based on meeting a minimum flame-spread rating after the material has been subjected to a specified weathering procedure. A material that is ignition resistant has passed this test. The California Building Code is based on the International Code Council requirement for exterior fire-retardant wood (lumber and plywood).

- **Ignition Sources:** Combustible elements that create the potential for fire starts, such as vehicle sparks near roadside fuels or downed power lines.

- **Immediate Threat Evacuation:** An evacuation announcement made during an immediate or imminent fire situation and residents are in danger of life-threatening events.

- **Impact Fees:** Fees (often called "developer fees" or "development impact fees") that are levied on new development to cover the cost of infrastructure or facilities necessitated by that development.

- **Impingement:** This occurs when flames from a fire touch an object (e.g., a plant, deck, or building).

- **Incident:** A human-caused or natural occurrence, such as wildland fire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources. Incident Management Teams also handle other non-fire emergency response, including tornadoes, floods, hurricanes, earthquakes, and other disasters or large events.

- **Incident Commander:** The person within the Incident Command System who is responsible for overall management of the incident and reports to

the Agency Administrator for the agency having incident jurisdiction.

- **Incident Command System (ICS):** A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

- **Indirect Attack:** A method of fire suppression in which suppression activities take place some distance from the fire perimeter, and often take advantage of fire barriers.

- **Ingress-Egress:** Roads and other avenues to enter and leave a property. Also refers to the act or right to come in or go through, as in entering a property (ingress), and the act or right to depart or go out, as in exiting a property (egress).

- **Infrastructure:** Roadways, utilities, and other basic elements serving developed areas.

- **Ingrowth:** The trees that grow large enough in a season to be considered a sapling or pole timber.

- **Initial Attack:** The actions taken by the first resources to arrive at a wildfire in order to protect lives and property and prevent further extension of the fire.

- **Initial Entry:** The first stage of vegetation and tree thinning performed in a fuel-reduction treatment.

- **Initial Site Assessment:** The preliminary steps of an evaluation of a site to determine fuel hazards and health conditions. Information is gathered to help plan a fuel hazard-reduction treatment.

- **Interface Community:** (Defined in the Federal Register, January 4, 2001) The Interface Community exists where structures directly abut wildland fuels. There is a clear line of demarcation between residential, business, and public structures and wildland fuels. Wildland fuels do not generally continue into the developed area. The development density for an interface community is usually 3 or more structures per acre, with shared municipal services. Fire protection is generally provided by a local government fire department with the responsibility to protect the structure from both an interior fire and an advancing wildland fire. An alternative definition of the interface community emphasizes a population density of 250 or more people per square mile.

- **Interface Fuels:** Refers to anything related to human development that can burn. Interface fuels are grouped into three categories: (1) urban structures; (2) landscaping; (3) urban "debris." Also known as urban fuels.

- **Intermix Community:** (Defined in the Federal Register, January 4, 2001) The Intermix Community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation; wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres. Fire protection districts funded by various taxing authorities normally provide life and property fire protection and may also have wildland fire protection responsibilities. An alternative definition of intermix community emphasizes a population density of between 28–250 people per square mile.

- **Insurance Services Office (ISO):** Private organization that formulates fire safety ratings based on fire threat and responsible agency's ability to respond to the threat. ISO ratings from one (excellent) to ten (no fire protection). Insurance companies have used ISO ratings to set insurance premiums. ISO may establish multiple ratings within a community, such as a rating of 5 in the hydrated areas and 8 in the non-hydrated areas.

- **Invasive Plants/Weeds/Species:** Undesirable plants that are not native and have been introduced to an area by humans. These plants generally have no natural enemies and are able to spread rapidly throughout the new location. Some examples include Himalayan blackberries, English ivy, arundo, tamarisk, and Scotch broom.

- **Jackpots:** Generally, small pockets of dense fuels, which could allow a fire to flare up and burn more intensely.

- **Jurisdictional Agency:** The agency having land and resource management responsibility for a specific geographical or functional area as provided by federal, state, or local law.

- **Jurisdictional Area/Boundaries:** See Response Area.

- **Key Ecosystem Component:** An important piece of an ecosystem such as soil, native species, or mature/rare habitats, which are essential to the stability of that ecosystem.

- **Knox Box:** A small safe typically mounted on a wall or post that holds the keys to a building or gate for firefighter or EMT use in emergency situations.

- **Ladder Fuels:** Fuels that provide vertical continuity between strata and allow fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

- **Local Agency Formation Commission (LAFCO):** Created by the State Legislature in 1963 to discourage urban sprawl and encourage the orderly formation and development of local government agencies. LAFCOs review proposals for the formation of new local governmental agencies and for changes in the organization of existing agencies. There is a LAFCO in each county in California except San Francisco. LAFCO is a seven-member Commission comprised of two city council members (chosen by the Council of Mayors), two county supervisor members (chosen by the

Board of Supervisors), two special district members (chosen by Independent Special District election), and one public member (chosen by the members of the Commission).

- **Landscape:** The visible features of an area of land, including topography, water bodies, vegetation, human elements, such as land uses and structures, and transitory elements such as lightning and weather conditions.

