ATTACHMENT 4:

2019 CWPP Part 5

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5.1 ASSETS AND VALUES AT RISK

Assets and values at risk are those things that are important to quality of life that can be threatened with destruction or loss from wildfire. These include a variety of items and conditions such as homes, businesses, critical 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.

The term **assets** may not fully convey the community value found in particular items and intangibles such as air quality. They are the precious and often unquantifiable elements that make up the quilted fabric of community life. Humboldt County's communities have evolved with a connection to the land and its history. This creates what could be described as high community value, springing from a shared sense of place, strong family and neighbor ties, and the enjoyment of community life within a unique *bioregion*.

Some communities contain infrastructure that is critical to the entire county (e.g. hospitals or utilities), which naturally makes the risk of loss much graver in the event of a wildfire. Many of the more populated areas around Humboldt Bay and the Highway 101 corridor contain the county's most critical facilities: hospitals, government facilities, major thoroughfares, schools, fire stations, etc., giving the area a higher asset value. **When an area has a concentration of high-value assets in the presence of *hazardous fuels* and a high fire threat, it is considered an area more at risk of loss due to wildfire.** *For more information on fire hazards, see Map 2.3.1, **Fire Hazard Severity Zones,** in Part 2, **Risk-Assessment Summary**.*

Bioregion: 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 life within a bioregion.
Hazardous fuels: Accumulations of burnable materials including but not limited to living or dead vegetation, structures, and chemicals that can feed a fire.

This chapter provides a brief introduction to Humboldt County and identifies those elements most at risk from loss due to wildfire.

5.1.1 INTRODUCTION TO THE PLANNING AREA: HUMBOLDT COUNTY

The planning area for this CWPP includes all the area within the boundaries of the County of Humboldt, with an emphasis on unincorporated areas. At 3,570 square miles (2.3 million acres), Humboldt County is the 14th-largest county in California. Nearly 34% of the county is either in public ownership or tribal lands. Incorporated cities occupy 23,011 acres, just under one percent of the total land area. The National Forests, National Parks, and public land managed by the Bureau of Land Management (BLM) total 571,200 acres; the State Parks system encompasses 72,200 acres. The Yurok and Hoopa tribal lands total 127,512 acres, or 5.6 percent of the total land area in the county. Unincorporated lands subject to the County's land-use jurisdiction (areas outside cities, and federal, state, and tribal trust lands) total approximately 1,565,000 acres.

Humboldt County is among California's northernmost counties, serving as a gateway to the vast temperate rainforests of the Pacific Northwest and alternatively to the legendary California wine country to the south *(see Map 5.1.1, **CWPP Planning Area**).* The County's strikingly rugged coastline spans approximately 100 miles and includes Cape Mendocino, the westernmost portion of the continental United States. Offshore is an area of intensive ocean upwelling and rich marine productivity. It is also an area where three tectonic plates converge, creating one of the most seismically active sites in the world, known as the Triple Junction. The sheltered waters of Humboldt Bay serve as an economic focal point, functioning as the principal port and a center of commerce. The Bay is also a significant

natural resource area featuring extensive wetlands, fertile bottomlands, and wildlife habitat, including the Humboldt Bay National Wildlife Refuge.

Moving inland, the Coast Range mountains rise quickly and dominate most of the county's interior, defining the Eel, Van Duzen, Mattole, and Mad River *watersheds* in the central and southern areas, and the Redwood Creek watershed in the northwest. In the furthest northeastern reaches of the county, the Klamath Mountains include some of the higher elevations, with steep slopes that descend to the Klamath and Trinity rivers.

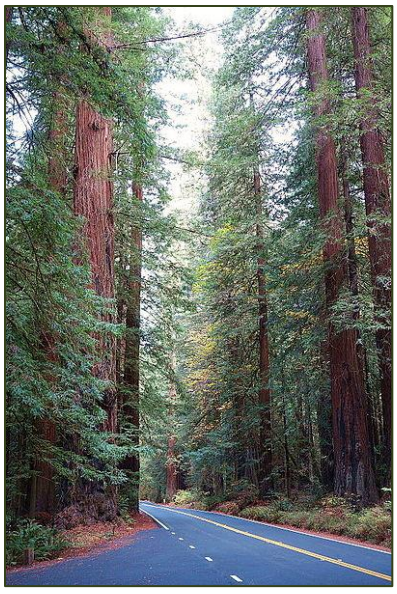
> ***Watersheds:*** All the land that drains water runoff into a specific body of water is the watershed of that river or lake, also referred to as a drainage area or drainage basin. Ridges of higher elevation usually form the boundaries between watersheds by directing the water to one side of the ridge or the other. The water then flows to the low point of the watershed.

Humboldt County's hydrologic features are abundant. Humboldt Bay, nestled into the coast at the county's midpoint, is the only deep-water port between San Francisco and Coos Bay, Oregon. Thousands of waterways flow through the region, from small ephemeral streams to large creeks and rivers, eventually making their way to the Pacific Ocean. Noteworthy rivers running through the county are the South Fork Eel, mainstem Eel, Mattole, Van Duzen, Mad, South Fork Trinity, Trinity, and the Klamath. Redwood Creek is a significant watershed that covers half the length of the county. These watersheds can be grouped into four larger basins: Klamath-Trinity, Mad-Redwood, Eel, and Mattole.

Eighty percent of the county's 2.3 million acres is forested. Fifty percent of this forested land is private commercial timberland (the county typically leads the state in timber production), and 35% is state or federal public land, including Redwood National and State Parks, Six Rivers National Forest, the King Range National Conservation Area, and Humboldt Redwoods State Park.

While Douglas fir represents the predominant forest type, the more emblematic tree is the coast redwood, of which towering groves thrive in areas of the county with a moist temperate climate. Though forests are a defining feature, agriculture is a key part of the landscape and remains an important base industry. Approximately one-quarter of Humboldt County (634,000 acres) remains agricultural.

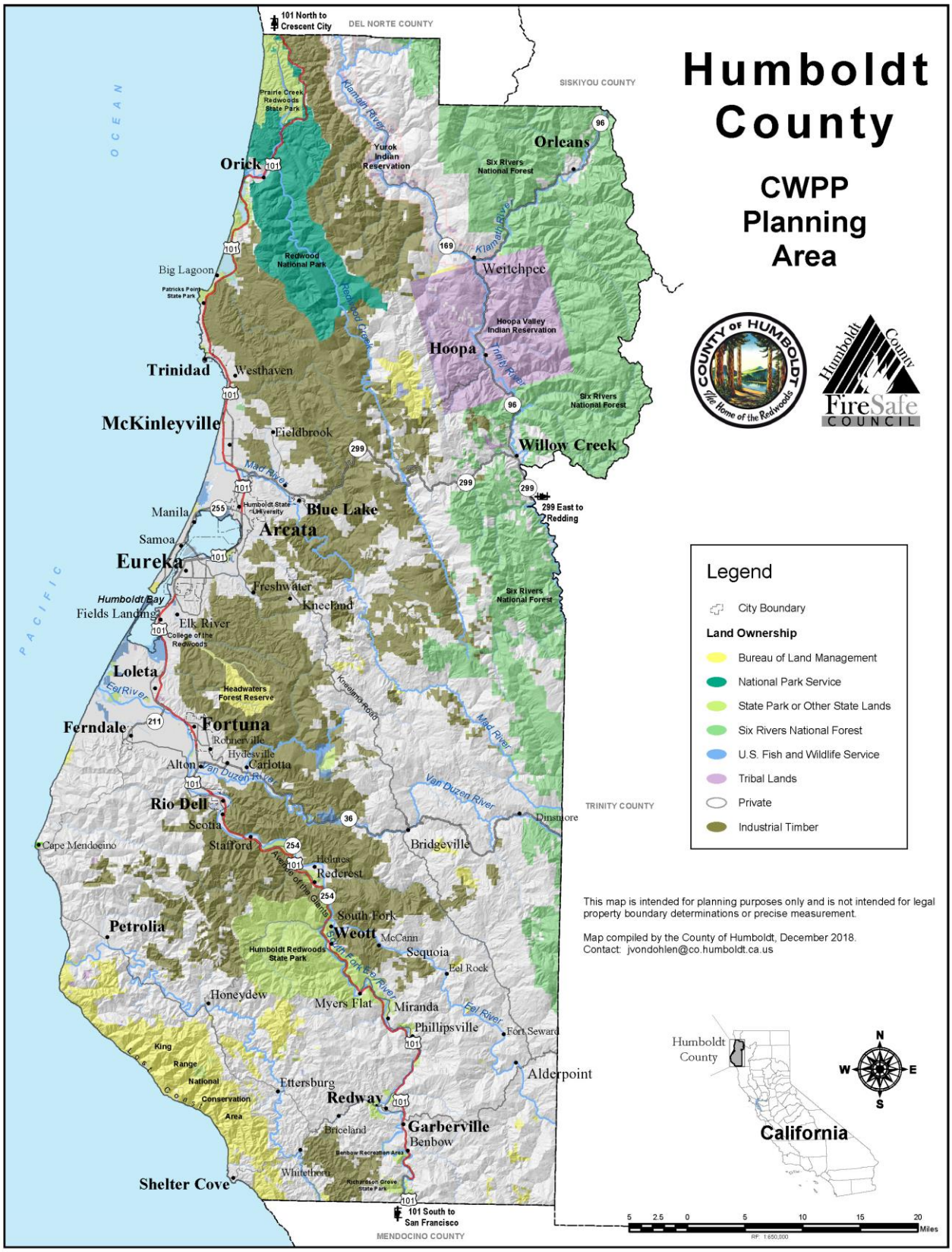
Timberland and agriculture account for the majority (60%) of the county's unincorporated rural land uses, including approximately 1,009,000 acres of Timberland Production Zone (TPZ) and 283,000 acres in Williamson Act agricultural preserves. Open space and parks occupy nearly 582,900 acres, representing 26% of the county land base.