- **Land Use Plan(ning):** A set of decisions that establish management direction for land within an administrative area; an assimilation of land-use-plan-level decisions developed through the planning process regardless of the scale at which the decisions were developed.

- **Large Fire:** 1) CAL FIRE defines a fire burning more than 300 acres as a large fire. 2) A fire burning with a size and intensity such that its behavior is determined by interaction between its own convection column and weather conditions above the surface.

- **Late Seral/Succession Forest:** A forest that has evolved, through successional processes, near to the end of the successional line, or climax forest. Only through disturbance (fire or clear-cutting, for example) will the forest return to an earlier seral (successional) stage.

- **Leading Edge of a Fire:** The foremost part of a fire that is guiding the fire in the direction of travel.

- **Leaf Drop:** A normal condition of growth for many plants, whose lower leaves gradually die and fall off.

- **Leave-Trees/Patches:** Swaths or clusters of trees or other vegetation that have been selected to remain standing in an area of fuel treatment.

- **Level-of-Service (LOS) Standard:** Quantifiable measures against which services being delivered by a service provider can be compared. Standards based upon recognized and accepted professional and county standards, while reflecting the local situation within which services are being delivered. Level-of-service standards for fire protection may include response times, personnel per given population, and emergency water supply. LOS standards can be used to evaluate the way in which fire protection services are being delivered, for use in county-wide fire-planning efforts.

- **Light Fuels:** See Fine Fuels.

- **Lightning Activity Level (LAL):** A number, on a scale of 1 to 6, that reflects the frequency and character of cloud-to-ground lightning. The scale is exponential, based on powers of 2 (e.g., LAL 3 indicates twice the lightning of LAL 2).

- **Limbing/Limb Up:** Removing selected branches of a standing or fallen tree or shrub.

- **Litter:** Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

- **Live Fuels:** Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

- **Local Agency:** Pursuant to California Government Code §56054 means a city, county, or district. For the purposes of the Fire Plan, a Local Agency refers to a city or special district that provides fire protection.

- **Local Responsibility Area (LRA):** Lands in which the financial responsibility of preventing and suppressing fires is primarily the responsibility of the local jurisdiction.

- **Local Agency Boundary:** A specific land area that has been approved by LAFCO, within which a local agency (either a special district or a city) is obligated to provide services, and from which it generates tax revenue.

- **Low-Income Community**: A census tract with a median household income less than 80% of the statewide average.

- **Manual Treatment/Fuel Reduction:** Methods of modifying wildfire fuel complexes without the use of machinery; such treatments may include chainsaws, fire-use applications, chemical treatments, and grazing.

- **Mast:** Nuts or fruits of trees and shrubs, such as acorns, walnuts, or berries that collect on the forest floor and are a food source for animals.

- **Mastication:** The process of "chewing up" or grinding vegetative fuels with machinery to reduce their hazard as a fuel source.

- **Mechanical Treatments/Fuel Reduction:** Methods of modifying fuel complexes with machinery; these treatments include chipping, piling, felling, and piling, crushing, and mastication.

- **Merchantable Timber:** Timber that is viable for sale under the current economic situation. This is generally determined by the part of the stem (trunk) that is suitable for timber products.

- **Mesic:** The condition of being normally moist, as in vegetation or ecosystems.

- **Mitigation:** Those activities implemented prior to, during, or after an incident which are designed to reduce or eliminate risks to persons or

property that lessen the actual or potential effects or consequences of an incident. Mitigation measures can include efforts to educate governments, businesses, and the general public on measures they can take to reduce loss and injury and area often informed by lessons learned from prior incidents.

- **Moisture Content/Levels:** The dry weight of a material, such as wood or soil, compared to the wet weight of the same material. It is not unusual for live material to have moisture content greater than 100% because it could contain more water than solid material by weight.

- **Monitor:** To watch, keep track of, or check regularly for changes --in this case, to the environment.

- **Montane:** A mountainous region of moist, cool, upland slopes that occurs below the tree line and is predominantly composed of evergreen trees. It is also described as the lower vegetation belt on mountains that are composed of montane plants and animals.

- **Mulch:** A material (such as decaying leaves, bark, or compost) spread around or over a plant to keep invasive weeds down, to reduce moisture loss and/or to enrich and insulate the soil; as a verb, the application of such material.

- **Mutual Aid Agreement:** A reciprocal aid agreement between two or more agencies that defines what resources each will provide to the other in response to certain predetermined types of emergencies. Mutual aid response is provided upon request.

- **National Wildland Fire Management Strategy:** A collaboratively developed strategic document intended to provide a framework to coordinate multiple agency and homeowner efforts toward three goals: 1) Resilient Landscapes; 2) Fire Adapted Communities; and 3) Safe and

Effective Wildfire Response.

- **National Environmental Policy Act (NEPA):** The basic national law for protection of the environment, passed by Congress in 1969. NEPA sets policy and procedures for environmental protection and authorizes Environmental Impact Statements and Environmental Assessments to be used as analytical tools to help federal managers make decisions on management of federal lands.

- **National Fire Danger Rating System (NFDRS):** A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

- **National Fire Plan:** "A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan." Prepared by the Secretaries of the Interior and Agriculture and Western Governors. May 2002.

- **National Fire Incident Reporting System (NFIRS):** A database of fire incident reports compiled at the local fire department level. NFIRS was an outgrowth of the 1974 National Fire Prevention and Control Act, Public Law 93–498. The U.S. Fire Administration (USFA), an entity of the Department of Homeland Security, developed NFIRS as a means of assessing the nature and scope of the fire problem in the United States.

- **National Fire Protection Association (NFPA):** An international non-profit organization whose mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically-based consensus codes and standards, research, training, and education.

- **National Wildfire Coordinating Group (NWCG):** An organization formed under the direction of the Secretaries of Agriculture and the Interior that includes representatives of the U.S. Forest Service, Bureau of Land

Management, Bureau of Indian Affairs, National Park Service, U.S. Fish and Wildlife Service and National Association of State Foresters. The group's purpose is to facilitate coordination and effectiveness of wildland fire activities and provide a forum to discuss, recommend action, or resolve issues and problems of substantive nature. NWCG is the certifying body for all courses in the National Fire Curriculum.

- **Natural Barriers:** Naturally existing breaks in fuel continuity within a landscape, which can help block the spread of fire in the direction of their location; natural barriers include: lakes, streams, ponds, roads, cultivated fields, and pastures.

- **Natural Disturbance:** Disruptions, like fire and floods, which occur in the environment without the intervention of humans.

- **Natural Fire Regime:** (1) A natural fire regime is a classification of the role fire would play across a landscape in the absence of modern human mechanical intervention but including the influence of aboriginal burning. Five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation.

- **Natural Resources:** A necessary or beneficial material source (such as timber, minerals, water, and grazing area) occurring in nature that has a value in human commerce.

- **Niche:** A species or population's role and/or function within an ecosystem. Includes resource use, interactions, etc.

- **Nurse Log:** A tree that has fallen, died, and started to decompose. The decaying log is rich in moisture and nutrients and provides a germination place for plants, as well as habitat for insects.

- **Open Burning:** The use of outdoor fires for disposing of natural vegetation around homes.

- **Operational Area:** An intermediate level of the state emergency services organization, consisting of a county and all political subdivisions within the county area.

- **One-Way-In, One-Way-Out Roads:** Non-continuous and non-connecting roads that constitute the sole ingress/egress route into/away from a particular location; oftentimes, these roads lead to residences or small neighborhoods, and can be located in remote or semi-remote areas. These roads can become hazardous in emergency incidents when simultaneous home evacuations and emergency response are necessary.

- **Organic Matter:** The fraction of soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

- **Overstory:** The topmost trees in a forest that compose the upper canopy layer, compared to the understory, which is the lower woody or herbaceous layer underneath the treetops.

- **Patch Burning:** (1) A method of prescribed burning where patches of trees and vegetation are retained in a given area while other parts of the treatment area are burned. (2) A range management technique used to reduce grazing pressure where sections of the range are burned on a rotating basis and livestock are shifted onto the most recently burned unit.

- **Pathogens:** Insects or disease that can affect a site or individual plant.

- **Peak Fire Season:** That period of the fire season during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damage at an unacceptable level.

- **Perennial:** (1) Plants that live for more than two growing seasons. For fire danger rating purposes, biennial plants (alive for two growing seasons) are classed with perennials. (2) In reference to water, a stream that flows year-round during a typical year.

- **Permeability:** In this case, a condition whereby fire can spread through a community with minimal negative impact.

- **Personal Protective Equipment (PPE):** Equipment and clothing used and worn by all firefighting personnel in order to mitigate the risk of injury from, or exposure to, hazardous conditions encountered while working.
    - Structure PPE, or Bunker Gear, includes NFPA/OSHA compliant helmet, goggles, hood, coat, pants, boots, gloves, pocket tools, and Self-Contained Breathing Apparatus.
    - Wildland PPE includes 8-inch laced leather boots with lug soles, fire shelter, hardhat with chinstrap, goggles, earplugs, aramid (flame-resistant) shirts and trousers, leather gloves, and individual first aid kits.

- **Photo Point Monitoring:** Utilizing a specific, identifiable point on a property from where photos are taken over time to compare and monitor changes.

- **Pile Burning:** A method used to reduce fuel wherein vegetation is cut, stacked, and then burned.

- **Plant Community:** A group of plants that are interrelated and occupy a given area.

- **Plant Succession:** In ecology, progressive change of the plant and animal life of an area in response to environmental conditions.

- **Point of Attack:** That part of the fire on which work is started when suppression crews arrive.

- **Pole Sized:** Generally younger trees with a trunk between four and eight inches.

- **Post-Fire Effects:** Lingering or residual impacts following a wildfire fire that create hazardous conditions for people and the environment. These may include soil erosion and slope instability, which can cause sedimentation in watersheds, negatively impact drinking water, and create flood risks; invasive species may also take hold and alter natural vegetation compositions and create additional fire hazards.

- **Pre-Fire Mitigation:** Prior to fire ignition, a systematic application of risk assessment, safety, prevention, and hazard reduction techniques to reduce wildland fires, damages, and cost of suppression.

- **Pre-Fire Plan:** A plan to address fire issues before ignition, including fire prevention actions such as hazardous fuel reduction. Occasionally, these plans may extend into the suppression phase of fire protection and include such items as evacuation routes, fuelbreaks, and firefighting strategies.