Avenue of the Giants

Mattole Estuary

Map 5.1.1 CWPP Planning Area



5.1.2 COMMUNITY AND ECONOMY

Population and Demographics

According to the US Census, the total population of Humboldt County was 136,754 in July 2017, which represents a 1.6% increase since the 2010 Census.[1] With the exception of a population decline that occurred between the years 1960 and 1970 due to reductions in the local lumber industry, the countywide average annual growth rate has been approximately 0.75% per year over the last thirty-five years.[2]

In 2016, approximately 53.2% of Humboldt County's residents lived in unincorporated areas, outside of the county's seven cities, down from almost 57% in 1970.[3] This is important in regard to *wildfire*, as unincorporated areas in Humboldt County generally have a higher *fire hazard* rating than incorporated areas; unincorporated areas often lack adequate fire services, are rural and/or remote, and have homes surrounded by dense vegetation. Three of the county's seven cities have populations over 10,000: Arcata, Eureka, and Fortuna. Approximately one-third of the county's population resides in Eureka and Arcata, which constitute the Humboldt Bay region and the economic center of the county. Forty-seven percent reside in the county's seven cities. *See Map D.1,* ***Population and Communities at Risk*** *in Appendix D,* ***Background Information for Assets and Values at Risk*** *for more information.*

> ***Wildfire:*** An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.
>
> ***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.

Based on the U.S. Census, per capita income in Humboldt County was $25,208 in 2017, and the median household income was $43,718.[4] It was estimated in 2017 that there are 3,997 households with less than $10,000 in income and benefits per year and 11,356 households with $10,000 to $25,000 in income and benefits per year. In total, this represents 28.4% of all households in the county.[5] Additionally, 56.5% of homes were owner occupied from 2013-2017, with median gross rent $914.[6] It should be noted that Humboldt State University's student population represents about 6% of the county's population (average of 8,294 2011-2018).[7] Students often do not work, or they are employed in part-time, low-wage service jobs. This can deflate the median household income for the county and inflate the numbers of those who are living below the poverty line.

Based on 2017 U.S. Census Population Estimates Program, 17.2% of Humboldt County's population is 65 or older. This is greater than the state average of 13.9%.[8] Thirty-seven percent of the County's over-

[1] U.S. Census Bureau. (2017). Quick Facts: Humboldt County, California. Retrieved from https://www.census.gov/quickfacts/fact/table/humboldtcountycalifornia/PST045216

[2] County of Humboldt, Department of Planning & Building. (2017). Humboldt County General Plan – Revised Draft Environmental Impact Report. Section 2.1: Project Location and Setting, Tables 2.1-1 and 2.1-2. (pp. 2-2 and 2-3). Retrieved from https://humboldtgov.org/DocumentCenter/View/58838

[3] County of Humboldt, Department of Planning & Building. (2017). Humboldt County General Plan – Revised Draft Environmental Impact Report. Section 2.1: Project Location and Setting. (p. 2-2).

[4] U.S. Census. Quick Facts: Humboldt. (2017).

[5] U.S. Census Bureau. American FactFinder. 2013-2017 American Community Survey 5-Year Estimates. Retrieved from https://www.census.gov/acs/www/data/data-tables-and-tools/american-factfinder

[6] U.S. Census. Quick Facts: Humboldt. (2017).

[7] Humboldt State University. (2018). Data: Reports. Fall Semester 2011-2018. Retrieved from https://www2.humboldt.edu/data

[8] U.S. Census Bureau. Quick Facts: California [vs.] Humboldt County [as of July 2017]. Retrieved from https://www.census.gov/quickfacts/fact/table/CA,humboldtcountycalifornia/AGE295216

65 population has disabilities of some kind, and 8% have incomes below the poverty line.[9] **These residents may be less able to prepare for wildfire and other disasters, or to undertake other fire-safety and prevention actions, and so may require assistance to ensure their homes and properties are fire safe.** It is also estimated that 19.2% of the county's population is 18 or younger, slightly less than the state average of 22.9%.[10]

Communities at Risk

Nearly all populated areas within the county have been designated a state or federally recognized Community at Risk (CAR). CARs are defined as wildland-urban interface communities that are at high risk of damage from wildfire. *Existing CARs are shown in Figure D.1, **Humboldt County Designated Communities at Risk** in Appendix D, **Background Information for Assets and Values at Risk**. Map D.1, **Population and Communities at Risk** in that same appendix also displays these existing CARs geographically.*

Homes and Structures

Property values range from moderate to moderately high. Prices are continuing to rise as people leave warmer areas for the cool coastal climate. Although real estate prices peaked in the first quarter of 2017 following recreational marijuana legalization and are now declining, they are still high in rural areas, with urban values consistently climbing.[11] **On a statewide scale, real estate values in Humboldt County are considered moderate.**

Some land uses, such as single-family rural residential, are more vulnerable to wildfire. According to the Revised Draft of the Humboldt County General Plan,

> "Rural residential land, which may also contain timber, agriculture, and grazing lands, occupies approximately 152,863 acres of the unincorporated area. Single-family residential-zoned lands cover 21,412 acres and an additional 560 acres are designated for multi-family housing.[12]"

An analysis of Humboldt County Assessor data found that 62% of all unincorporated area parcels fall within High or Very High Fire Hazard Severity Zones (as determined by CAL FIRE) and that approximately 86% of those are residential dwelling parcels.[13] *(See section 5.2.3 in Chapter 5.2, **Wildfire Environment,** for more information on Fire Hazard Severity Zones.)* This indicates that a large majority of the parcels within areas of the greatest Fire Hazard Severity zoning are liable to contain existing homes or accommodate new homes in the future—one of the county's most valued community assets. In fact, based on an evaluation of parcels with development potential in Humboldt County, 67% of General Plan build-out[14] county-wide could be expected to occur in High and Very High Fire Hazard Severity Zones. Much of the future growth in the county is expected to occur in areas that are more vulnerable to wildfire risk.

It is a well-known fact, albeit difficult to quantify, that there are many homes built in Humboldt County without permits. Much of this unpermitted building is believed to be located in rural areas beyond the urban fringe and off the beaten path. The Humboldt County Planning and Building Department is administering the Safe Homes Program through the year 2022 in an effort to incentivize

[9] U.S. Census Bureau. American Fact Finder. 2013-2017 American Community Survey 5-year Estimates.

[10] U.S. Census Bureau. Quick Facts: California vs. Humboldt County.

[11] Kyla and Charlie Tripodi, The Land Man Office, "Rural land valuation trends: cannabis and timber," University of California Cooperative Extension: Redwood Region Forest Management and Market Trends workshop, April 4, 2018.

[12] Revised Draft EIR. (p. 2-1).

[13] A parcel that is categorized by the Assessor for use as single family, multiple family, or rural residential development, including Agriculture and Timber parcels.

[14] The potential development based on the allowed density according to the Humboldt County General Plan.

building permit compliance for existing unpermitted structures.[15] There are also many homes in the county that were built before building code compliance was required; building codes include standards intended to harden homes against damage from wildfire. In addition, in some instances, alternative owner builder permit procedures can be used, for which many of the standard permit requirements do not apply, including those intended to harden homes against wildfire. Many of these unpermitted, pre-code, and alternative owner builder permitted homes are especially vulnerable to wildfire ignition. That being said, and based on recent examples in neighboring counties, all homes in Humboldt County have vulnerabilities to wildfire and steps should be taken to mitigate wildfire impacts.

SAFE HOMES PROGRAM

Do you have an unpermitted residential structure, residential accessory structure, or addition on your property?

Through December 31, 2022, the Humboldt County Planning and Building Department and the Humboldt County Division of Environmental Health will waive penalty fees associated with construction permits. Please note that all customary permit fees will apply during this program.