- **Preparedness:** (1) Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination. (2) Mental readiness to recognize changes in fire danger and act promptly when action is appropriate. (3) The range of deliberate, critical tasks and activities necessary to build, sustain, and improve the capability to protect against, respond to, and recover from wildfire.

- **Prescribed Fire (Controlled Burning):** A fire that burns within a range of predetermined conditions (such as fuel moisture content, weather conditions, etc.) that will keep it controllable, at desired intensity, and

able to achieve its stated objectives. A written, approved burn plan must exist, and environmental requirements (where applicable) must be met, prior to ignition.

- **Precautionary Evacuation:** An evacuation of the public away from an area which seems to be in the path of an oncoming, uncontained wildfire. Precautionary evacuations are especially likely in areas with limited ingress and egress in order to ensure that residents get out while they can and clear the road for emergency response vehicles.

- **Prevention:** Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards.

- **Productive:** A term used for land or forests that are growing efficiently and in a vigorous manner.

- **Protection Resources:** Assets that are available to support fire protection efforts and public safety; protection resources include firefighting facilities, personnel and equipment, fire protection water storage and areas from which water may be drafted, open areas that can act as fuel breaks or evacuation safe zones, and access roads.

- **Pruning:** The act of cutting back the unwanted portions of a plant or cutting for the purpose of enhancing growth.

- **Pump Chance:** An area where water can be pumped from a pond or creek for fire-suppression purposes.

- **Pyrolysis:** Pyrolysis involves the decomposition of waste under anaerobic conditions at temperatures ranging between 300°C and 800°C. The pyrolytic products obtained include a gaseous product (syngas), a liquid (tar), and char, with ash as an undesirable residue. The yields of the products depend on the composition of the waste, the pyrolysis

temperature, and the heating rate. Lower pyrolysis temperatures lead to the production of more liquid products, whereas higher temperatures yield more gaseous products. The major advantage of pyrolysis is that it is a cost-effective technology and helps curb environmental pollution. However, the production of various pollutants occurs in the exhaust gas during the pyrolysis process such as hydrogen sulfide (H_2S), ammonia (NH_3), SO_x, and NO_x.

- **Radiant Heat:** Heat energy carried by electromagnetic waves longer than light waves and shorter than radio waves. Radiant heat (electromagnetic radiation) increases the sensible temperature of any substance capable of absorbing the radiation, especially solid and opaque objects.

- **Radiation:** Transfer of heat in straight lines through a gas or vacuum other than by heating of the intervening space.

- **Rate of Spread:** The speed of an advancing fire. May be measured by the growth in area or by the speed of the leading edge of the fire.

- **Regeneration:** The renewal of trees or forests by planting seedlings, or direct seeding by humans, wind, birds, or animals after large disturbances like fire. It also refers to young trees that were naturally seeded or planted.

- **Registered Professional Forester (RPF):** A person licensed in California to manage state or private forestlands and advise landowners on management of their forests. For more information, see http://bofdata.fire.ca.gov/professional_foresters_registration.

- **Relative Humidity**: A measure of moisture in the air. If the humidity is 100%, the air is completely saturated with moisture. If the humidity is less than 20%, the air is very dry. When the air is dry, it absorbs moisture from the fuels in the forest, making them more flammable.

- **Release:** Using thinning techniques to free a tree or group of trees from competition for nutrients, sunlight, and water by removing the competing trees and shrubs.

- **Residence Time:** Time, in seconds, required for the flaming front of a fire to pass a stationary point at the surface of the fuel. The total length of time that one flaming front of the fire occupies one point.

- **Resilient/Resiliency:** The ability of an ecosystem or community to return to its functionally balanced state after a disturbance, such as fire. Or the ability of a forest to absorb disturbances and re-organize under change to maintain similar functioning and structure.

- **Resistance to Control:** The relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. Also known as difficulty of control.

- **Response:** (1) Movement of an individual firefighting resource from its assigned standby location to another location, or to an incident in reaction to dispatch orders, or to a reported alarm. (2) Activities that address the short-term, direct effect of an incident, including immediate actions to save lives, protect property, and meet basic human needs. Also includes the execution of emergency operations plans as well as mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes.

- **Retention Patch:** A clump of vegetation that has been isolated from contiguous fuels and retained for wildlife habitat and/or native plant species diversity.

- **Resort Improvement Districts (RID):** Districts authorized under §13000 of the Public Resources Code to provide a broad range of services (similar to CSDs), including fire protection, in unincorporated areas that are

occupied seasonally for recreation and/or resort purposes.

- **Resource Management Plan (RMP):** A document prepared by field office staff with public participation and approved by field office managers that provides general guidance and direction for land management activities at a field office. The RMP identifies the need for fire in a particular area and for a specific benefit.

- **Response Area:** The CWPP defines two types of response areas, District Response Areas and Non-District Response Areas.
    - *District Response Areas* are areas outside the local agency boundaries of the special district or city within which the fire department associated with the local agency provides fire protection.
    - *Non-District Response Areas* are areas within which a volunteer fire department or company provides fire protection. The primary difference between a response area (district or non-district) and a local agency boundary is that there is no legislated obligation for a fire organization to provide structural fire protection within a response area.