For additional information and submittal requirements contact:

Humboldt County Building Inspection Division **707-445-7245**

Humboldt County Planning Division **707-445-7541**

Humboldt County Environmental Health Division **707-445-6215**

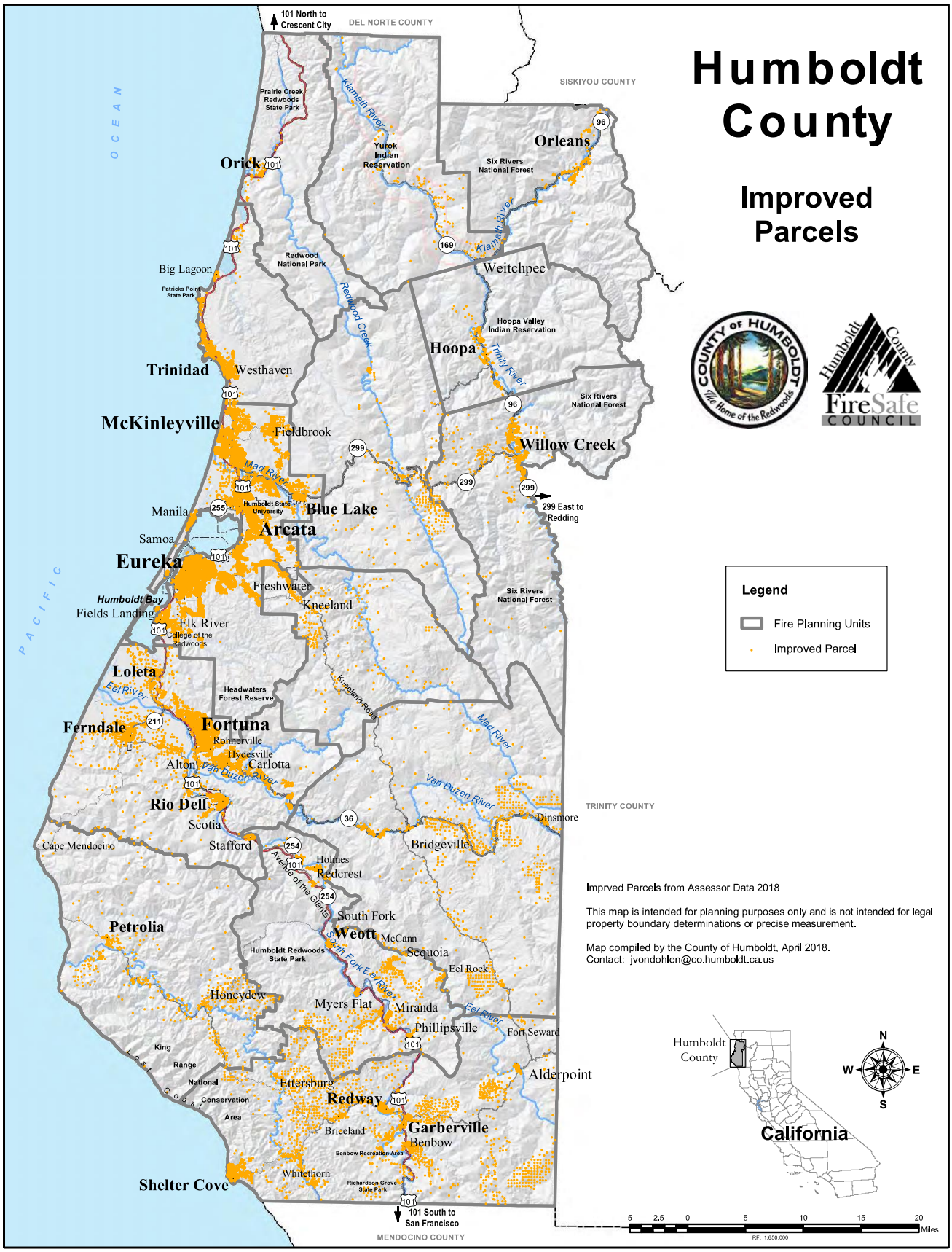
https://humboldtgov.org/156/Planning-Building

One way to identify development that is not reflected in building permit data is through an analysis of the assessed value of parcels. If a property is assessed at a higher value than the base land value, it can be surmised that there is some type of improvement, most likely a structure. The *Improved Parcels* map on the following page *(Map 5.1.2)* provides an illustration of parcels with improvements. Each orange dot signifies a parcel containing an assessed improvement, most likely a structure. This map shows the extent of the *wildland-urban interface* (WUI) in the rural southern and eastern portions of the county, where dispersed development creates both land management and fire preparedness and protection challenges. (It must be noted that this map only shows assessed parcels and will not include some parcels such as Tribal trust lands, which is a limitation in the data source). Another, more general way to illustrate where homes and structures are located, with a focus on unincorporated areas (based on 2010 Census data) is shown in *Map 5.1.3, Development Density*.

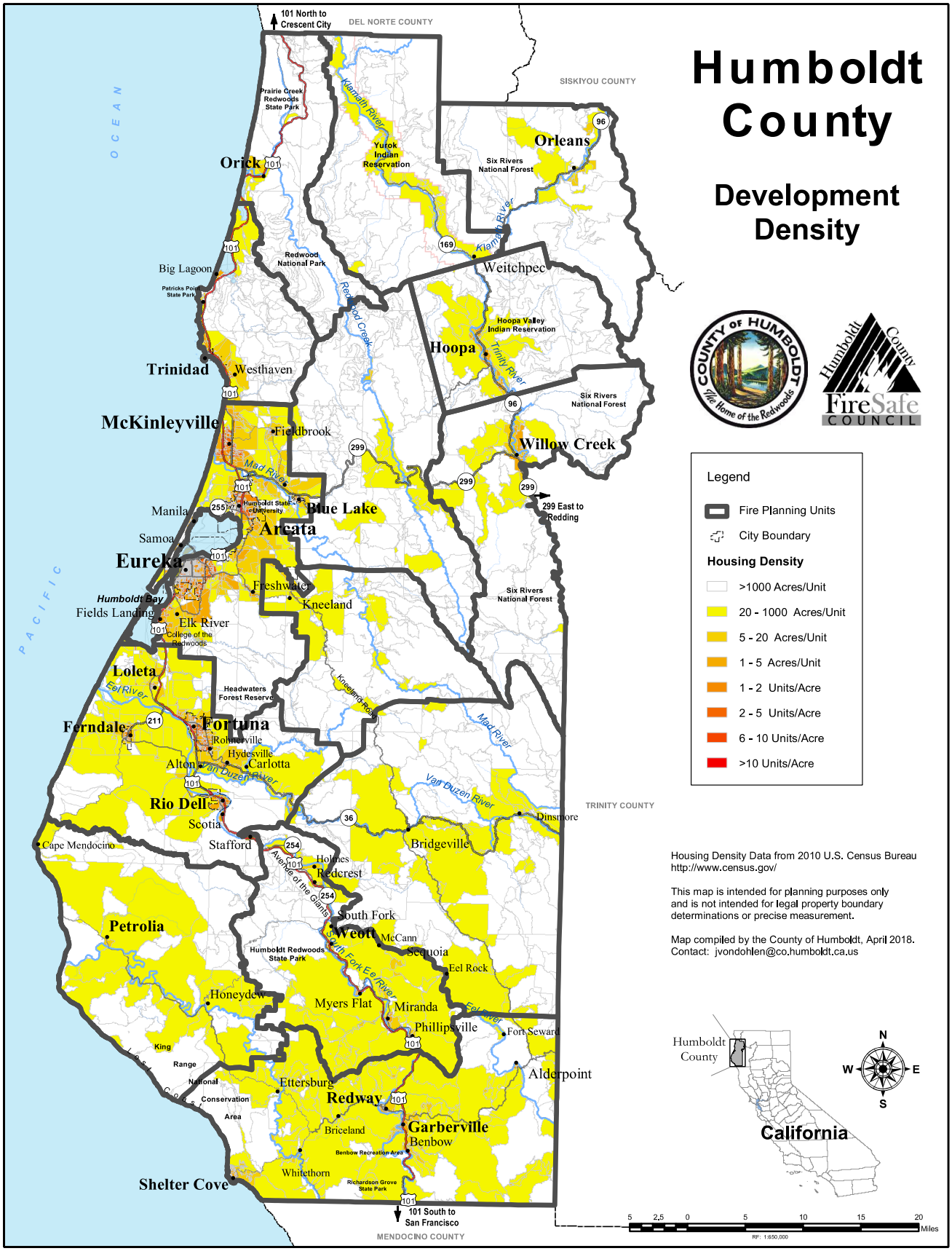
Wildland Urban Interface (WUI): The zone where structures and other human developments meet, or intermingle with, undeveloped wildlands.

[15] Humboldt County, Building Inspection Division Homepage: *https://humboldtgov.org/153/Building-Inspection*

Map 5.1.2 Improved Parcels



Map 5.1.3 Development Density



The seasonal use of some structures is also a factor in terms of wildfire threat. As described below, Humboldt County has a significant tourism economy, which generally means: 1) There are more people in the county during summer months, and 2) Cabins and other structures that may be more vulnerable to wildfire are frequently occupied during this time. This is also true of the population increase in autumn, during the marijuana harvest. Many people who are unfamiliar with wildfire safety issues come to Humboldt County during the fall harvest season—which coincides with the time of greatest wildfire danger—and populate areas that are generally of higher fire risk and hazard. Although the total numbers of this seasonal population increase are not significant at the county level, they can be significant at the local level, and frequently occur in communities with high or very high wildfire hazard and risk. Furthermore, these population increases, along with the activities and housing accommodations associated with marijuana harvesting, can contribute to the already considerable wildfire risk in these areas. It is unclear how this trend will be influenced by the legalization of marijuana and the associated regulation and oversight of the legal industry. *For more information, see **Marijuana** in section 5.1.3 below.*

Structural Ignitability

Most homes in Humboldt County are built in towns—or the more urban areas of the county—principally in the coastal zone surrounding Humboldt Bay. There are a vast range of construction types in the county, from non-permitted cabins off the electrical grid to state-of-the-art newer homes. Older wooden homes generally have higher *structural ignitability* than newer homes, meaning they can catch fire more easily. That is, unless they have been retrofitted to current building standards, which is not common here.

Generally, **structural ignitibility of homes in Humboldt County is very high,** with most homes made of wood and built before the 2007 WUI Building Codes (CA Building Code Chapter 7A) came into effect. The dominant construction style uses local wood products, especially Douglas fir and redwood, which are highly flammable when dry. Homes here generally have many small openings where embers could penetrate the building envelope and ignite the structure during a wind-driven ember storm. Ember storms are becoming more common throughout California, leaving entire neighborhoods and even towns destroyed.

Homes with non-fire-safe roofing and siding are common, as are cantilevered decks with flammable materials stored underneath (e.g. lumber, cardboard boxes, etc.). Relatively few homes and structures in Humboldt County have been lost as a result of wildfire, although this may be due to the fact that few wildfires have burned close to urban areas rather than a reflection of fire-safe construction.

The relatively low occurrence of recent wildfire, in combination with the coastal climate, leads many Humboldt residents along the coast to assume that their risk of wildfire is low, which is often untrue. As a result, many local residents do not consider fire safety activities as part of their regular home maintenance. This could leave many homes here highly vulnerable to the types of urban wildfire recently seen throughout California.

Anecdotal evidence from fire service personnel indicates that structure loss from fire (not wildfire) in Humboldt County has increased over the past decades. Some link this trend to indoor growing of marijuana, with the most common ignition occurrence resulting from faulty, poorly modified, and/or unpermitted wiring, or more recently, explosions from extraction operations. It is widely recognized that many homes in Humboldt County are now being used for indoor marijuana cultivation. These structures (or at least the wiring within them) are often not up to state building code standards. In many cases, there are hazardous items located near the structure, including propane and diesel tanks, generators, and even bales of straw, which are sometimes used as soundproofing material to limit noise produced by generators. The ignition potential for these structures is very high and poses an ignition risk to the surrounding wildlands or urban neighborhoods, as the case may be. This risk could begin to decline with marijuana legalization, as legal operations will have to come into compliance, and the black market will continue to decline. On the other hand, one could conjecture that marijuana growers, unaccustomed to

the cost and complexity of compliance with legal marijuana regulations may choose to move back indoors and underground, which could mean a continued risk of structure fires from indoor marijuana operations. It is still too early to know; this is a risk to monitor closely and for which to prepare possible solutions.

Commercial and Economic

The local economy was built on natural resource-based industries such as timber production and manufacturing, fishing, ranching, and dairy farming. These industries, although diminishing to varying degrees from historic levels, are still important contributors to the local economy. Agricultural land and timberlands are an important element of Humboldt County's identity. Fire was historically used as a land-management tool in local rangeland and timber management. Prescribed fire is now seeing a resurgence in the county, especially in range and oak woodland management.

*For more information on prescribed fire, see **Recent Fire History** in Chapter 5.2, **Wildfire Environment**, and Chapter 3.5, **Restoration of Beneficial Fire**.*

There are many dense, overstocked timber stands resulting from decades of clearcutting and fire suppression. Without strategic and effective pre-fire thinning treatments, wildland fire could have potentially disastrous consequences to timber resources, removing them from production and necessitating lengthy restoration programs.

As Humboldt County shifts away from dominant natural resource extraction industries, new innovations are emerging to diversify the economy. However, many enterprises are still dependent on wildlands and agricultural lands, both of which could be vulnerable to wildfire. According to the *Economic Development Element* of the 2017 *Humboldt County General Plan:*

> "New local industries have emerged that export more knowledge-based, specialty, and technology-driven products and services. In fact, our traditional industries have provided the basis for many of these emerging businesses. Habitat restoration, sustainable forest management, organic milk production, and computer network services are all examples of innovative local products and services that the world needs and wants to buy. These new industries have joined traditional natural resource and agricultural industries to diversify and integrate the county into the global economy."[16]

Based on the 2012–2016 American Community Survey 5-Year Estimates, the measurable employment industry type responsible for the most occupations in Humboldt County is the "management, business, science, and arts" sector, making up 34% of the working population. A contributing factor to this employment category reflecting the greatest number of workers, is the inclusion of most of those employed by Humboldt State University, a significant employer in the county. Continuing down the list, the "sales and office occupations" are 24%, "service occupations" are 23%, "natural resources, construction and maintenance occupations" are 10%, and finally "production, transportation, and material moving occupations" make up 9% of total employment in Humboldt County.[17]

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[16] County of Humboldt, Department of Planning & Building. (2012). Humboldt County General Plan Update. Chapter 9: Economic Development Element. Planning Commission Approved Draft General Plan. Retrieved from www.co.humboldt.ca.us/gpu/documentsplan.aspx

[17] U.S. Census Bureau. American Fact Finder. Occupation by class of worker for civilian employed population 16 years and over. 2013-2017 American Community Survey 5-Year Estimates. Retrieved December 28, 2018, from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_S2406&prodType=table

Figure 5.1.1 Occupations by Measurable Employment Industry Type

Public and private service and retail sectors are less vulnerable to impacts from wildfire. Tourism, recreation, and most of the natural resource-based sectors of the local economy however could be significantly impacted by a large wildfire, including deterioration of air quality from excessive smoke.

Humboldt Bay is the commercial focal point of the county, serving as the major port and center of exchange. The Bay provides most of California's oyster production and is a significant natural resource. Much of the county's property value is concentrated around the Bay and surrounding coastal areas where the cities and larger population centers are located, particularly industrial and residential uses. Many of these coastal urban and suburban areas are categorized by CAL FIRE as Moderate Fire Hazard Severity Zones, or are not ranked at all. Yet these areas have excessive fuels that could be ignited under the wrong combination of conditions.

Marijuana production has been a fundamental component of the Humboldt County economy for decades. It is estimated to have a $4 billion cash value in the county (in comparison to about $350 million for timber and other agriculture combined).[18] The commercial and economic changes to the local economy with the 2018 statewide legalization of recreational marijuana, more recently called "cannabis," are still being documented.[19,20] However, there are indications of a rapid economic shift; some areas of the local economy are growing, and others—most notably retail businesses in rural areas—are declining rapidly, presumably with less cash availability in the hands of local residents.

*See the descriptions of **Forests**, **Agriculture,** and **Marijuana** below for more information on commercial natural-resource-based assets in Humboldt County.*

Schools

There are 32 school districts in Humboldt County.[21] The districts collectively operate 71 schools including elementary, middle, and high schools, as well as many local charter schools. Many schools are designated Red Cross emergency shelters. In rural communities with high fire risk, many schools have been identified by local residents at community workshops as potential wildfire evacuation sites.

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[18] Forsburg, R. (2018). American Ag Credit, "Redwood Region timber market: regional, national and international influences." Redwood Region Forest Management and Market Trends. Workshop, April 4, 2018. University of California Cooperative Extension (UCCE), Eureka, CA. USA.

[19] Wilson, S. & Awal, K. (2018). Outlaw weed comes into the light. The Washington Post. Retrieved from *https://www.washingtonpost.com/news/national/wp/2018/03/16/feature/californias-outlaw-marijuana-culture-faces-a-harsh-reckoning-legal-weed/?utm_term=.939bcde838ed*

[20] Fuller, T. (2017). Legal Marijuana is almost here: If only pot farmers were on board. The New York Times. Retrieved from *https://www.nytimes.com/2017/09/09/us/california-marijuana-growers.html*

[21] County of Humboldt, Office of Education. (n.d.). Humboldt County School Districts. Retrieved December 28, 2018, from *https://hcoe.org/schools*

Medical Facilities

Four hospitals are located within Humboldt County. These critical assets become increasingly valuable in emergency situations and during wildfire incidences. *Figure D.3, **Medical Facilities** in Appendix D contains a list of these facilities with contact information.*

Critical Infrastructure

Critical infrastructure includes the roads, utilities, water, and other services that enable Humboldt County residents to live here. The major road systems within the county—Highways 101, 299, 36, and 96—are crucial assets.

Erosion and landslides, which are likely to follow a wildfire event in the county, pose a significant threat to the transportation infrastructure. It is not uncommon for all four of these highways—all major routes in and out of the County—to be closed at the same time. A major wildfire could easily leave Humboldt County isolated for days, weeks, or more.

Fire-suppression efforts rely on roads to strategically place equipment and firefighting personnel during wildfires. Fires can create conditions that block or prevent access throughout the county; fires can isolate residents and prevent emergency service providers from reaching vulnerable populations or making repairs.

Power lines are at significant risk of wildfire, not only due to increasing winds with climate change; many power poles are made of wood and are therefore susceptible to burning. Power lines have become an increasing risk to starting wildfires throughout the state, as seen in the 2017 Wine Country Fires.