- **Response Time:** For the purposes of the CWPP, response time is the time that elapses between the moment a 911 call is placed to the emergency dispatch center and the time that a first-responder arrives on scene. Response time includes dispatch time, turnout time (the time it takes firefighters to travel to the fire station, don their gear, and prepare the apparatus), and travel time.

- **Restoration Activity/Efforts:** Activities designed to help repair damage or disturbance caused by wildfire, or the wildfire suppression activity, that are intended to restore the landscape back to its original state.

- **Riparian:** A strip of land along the bank of a natural freshwater stream, river, creek, or lake that provides vast diversity and productivity of plants

and animals.

- **Risk:** (1) The chance of a fire starting as determined by the presence and activity of causative agents; (2) A chance of suffering harm or loss; (3) A number related to the potential of firebrands to which a given area will be exposed during a rating day.

- **Risk Assessment:** The process of identifying and evaluating assets or values at risk.

- **Risk Factors:** Factors can be either natural (i.e., wind, temperature) or human-associated. Human-associated risk factors are those we have control of, such as building materials (e.g., roofs, chimneys, siding, windows, etc.), design, and location of the home, that can influence whether a home or structure can easily ignite, and if so, whether fire can be sustained to the extent that the structure would be lost.

- **Roof Assembly:** The component(s) above the roof structural framing including the roof deck, vapor barrier, insulation, roof cover, coatings, toppings, or any combination thereof.

- **Roof Classification:** Roof classification is determined by tests that expose the top surface of roof decks to both gas flames and burning wood brands. Tests are arranged to provide three levels of severity by adjusting the temperature and duration of the gas flame and the sizes of the burning wood brands. Successful coverings are rated Class A, Class B, or Class C, with Class A withstanding the most severe exposure, Class B withstanding intermediate exposure, and Class C withstanding the least severe exposure.

- **Roof Covering:** The membrane, which may also be the roof assembly, that resists fire and provides weather protection to the building against water infiltration, wind, and impact.

- **Safety Zone:** An area cleared of flammable materials used by firefighters for escape in the event the line is outflanked or in case a spot fire causes fuels outside the line to render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuel breaks; they are greatly enlarged areas which can be used with relative safety by firefighters and their equipment in the event of a fire blowup in the vicinity.

- **Salvage Logging:** Logging and removing merchantable trees after a fire to capture economic potential. This is a very controversial subject due to impacts on ecosystem recovery.

- **Sawlogs:** A log that meets minimum standards of diameter, length, and defect for sawing into lumber.

- **Scratch Line:** An incomplete control line in the beginning stages of fire suppression that is constructed as an emergency backup for spreading fires.

- **Sediment/Sedimentation:** Particles of topsoil, sand, and minerals that come from soil erosion or decomposing plants and animals; wind, water, and ice carry these particles. When excessive sediment collects in waterways it can harm fish and wildlife habitat.

- **Seedbank:** A repository of dormant seeds found buried in the soil.

- **Sensitive Habitat/Environmentally Sensitive Habitat:** Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments. Sensitive habitat areas include, but are not limited to, riparian corridors, wetlands, marine habitats, sand dunes, sea cliffs, and habitats supporting

rare, endangered, and unique species.

- **Sensitive Species:** A plant or animal species that can tolerate a small range of resources and environmental situations, or habitat. These species raise concerns about population numbers and may be recognized locally as rare or listed as Threatened or Endangered by the state or federal Endangered Species Act.

- **Serotinous:** A condition where seeds are retained within cones that only open and release seeds en masse following fire. The mechanism varies, with some cones sealed by resin and waxes that melt during the fire, allowing the cones to open afterwards, releasing the seed.

- **Setback:** The minimum distance by which any building or structure must be separated from a street or property line.

- **Shade Tolerant:** Attribute of a species that is able to grow and mature normally in and/or prefers shaded areas.

- **Shaded Fuel Break (or shaded fuelbreak):** A fuel break built in a timbered area where the trees on the break are thinned and pruned to reduce the fire potential yet retain enough crown canopy to make a less favorable microclimate for surface fires and regeneration.

- **Shrublands:** Plant communities characterized by vegetation dominated by shrubs (woody plants with many branches, usually growing less than 8 feet high), often also including grasses, herbs, and geophytes. Mediterranean shrublands in the California North Coast contain northern coastal shrub and coastal sage scrub.

- **Signage:** Address markers, road postings, and street signs that designate the location of residences and help orient people within a community or area. Highly visible signage is important for helping emergency responders

quickly locate incident sites.

- **Silvicultural:** The theory and practice of controlling the establishment, composition, and growth of forests. For example, foresters may control the composition and quality of a forest stand for goods such as timber and/or benefits to an ecosystem.

- **Site Specific:** Applicable to a specific piece of land and its associated attributes and conditions (e.g., microclimate, soils, vegetation).

- **Size Class:** The division of trees by the size of their diameter, sometimes split into three categories – seedlings, pole, and saw timber – or by diameter in inches.

- **Slash:** Debris left after logging, pruning, thinning, or brush cutting; includes logs, chips, bark, branches, stumps, and broken understory trees or brush.