Wildfire typically does not have a major direct impact on bridges. However, wildfires can create conditions in which bridges are obstructed. This is especially true for rain events following wildfire, which can lead to excessive erosion. Many bridges in areas of high to moderate fire risk are critical to provide the only ingress and egress for large areas and, in some cases, for isolated neighborhoods. Additionally, under a worst-case scenario of an earthquake during fire season initiating a wildfire, bridges could be unsafe or unusable, causing major evacuation problems.

Public and private utilities within Humboldt County are important assets. The security of clean water is fundamental to all communities. Increased surface runoff following a wildfire can cause inputs of nutrients, ash, and other particulate matter into county water sources. There are approximately 24 different local agencies[22] that provide water service, 2 regulated public utilities[23], and an additional 35 mutual water associations[24] of varying sizes throughout the county. These providers supply domestic water to residents and visitors. The larger providers also maintain water for fire suppression. All these water suppliers are site-specific and service the needs of a particular location. Facilities maintained by these providers such as treatment plants, pumps, and storage facilities can be damaged during or following a wildfire.

Airports

Nine public airports operate in Humboldt County. *See Figure D.4 in Appendix D, for a list of local airports.*

Airstrips are important infrastructure components as they provide recreational opportunities, emergency landing sites, and potential evacuation sites, and facilitate visitor travel and tourism. Private airstrips exist in the county that can be used as emergency landing or evacuation destinations, many of which are known only to local emergency responders.

[22] City and District providers regulated by an elected board.

[23] Regulated by the California Public Utilities Commission (CPUC) and the utility establishes rates through a CPUC rate making process.

[24] Landowners own shares in these systems rather than paying rates.

5.1.3 NATURAL

Natural resources are one of the defining characteristics of Humboldt County and are highly valued for their contribution to quality of life. They are also important because they attract tourist-related income and outdoor enthusiasts.

As discussed in *Chapter 5.2, Wildfire Environment,* fire is a natural process in this bioregion; low-intensity fire can promote *ecosystem* health. However, the suppression of wildfire for decades has resulted in a buildup of hazardous fuels, increasing the potential for large fires that could severely damage Humboldt County's natural assets, including protected and recreational areas as well as the extensive timber industry lands. *(See section 5.2.2 and Appendix E,* ***Background for Wildfire Environment,*** *for more information on fire ecology.)*

> ***Ecosystem*****:** A community of organisms that makes up a specific area. Examples of ecosystem types include a pond or a forest.
>
> ***Biodiversity*****:** The abundance and variety of plant, fungi, and animal species found in an ecosystem, including the diversity of genetics, species, and ecological types.

Forests

As stated in *section 5.1.1* above, forestlands define much of the visual landscape of Humboldt County, covering more than eighty percent of the land area and totaling nearly 1.9 million acres. Forest types vary across the county, with Douglas fir/mixed-evergreen forests dominant, including oaks and pines, with yew, cedar, and hemlock trees. Other forest types include redwood forests, montane hardwood forests, and oak woodlands, which provide a wide range of wildlife habitat. Forest ecosystems support a wealth of *biodiversity*, facilitate wildlife migration patterns, and provide sanctuary for many threatened, endangered, or otherwise sensitive species. These valuable ecosystems also support watersheds by retaining significant amounts of water.

In addition to their vulnerability to lightning-caused fires, forestlands can draw large numbers of people for their beauty and recreational opportunities, increasing the likelihood of human-caused fire ignitions. The scenic value of forestlands, whether viewed from within or afar, is of great local importance; their vast expanses being emblematic of the visual character of the county.

As previously mentioned, the timber industry has long been a cornerstone of Humboldt County, with approximately half of all forestlands being private commercial timberlands. Timberlands can be highly threatened by wildfire, and contribute to higher fuel hazards across the landscape. The timber cycle of cutting the larger trees, planting with young seedlings, and aggressively suppressing fire to protect those seedlings, results in dense, young forests on both public and private lands that are very susceptible to wildfire. These young forests could carry fire quickly across the landscape. Fire suppression within such forests has contributed to the accumulation of heavy fuel in forest understories, increasing the likelihood of high-intensity fires damaging significant forested areas.

Of note is the industrial timber industry use of the "hack and squirt" (or "frilling") forestry practice, where trees (principally tanoak and some madrone) are cut into and sprayed with concentrated herbicides, leaving large areas of highly flammable standing dead trees. These patches can put nearby areas of healthy trees and wildlife habitat at greater wildfire risk. This practice has led to community concern and protests, especially in the North Fork Mattole watershed.

Finally, another result of fire suppression in Humboldt County's forests is the loss of oak woodlands, a phenomenon seen throughout California. Frequent fire historically kept ridgetop prairies open and reduced Douglas fir (conifer) encroachment into oak woodlands by killing the fir seedlings. With continued fire suppression, conifers have increasingly overtopped the oak canopy and converted declining oak woodland ecosystems to mixed-conifer forests. California adopted new regulations in 2018 to allow for restoration of oak woodlands. The new oak regulations include a "special prescription" for timber harvest or an "exemption." Both options are being tested for 6 years.[25]

Agricultural Lands

Large swaths of working agricultural land around Humboldt County lend a pastoral charm to the local scenery. While vistas of immense forestlands create a sense of remote beauty, the rolling agricultural lands within the prairies and flatlands contribute to the rural character of the region. In addition to the larger dairies and bulb farms, numerous small, organic farms are sprinkled throughout the county. There are a number of "heritage landscapes" within Humboldt County—lands with combined historical, cultural, and scenic values, such as the Arcata and Ferndale Bottoms.

These open areas can act as wildlife corridors and facilitate species migration throughout the region. They can also serve as important fuel breaks for larger wildfires—a place where fire could slow its spread—especially when irrigated. Although these agricultural landscapes may not be especially vulnerable to wildfire directly, they may be impacted by large fires that produce an abundance of smoke, which can have negative impacts on air quality and sun exposure, and even scatter ash on crops. On the other hand, they can potentially function as public escape areas for nearby residents in the event of a large-scale wildfire.

Marijuana

Humboldt County is currently undergoing a rapid economic shift as California's 2018 legalization of marijuana production and recreational use is implemented. It is uncertain what this means for the county's future but several local trends have begun to emerge.

- Since the decriminalization of medical marijuana, there has been an increasing trend of large-scale marijuana production throughout the county, including many greenhouses to facilitate year-round production. Google Earth shows an

Known marijuana cultivation sites in 2015 in a remote area of the county, visible from Google Earth.

[25] For more information, see:

1. Board of Forestry and Fire Protection. (2017). Initial Statement of Reasons, "Oak Woodland Management Exception". [PDF]. Retrieved from http://bofdata.fire.ca.gov/board_business/binder_materials/2017/july_17/full/full_10.0_draft_oak_woodland_exemption_isor.pdf

2. Board of Forestry and Fire Protection. (2016). Final statement of Reasons, "White and Black Oak Woodland Management Special Prescription". [PDF]. Retrieved from http://bofdata.fire.ca.gov/board_business/binder_materials/2016/july_2016/full_/full_8.1_fsor_white_and_black_oak_woodland_special_prescription.pdf

3. Forestry: Timberlands: Restoration and Conservation Forest Management Activities. California Legislative Information, Assembly Bill 1958, Chapter 583 (2016). Retrieved from https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1958

abundance of greenhouses used for marijuana production throughout the county. Nearly all of these were put in without any environmental review, and can have significant negative environmental impacts.

- Many formerly underground sectors of the economy are now in the process of becoming legal, including the processing side of marijuana end products. These have driven up urban real estate prices for warehouses and other industrial sites. Safety factors are still new or do not exist for this developing industry.[26]
- Many new and existing growers, especially those with larger operations, applied for a limited number of County permits; several applicants, and even more considering "going legal," are overwhelmed by the steps necessary to function as a legal business. There are many smaller producers who are unable to obtain permits for a variety of reasons; many of whom are continuing underground operations.
- Local prices for marijuana are declining rapidly as Humboldt County competes with less expensive marijuana produced elsewhere around California.
- Humboldt County real estate prices peaked at an average price per listing of $1.4 million in the first quarter of 2017, and began declining immediately after, dropping to approximately half that value in one year.[27]
- Many smaller marijuana farmers who were historically reliant on black-market marijuana production are leaving. This is resulting in rapid changes in rural land ownership. It is unclear what this will mean for future ownership trends in the county.
- Some community members have reported that this land turnover is also affecting the availability of volunteer firefighters, and the amount of donations made to their volunteer fire departments, many of which operate without a stable funding source.

Marijuana cultivation greenhouses in the middle of dense forested lands.

Future marijuana cultivation site clearing.

[26] Roman, J. (2016). Hazards of the Trade. National Fire Protection Association Journal. Retrieved from https://www.nfpa.org/News-and-Research/Publications/NFPA-Journal/2016/September-October-2016/Features/Growing-Pains/Hazards-of-the-Trade

[27] Tripodi K. & Tripodi, C. The Land Man Office, "Rural land valuation trends: cannabis and timber." Workshop, April 4, 2018. Redwood Region Forest Management and Market Trends. University of California Cooperative Extension (UCCE), Eureka, CA. USA.

The newly legal marijuana production industry is especially vulnerable to wildfire. Many report significant losses to their 2017 crops from smoke damage from that fire season. *The New York Times* wrote after the 2017 Wine Country Fires:

> Even the crops that were not in the direct line of fire could lose value or become unusable because of smoke damage, soot and ash. Growers will have to sort out whether the damage is merely aesthetic or whether it could include contaminants that would present a health risk to consumers, Mr. Allen said. Smoke tends to stick to the plants, which is bad news for a product that depends largely on flavor and scent for its value.[28]

Economic loss from wildfire can be even more devastating for producers who are not able to obtain insurance since marijuana is still considered an illegal drug by the federal government.[29] That said, a recent settlement for over $1 million was paid out to a marijuana production facility following the Thomas Fire.[30]

Additionally, there is the very real threat of fighting fire and running into someone's marijuana crop. This has been a serious issue in Humboldt County for decades, especially when marijuana is grown illegally on public lands (via trespass). This could change with legalization, although it could take years for the outlaw mentality of marijuana production to change.

> Marijuana growers fear they'll lose their crop or even be jailed when fire personnel encounter their rural gardens.
>
> And, at the same time, firefighters fear that growers will get violent or that possibly booby traps set (very rarely) to protect a grow, might injure crew members who encounter them.[31]

The National Fire Protection Association is developing standards for *Marijuana Growing, Production, and Extraction Facilities* (NFPA 1. Fire Code, Chapter 38[32]). These standards are based in part on the experience of legalization in Colorado. Those growing, producing, or extracting marijuana in Humboldt County should review this NFPA code to ensure the safety and compliance of operations.

The legal marijuana industry is still in its infancy in Humboldt County. Regulations provide the opportunity to reduce fire risks and hazards associated with the industry. Reducing ignitions in this sector is targeted in this CWPP's *Countywide Action Plan, Chapter 3.1, Wildfire Ignition Prevention*.

Map 5.1.4 Resources and Economic Assets at Risk below shows resource lands in Humboldt County (agriculture, grazing, and timber production; marijuana cultivation sights are not yet included in available data sets) as well as primary residential areas. These are areas of assets and values potentially at risk to wildfire.

[28] Fuller, T. (2017). Legal Marijuana is almost here: If only pot farmers were on board. The New York Times. Retrieved from https://www.nytimes.com/2017/09/09/us/california-marijuana-growers.html

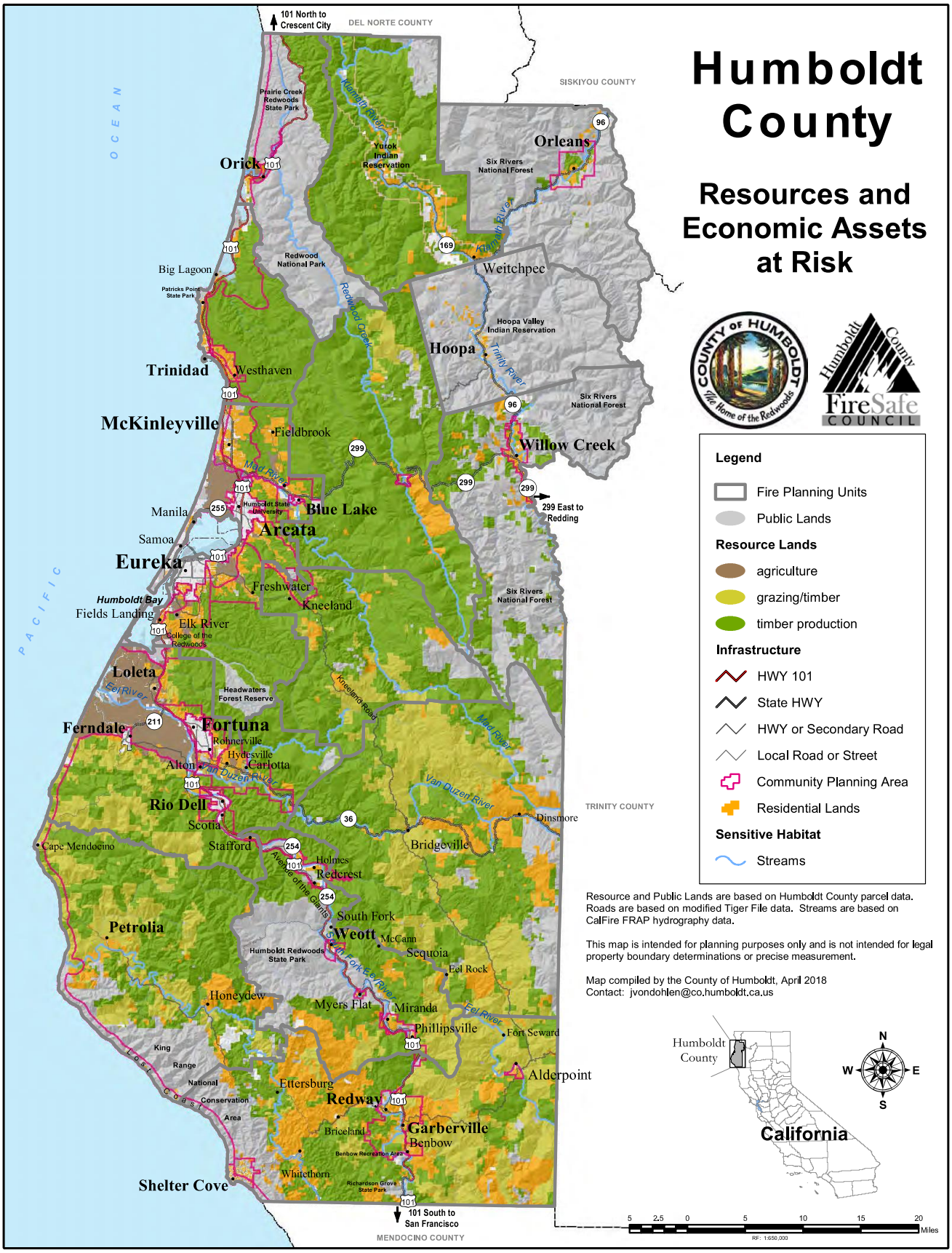
[29] Fuller, T. (2017).

[30] Brugger, K. (2018). Cannabis farmer gets over $1 million insurance payout. Santa Barbara Independent. Retrieved from https://www.independent.com/news/2018/mar/19/cannabis-farmer-gets-over-1-million-insurance-payo

[31] Kemp, K. (2014). Feeling Threatened: When Firefighters Encounter Marijuana Growers. Redheaded Blackbelt. Retrieved from http://kymkemp.com/2014/10/20/fire-and-pot

[32] NFPA 1: Fire Code. (2018). Chapter 38: Marijuana Growing, Production, and Extraction Facilities. National Fire Protection Association. Retrieved from https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1 (The codes may be viewed for free at this link.)

Map 5.1.4 Resources and Economic Assets at Risk



Wildlife

Wildlife in Humboldt County includes animals, fish, plants, insects, and other invertebrates. The diversity of organisms here is extensive. All species found within the county, from the marbled murrelet (*Brachyramphus marmoratus*) to the coho salmon (*Oncorhynchus kisutch*) to the Humboldt milk-vetch (*Astragalus agnicidus*), depend on the environment around them to provide the food, water, and shelter they need to survive. *(More information on at-risk species can be found in Appendix D.)*

While most biologists acknowledge that fire plays a role in the environment in which these species live, little is known (or perhaps remembered) about the relationship of these species to fire. Their response to fire of varying intensities, frequencies, and seasons is also not well understood; even less understood are the effects of various hazard-reduction treatments on rare species. What is known is that that much of the forest exhibits conditions different from those wildlife species are adapted to; it can reasonably be assumed there are at least some negative impacts.

It is important to note that some species depend on downed or standing dead trees for shelter and forage. Fuel reduction efforts have the potential to reduce or eliminate these resources in some areas. Fuel reduction projects can also open the canopy and enable the spread of invasive species that may in turn, affect the wildlife that were dependent on the displaced plant life. Connecting current and evolving research on this topic with fuels reduction practitioners will be important as wildfire hazard mitigation projects are designed and implemented.

All species found within the county have had to adapt to fire in some way in order to survive within this fire-evolved landscape. Some organisms learn to flee, others sprout as a result of fire, while others store extensive amounts of seed within the soil in order to re-occupy a site after a fire. These adaptations have helped to establish the flora and fauna found here.

Aquatic Systems and Fish

The effects of wildfire on aquatic systems and fish have been linked to the *direct* or immediate influence of fire on water quality, and the *indirect* or subsequent effects on watershed characteristics and processes that influence water quality and quantity, stream channels, and aquatic biota.[33]

The effects of fire and fire-related management are of particular importance to those interested in, or responsible for, management of native fish, especially salmonids. Fish and associated fisheries constitute an asset of cultural and economic importance to Humboldt County. The sometimes dramatic, short-term effects of fire and post-fire disturbance on stream channels, water quality, and mortality of individual organisms can be readily apparent.