- **Slope:** Upward or downward incline or slant, usually calculated as a percentage. One percent of slope means a rise or fall of one foot of elevation within a distance of 100 feet. Thus, 45% would equal 45 feet of rise in 100 feet.

- **Slope Stability/Instability:** The degree to which a slope is susceptible to erosion and slides, or the measure of its overall stability.

- **Small-Diameter Wood Products:** Logs generally less than 10-inches in diameter at the large end.

- **Snow water equivalent (SWE):** A measurement of how much water is present within a snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously.

- **Snag:** A standing dead tree that has usually lost most of its branches. Snags offer essential food and cover for a host of wildlife species.

- **Social Capital:** The individual and communal time and energy that is available for such things as community improvement, social networking, civic engagement, personal recreation, and other activities that create social bonds between individuals and groups; can also refer to community support for a specific person, organization, or concept.

- **Soffit:** The underside of an architectural element such as a cantilever, an arch, a staircase, or a cornice.

- **Soil Type:** Refers to the different combinations of soil particles and soil composition. Soil can vary greatly within short distances.

- **Spatial Distribution:** The manner in which plants are arranged throughout an area.

- **Special District:** As government organizations, special districts are a type of local agency that deliver specific public services within defined boundaries. The Cortese-Knox-Hertzberg Local Government Reorganization Act of 2000 (the state law that governs the activities of LAFCO) more narrowly defines a special district and excludes school related districts, financing districts and numerous other districts.

- **Special-Status Species:** Animal or plant species that are officially listed, proposed for listing, or are a candidate for possible listing under the state and/or federal Endangered Species Act. Also includes species that are biologically rare, very restricted in distribution, declining throughout their range, or have a critical, vulnerable stage in their life cycle that warrants monitoring. See also Sensitive Species.

- **Special Tax:** Any tax imposed for specific purposes, including a tax imposed for special purposes, which is placed into a general fund.

(Subdivision (d), Section 1, Article XIII C of the California Constitution). All taxes imposed by any local government shall be deemed to be either general taxes or special taxes. Special purpose districts or agencies, including school districts, shall have no power to levy general taxes (Subdivision (a), Section 2, Article XIII C of the California Constitution)

- **Species Composition:** The combination of species found in a particular site.

- **Spot Fire:** A fire ignited outside the perimeter of the main fire by flying sparks or embers.

- **Stacking Functions:** Achieving several goals at once with one activity.

- **Stand:** A group of trees or shrubs with similar species composition, age, and condition that makes the group distinguishable from other trees in the area.

- **Stand Composition:** see Species Composition.

- **Standard:** A criterion; the ideal in terms of which something can be judged. An acknowledged measure of comparison for quantitative or qualitative value.

- **Standardized Emergency Management System (SEMS):** (California Government Code § 8607). The group of principles developed for coordinating state and local emergency response in California. SEMS provides for organization of a multiple-level emergency response and is intended to structure and facilitate the flow of emergency information and resources within and between the organizational levels--the field response, local government, operational areas, regions, and the state management level. SEMS incorporates by reference: the Incident Command System (ICS); multi-agency or inter-agency coordination; the

State's Mutual Aid Program; and Operational Areas.

- **Standard Operating Procedure:** (1) A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions. (2) An organizational directive that establishes a standard course of action.

- **Stand-Replacing Fire:** A fire that kills most or all of the trees in a forest stand.

- **Stand Structure Model:** The spatial arrangement of the forest stand, describing the density and connectivity of the understory, mid-story, and overstory vegetation.

- **State Responsibility Area (SRA):** Defined in California Public Resources Code § 4125 – 4127 as lands in which the financial responsibility of preventing and suppressing fires is primarily the responsibility of the state. State Responsibility Areas are defined by code:
    - § 4126. The Board of Forestry shall include within state responsibility areas all of the following lands: (a) Lands covered wholly or in part by forests or by trees producing or capable of producing forest products. (b) Lands covered wholly or in part by timber, brush, undergrowth, or grass, whether of commercial value or not, which protect the soil from excessive erosion, retard runoff of water or accelerate water percolation, if such lands are sources of water which is available for irrigation or for domestic or industrial use. (c) Lands in areas which are principally used or useful for range or forage purposes, which are contiguous to the lands described in subdivisions (a) and (b). § 4127. The Board of Forestry shall not include within state responsibility areas any of the following lands: (a) Lands owned or controlled by the federal government or any agency of the federal government. (b) Lands within the exterior boundaries of any city, except a city and county with a population

of less than 25,000 if, at the time the city and county government is established, the county contains no municipal corporations. (c) Any other lands within the state which do not come within any of the classes which are described in Section 4126.

- **Stemwood:** The wood of the main stem or trunk of a plant.

- **Strip Patch:** In prescribed burning, a narrow section or area where the fuel is burnt while the surrounding area is left untreated.

- **Structure:** Any building or structure used for support or shelter of any use or occupancy.

- **Structural Fire Protection:** The protection of a structure from interior and exterior fire ignition sources. This fire protection service is normally provided by municipal fire departments with trained and equipped personnel. After life safety, the agency's priority is to keep the fire from leaving the structure of origin and to protect the structure from an advancing wildland fire. (The equipment and training required to conduct structural fire protection is not normally provided by the wildland firefighter.)