Circumstances shape the effects of wildfire on populations and communities of native fish. Fish are most vulnerable to both direct and indirect effects of fire where populations are restricted to relatively small areas of habitat, and risk is greatest in isolated stream segments or small networks in steep, confined drainages where severe fires are likely to burn a large proportion of the headwaters and riparian corridors. Where populations are relatively large, have access to diverse, well-connected habitats and/or the capacity to adapt to changing environments, vulnerability is lessened; in many cases, the capacity and even the productivity of habitat can even be improved following wildfire.

Managers have responded to the challenges posed by changing fire regimes and the conservation of native fish and diverse aquatic ecosystems in different ways. In general, options can be categorized as management before, during, and after fire (Dale et al., 2001; Dunham et al., 2003), but a framework for

[33] Gresswell, R.E. (1999). Fire and aquatic ecosystems in forested biomes of North America. *Transactions of the American Fisheries Society* 128(2). (pp. 193-221).

monitoring and adaptation is critical in all cases (Dunham et al., 2003). Management before fire includes maintaining or restoring the resistance or resilience to disturbance before the next disturbance occurs.[34]

Vulnerable salmonid populations are at significant risk to sediment and erosion following wildfires, yet inversion layers created from smoke in late summer and fall can cool streams and help those same populations. Riparian areas are highly vulnerable to wildfire disturbance. Erosion can cause large sediment loads in streams, which can be transported and deposited into rivers and damage aquatic habitat.

Wildlife Habitat

Changing disturbance regimes associated with climate change will impact wildlife species in complex ways in the future. Species that require older, denser, and more structurally complex forest conditions, like the Pacific fisher and the northern spotted owl, would likely be negatively impacted by changes in fire regimes associated with climate change.[35] Researchers note that fisher habitat is driven to a great extent by local vegetation features, and stand-level implications of fire have been examined under a series of future fire scenarios, since fire occurrence and behavior—largely driven by climate and weather—have substantial effects on local vegetation.[36] Research recommends protecting fisher habitat through targeted fuel-reduction treatments, and applying more liberal fire-management policies to naturally ignited fires during moderate weather conditions. Sensitive benthic invertebrate populations may also be reduced by increases in large and severe wildfires that are likely to be associated with climate warming. Larger effects will likely be observed in small, first-order streams.[37]

In order to reduce potential adverse effects to flora and fauna, and especially to listed species, fuel-reduction planners in Humboldt County (such as Registered Professional Foresters) must use the best available information regarding each species within a project area. This includes considering critical habitat attributes that species need in order to survive. Important information such as breeding period, migration patterns, blooming period, and much more can help planners reduce fire threat, while restoring, enhancing, and/or creating necessary habitat within Humboldt County. This is particularly important for landscape level projects.

Before doing any ground-disturbing activities like fuel reduction, residents and land managers must:

- Identify applicable laws and regulations,
- Develop compliance plans,
- Apply measures to avoid the potential spread of invasive species,
- Review existing compliance resources and best management practices, and
- Determine if additional guidance materials are necessary.

For more information on wildlife, and a case-study on the California Condor, see Appendix D.3. For more information on regulations and compliance requirements, see Appendix I.

[34] Rieman, B., Gresswell, R. & Rinne, J. (2012). Fire and fish: A synthesis of observation and experience. Climate change, forests, fire, water, and fish: Building resilient landscapes, streams, and managers. General Technical Report RMRS-GTR-290. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. (pp. 159-175).

[35] Scheller, R. M., W. D. Spencer, H. Rustigian-Romsos, A. D. Syphard, B. C. Ward, & J. R. Strittholt. (2011). Using stochastic simulation to evaluate competing risks of wildfires and fuels management on an isolated forest carnivore. *Landscape Ecology* 26: 1491–1504.

[36] Lawler, J. J., H. D. Safford, & E. H. Girvetz (2012). Martens and fishers in a changing climate. In K. B. Aubry, W. J. Zielinski, M. G. Raphael, G. Proulx, & S. W. Buskirk (eds). *Biology and Conservation of Martens, Sables, and Fishers: A New Synthesis.* Cornell University Press, Ithaca, NY.

[37] Oliver, A. A., M. T. Bogan, D. B. Herbst, & R. A. Dahlgren (2012). Short-term changes in in-stream macroinvertebrate communities following a severe fire in the Lake Tahoe basin, California. *Hydrobiologia,* advance online publication. DOI 10.1007/s10750-012-1136-7.

Rivers

Two of California's three largest river systems—Klamath and Eel—flow through Humboldt County, along with several other major rivers. Portions of many of these rivers are designated as part of the National and/or California Wild and Scenic Rivers Systems. Humboldt County rivers are significant natural assets; they are invaluable to the residents of this area, many of whom rely on the rivers for their water. They help attract tourist and recreationist dollars. They provide crucial habitat for a variety of fish species, many with important ecological, commercial, cultural, and recreational values. They help sustain a variety of local vegetation and wildlife species throughout their watershed boundaries. Finally, they can serve as strategic fuel breaks to manage fire at the landscape scale.

Riparian assets are highly vulnerable to disturbance from wildfires. Erosion following fires can cause large *sediment* loads in streams, which may then be transported and deposited into rivers and damage aquatic habitat in riparian areas. By killing or consuming vegetation next to streams and ponds and diminishing the shade it provides, forest fires can have strong and lingering influences on water temperatures, raising them and threatening fish and other aquatic species. Risk of fire starts near river areas is amplified by the popularity of river recreation during summer months when fire risk is greatest. Wildfires that occur near rivers can also make river recreation unappealing or dangerous, and diminish tourism. Finally, firefighting can have significant impacts on local rivers, including water removal during critical late-season flows and use of retardants.

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.

Sediment: 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.

Upslope restoration to improve fish habitat and reduce hazardous fuels is an activity that benefits both Humboldt County's forests and rivers. These restoration activities have long-term economic benefits to both the forestry and fisheries sectors of the local economy.

Protected or Environmentally Significant Areas

More than 550,000 acres in Humboldt County are protected open space, forests, and/or recreational areas, with four federal parks and beaches, ten state parks, and sixteen county parks and beaches, including Redwood National Park, Six Rivers National Forest, Redwoods State Park, Headwaters Forest Reserve, and Kings Range National Conservation Area.

These protected areas provide valuable habitat for an array of wildlife, fisheries, and *special-status species*. There are 22 listed species of plants and animals, with another four candidate species as Endangered or Threatened under federal and state classification systems *(see Figure D.6 in Appendix D, **Background Information for Assets and Values at Risk** for a list of these species).*

Natural assets are at varying degrees of risk from wildfire. Protected forest and river areas experience the greatest threat, due to existing fuel loads and popularity of recreation sites. Wildlife species within these areas are at risk of habitat destruction from wildfire, which could be especially detrimental to threatened and endangered species whose habitat is already in short supply. Although estuaries and other aquatic resources near the coast are less vulnerable to the negative effects from wildfire, smoke-caused air pollution could potentially impact migratory bird species and other sensitive wildlife. Furthermore, large-scale watershed disturbance generated by wildfires further inland can result in loss of vegetative cover near waterways, increased runoff, and severe erosion and sediment production.

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.

Recreational Areas (Seasonal Use)

Numerous opportunities for outdoor recreation add to the significance of Humboldt County's many natural assets, containing hiking trails, campgrounds, river access points, and a number of accessible coastal areas. Lonely Planet, a top travel guide publisher, gave the Redwood Coast its number-one tourism destination for 2018.[38] These natural assets attract backpackers, rock climbers, mountain bikers, and day hikers, as well as fishermen, river rafters, sea-kayakers, sail boaters, and surfers, among others.

Parks, recreation areas, and open spaces are vulnerable to negative impacts from wildfire events. Some areas could be directly affected by wildfire. Other areas are at risk of poor air and water quality, as well as decreased recreational appeal due to fires blocking access roads or diminishing views.

Scenic

Forested hillsides, working agricultural lands, river corridors, coastal areas, and scenic highways provide a range of stunning vistas throughout Humboldt County. Severe wildfire could have a significant negative impact on this important scenery.

Humboldt County's extensive coastline allows for a wide range of exceptional scenic vistas and recreational opportunities. It is assumed that these coastal areas are not often affected by wildfire. However, there have been large historical fires near the Trinidad area, as well as the 2003 Honeydew Fire that burned to the ocean. Finally, large, enduring fires further inland can produce heavy smoke that can negatively affect scenic areas on the coast. *See Figure D.5 for a list of scenic highways.*

Air Quality

Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (e.g. soot, tar, water vapor, and minerals), gases (e.g. carbon monoxide, carbon dioxide, nitrogen oxides), and toxins (e.g. formaldehyde, benzene). Emissions from wildfire depend on the type of fuel, the *moisture content* of the fuel, the efficiency (or temperature) of combustion, and the weather.

Humboldt County is prone to temperature inversions, which occur when a layer of warm air traps cool air near the surface and inhibits the vertical dispersion of smoke and other pollutants. In 2017, the North Coast Unified Air Quality Management District (NCUAQMD) issued one *Air Quality Alert for Hazardous Conditions* and eight *Air Quality Advisories for Unhealthy Conditions* due to wildfire smoke impacts. These smoke impacts came from fires in Siskiyou and Modoc counties, the Chetco Bar Fire in Oregon, and smoke from the Thomas Fire, Redwood Valley Complex, and Wine Country Fires.