- **Structural Ignitability:** The ease with which a home or other structure ignites.

- **Structure Fire:** Fire originating in and burning any part or all of any building.

- **Sudden Oak Death (SOD):** A disease in oak trees that is caused by *Phytophthora ramorum*, an invasive forest pathogen introduced to California in the mid-1990s through the horticultural plant trade. Affected areas can have a significantly higher fire hazard due to higher proportions of dead fuels of all sizes and prevalence of snags.

- **Suppression:** All the work of extinguishing or containing a fire, beginning with its discovery.

- **Surface Fire:** Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation.

- **Surface Fuels:** Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

- **Surface Mineral Soil:** The top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter. Surface mineral soil is not flammable.

- **Suspended Dead Material:** Typically composed of pine needles that are draped on living brush. Made up of dead fuels not in direct contact with the ground, consisting of dead needles, foliage, twigs, branches, stems, bark, vines, moss, and high brush. In general, these fuels easily dry out and can carry surface fires into the canopy.

- **Swamper Burning:** A method of prescribed fire where fuel is added gradually and continuously to a burning pile over the course of a day.

- **Thinning:** The act of removing a percentage of vegetation to encourage an open space and healthy growth for the remaining vegetation.

- **Threatened Species:** Any species including animals, plants, fungi, etc. that is vulnerable to extinction in the near future and is so classified by the state or federal government.

- **Torch/Torching:** A rapid and intense burning of a single or small group of trees/shrubs, causing the upward movement of fire; also known as crown

fire initiation or flare-up.

- **Touch-Off:** A controlled burning operation performed by a forestry or fire crew, where large quantities of forest treatment slash are arranged in hand piles and ignited with drip torches simultaneously by multiple crew members.

- **Topographic Breaks:** Natural formations within the topography of a landscape that can help break up fuel continuity and reduce the spread of fire. See also Natural Barriers.

- **Topography:** Geographic elements of an area, such as slope steepness, aspect, existence of hills, canyons, and rough terrain.

- **Treatment:** An action or controlled technique that is applied in a specific process. See Fuel Treatment.

- **Tributaries:** A stream, creek, or river that flows into a main stem (or parent) river or lake. Tributaries do not flow directly into seas or oceans.

- **Turn-Around Space:** A portion of a roadway, unobstructed by parking, that allows for a safe reversal of direction for emergency apparatus.

- **Turn-Outs:** Open spaces along roadways, unobstructed by regular parking, that allow for the safe passage of vehicles and can provide emergency parking for firefighting apparatuses.

- **Type Conversion:** The unintended replacement of native plant communities due to various disturbances, such as more frequent and unnatural fires. Typically, replacement is by invasive or non-native plants.

- **Underburn:** A prescribed fire method where burning is conducted in the understory so that the fire consumes surface fuels but not trees or shrubs.

Also known as understory burning.

- **Understory:** Generally herbaceous or shrubby vegetation that makes up the plant layer under the tree canopy layer.

- **Unit Fire Weather Plan:** Also known as a Fire Danger Operating Plan, documents the establishment and management of the local fire weather system and incorporates fire danger modeling into local fire management decisions. Fire danger operating plans include but are not limited to responsible parties (e.g., station maintenance, data entry); fire danger rating areas (e.g., location, development criteria); National Fire Danger Rating System thresholds and breakpoints (e.g., staffing levels, adjective ratings, preparedness levels, and indexes used for each); and operational procedures.

- **Untreated:** Not altered from a natural or original state; unprocessed (e.g., no fuel-reduction or defensible space activities).

- **Urban Fuels:** Any flammable materials within a landscape as a result of urban development. Examples include urban structures, landscaping, and urban debris such as wood piles, trash dumps along roadsides, and die-back from weedy invaders.

- **Values at Risk:** See Assets at Risk.

- **Variable-Density Treatment:** Silvicultural thinning practice where some portions of a stand are left lightly or completely un-thinned ("skips"), providing areas with high stem density, heavy shade, and freedom from disturbance; while other parts of the stand are heavily cut ("gaps"), including removal of some dominant trees to provide more light for subdominant trees and understory plants. Intermediate levels of thinning are similarly applied in a typical variable-density prescription. This practice is also known as "free thinning."

- **Vegetation Composition:** See Plant Composition and/or Stand Composition.

- **Vegetation Management:** The use of fire, timber harvest, tree thinning, rangeland, and wildlife habitat activities, practices, and projects that alter the vegetation to meet vegetation resource management objectives.

- **Vegetation Type:** A standardized description of vegetation. The type is based on the dominant plant species and the age of the forest. It also indicates how moist a site may be and how much fuel is likely to be present.

- **Vernal Pool:** Seasonal amphibious environments dominated by annual herbs and grasses adapted to germination and early growth under water. Spring desiccation triggers flowering and fruit set, resulting in colorful concentric bands around the drying pools.

- **Vertical and Horizontal Structure Diversity:** Describes the configuration of trees within a forest stand that create a variation of structure where trees stand straight up and down (vertical) or grow at an angle (horizontal).

- **Vertical Fuels:** Those fuels (brush, small trees, decks, etc.) that provide a continuous layer of fuels from the ground up into the upper fuel layers (i.e., tree canopy or roofs).

- **Viewshed:** The landscape or topography visible from a geographic point, especially that having aesthetic value.

- **Volunteer Fire Department:** A fire department associated with a local agency (either a city or a special district authorized to provide fire protection) that is composed almost entirely of volunteer, unpaid, firefighters, whose primary objective is community fire protection.

- **Volunteer Fire Company:** A fire department not associated with a local agency (either a city or a special district authorized to provide fire protection) that is composed almost entirely of volunteer, unpaid, firefighters. Volunteer Fire Companies also include volunteer firefighting organizations associated with Indian Tribes whose primary objective is community fire protection rather than wildland fire suppression, and volunteer firefighting organizations associated with timber/lumber companies who provide community fire protection.

- **Watershed:** All of the land that drains water runoff into a specific body of water. Watersheds may be referred to as drainage areas or drainage basins. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

- **Water Tender:** A ground vehicle capable of transporting specified quantities of water.

- **Wick:** A combustible material that allows fire to travel along a confined path to larger fuel sources. An example would be a wooden fence connected to a home.

- **Wildfire:** A wildland fire originating from an unplanned ignition, such as unauthorized and accidental human caused fires, lightning, and prescribed fires that are declared wildfires. Some natural forest ecosystems depend on wildfire.

- **Wildfire Risk:** See Fire Risk.

- **Wildlands:** Areas in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered. Can also include large cattle ranches and forests managed for timber production.

Wildland Agency: Any federal, tribal, state, or county government organization participating in wildland fire protection with jurisdictional responsibilities.

Wildland Fire: A non-structure (i.e., non-house) fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use, and prescribed fire. See also Wildfire.

- **Wildland Urban Interface (WUI):**

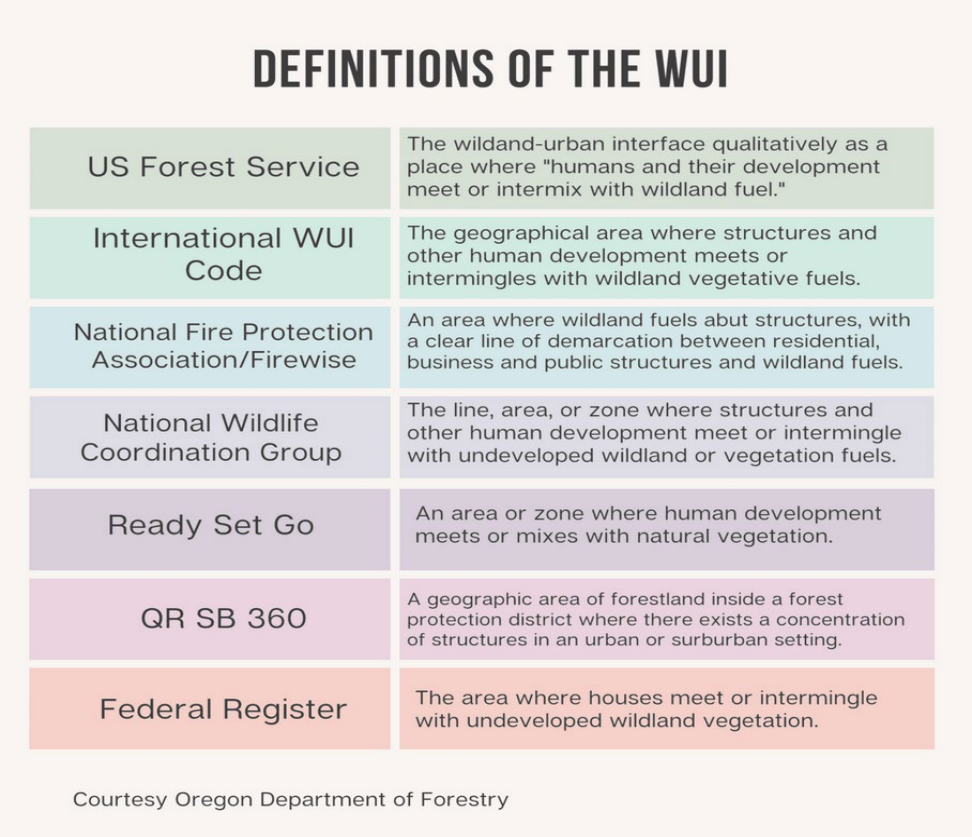

Figure 52: Table, From *Project Firehawk: The WUI is Dead. Long Live the WUI*, Ed Keith. Fire Adapted Communities Learning Network, December 9, 2021, https://fireadaptednetwork.org/project-firehawk-the-wui-is-dead/ Accessed 4/4/2022

- **Winds Aloft:** Upper winds that occur in the atmosphere above the surface level, generally 2,000 feet and higher.

- **Windthrow:** Trees that are uprooted by wind events. Formerly protected stands whose edges are opened up and become vulnerable to this effect. Also known as "blow-downs."

- **Woody Biomass:** The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management.

- **Woody Biomass Utilization:** See Biomass Utilization.

K. References

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