> ***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.

Smoky sky over Fortuna (Sept. 2017). Photo: Connie Rose for Lost Coast Outpost.

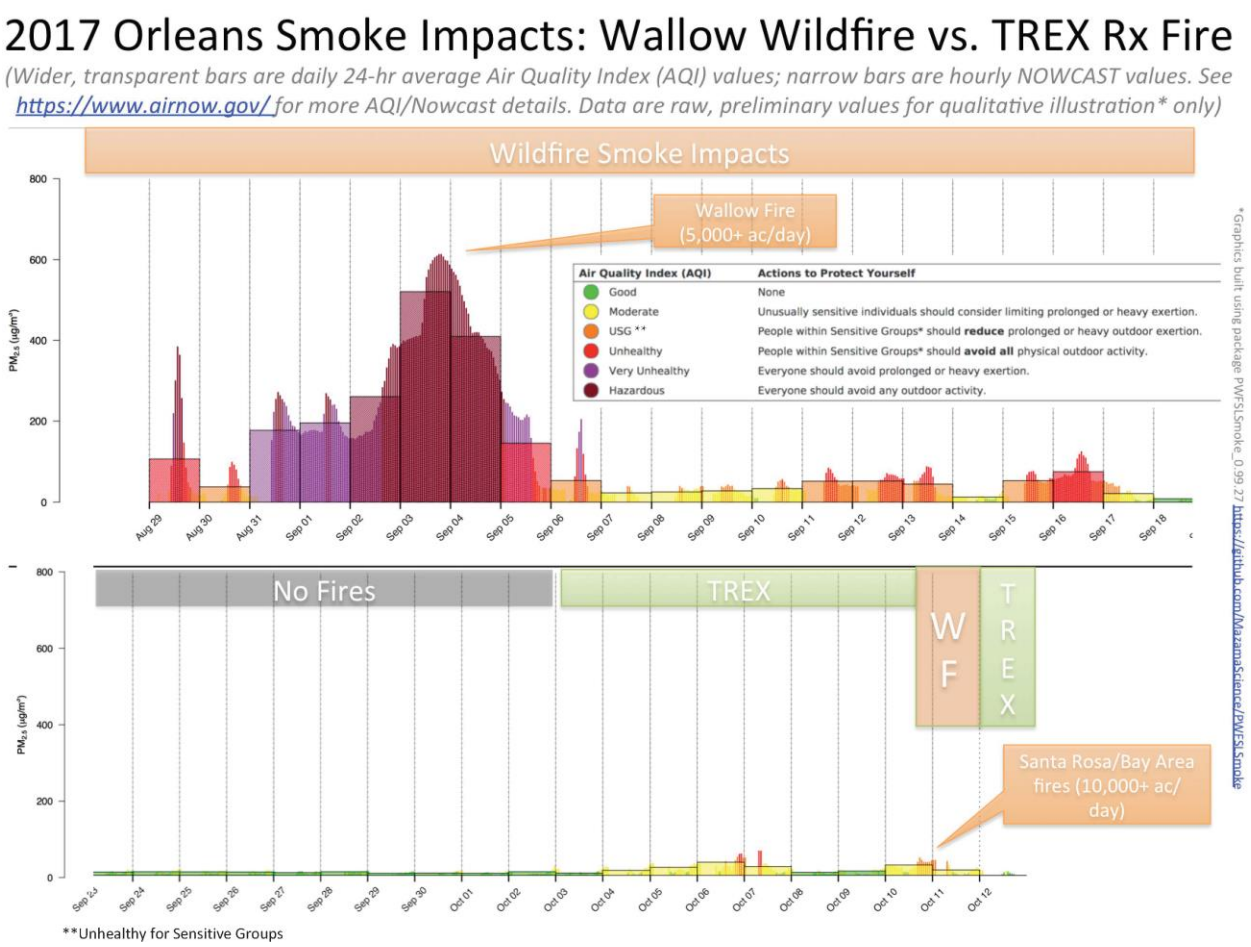
The Mid Klamath area is documenting the difference between smoke from prescribed fire versus wildfire to help residents understand the benefit of being proactive: prescribed fire creates some smoke in the near-term but it will help avoid the unhealthy, even dangerous, air quality conditions that can accompany wildfire. The following graph from the USFS[39] documents these differences by comparing the impacts of smoke produced by the Wallow wildfire and smoke produced by the 2017 prescribed fire Training Exchange (TREX).

[38] Forgione, M. (2018). Lonely Planet chooses California's Redwood Coast as top U.S. place to go in 2018. Los Angeles Times. Retrieved from *http://www.latimes.com/travel/la-tr-california-redwood-coast-selected-lonely-planet-top-destination-20180205-story.html*

[39] Leland Tarnay, USFS Region 5 Remote Sensing Lab, and USFS AirfireTeam. Retrieved from *https://tools.airfire.org*

Public health impacts associated with wildfire include difficulty breathing, odor, and reduction in visibility. Wood smoke raises health risks for everyone, but especially for people in sensitive groups, including the elderly, small children, those with heart disease, and those with respiratory disease (such as asthma)[40]. *For more information on local air quality, visit the North Coast Unified Air Quality Management District at www.ncuaqmd.org.*

Figure 5.1.1 2017 Orleans Smoke Impacts



For information on Air Quality Regulations see Appendix I, ***Regulations and Compliance.*** *For prioritized actions related to air quality, see Metric 3.6.7 in Chapter 3.6,* ***Integrated Planning.***

5.1.4 CULTURAL

As summarized in the 2017 Humboldt County General Plan:

> Cultural resources are elements of cultural heritage. From a land use perspective, important cultural resources include archaeological sites, historic architecture, industrial relics, artifacts, cultural landscapes, spiritual places, and historic districts. These elements provide traces of Humboldt County's rich history and add to the unique character and identity of the county.
>
> The importance of history to local residents can be seen in the many celebrations and expressions of Native American cultural heritage, the architectural preservation efforts of

[40] North Coast Unified Air Quality Management District. Wildfire Smoke - Air Quality Information. (2018). Retrieved from http://www.ncuaqmd.org/index.php?page=wildfire

> numerous local home and business owners, and the high level of support for local museums and historical societies...
>
> Over one thousand sites of cultural significance have been surveyed and officially designated as cultural resources in Humboldt County. The participation of state and federal historic registration programs include 13 sites as California Historical Landmarks, 16 sites included on the National Register of Historic Places, 58 sites as California Historical Resources, and nearly 700 sites as historical and prehistoric archeological sites. Many of these sites, as well as numerous unlisted sites, are of cultural and religious significance for Native American populations. Any scientific archeological interest in such sites must be respectful of the cultural and religious significance they may hold.[41]

Many cultural sites can be damaged by wildfire, whether they be historical sites that can be directly lost to fire, or spiritual or gathering sites that can be damaged by fire at the wrong time or under heavy fuel conditions. Pre-fire work also can damage cultural sites. Any ground-disturbing actions to reduce fuels must include an archeological survey, to ensure no damage is done to cultural resources. *For more information on related compliance issues, see Appendix I,* ***Regulations and Compliance****.*

In addition to historic sites and resources, Humboldt County has a rich Native American culture. As the home of more than a dozen local tribes, speaking languages from three different linguistic affiliations, the Wiyot, Yurok, Hupa (or Hoopa), Karuk, Chilula, Whilkut, and the southern Athabascans, including the Mattole and Nongatl, practiced lifeways carefully prescribed by cultural and religious mores. These cultures all include a long and, sometimes continuing active use of fire as a land-management tool.

Like most indigenous territories in California and the US, cultural resources and traditions were regularly, often systematically, damaged or destroyed. The following text from the Karuk Tribe Department of Natural Resources, *Eco-Cultural Resources Management Plan,* summarizes modern destructive practices:

> “Many federal land management practices have failed to adequately protect cultural resources. Many sacred sites have been decimated (Holmlund 2006). The primary ceremonial lands; Panamaniik, Katimiin, Aamaikiaraam, Helkau, and Inam, as physiographic cultural settings all have experienced major disturbances from mining, logging (Jewett 2007), road construction, fire exclusion and suppression, fire salvage recovery, and recreational uses (Crosby 1977, Halford 2001, Hanes n.d.). Forest uses overall have negatively affected many sacred, traditional, contemporary, or cultural use areas, values and resources.[42]”

Although these practices have lessened, some continue. Additionally, cultural sites could be at risk of destruction from wildfire, potentially destroying artifacts and structures. Prescribed fire, as was traditionally used by local native cultures, can reduce ground fuels, exposing new cultural sites and artifacts without causing damage. The discovery of these cultural sites can be beneficial to local tribes. However, they can also present problems of looting and vandalism.

[41] County of Humboldt, Department of Planning & Building. Humboldt County General Plan. (2017). (p. 10-38). Retrieved from *https://humboldtgov.org/205/General-Plan*

[42] Karuk Tribe. Department of Natural Resources. (2010). Draft Eco-Cultural Resources Management Plan. [PDF]. (pp. 23-24). Retrieved from *http://www.karuk.us/images/docs/dnr/ECRMP_6-15-10_doc.pdf*

The *Humboldt County General Plan* provides guidance regarding culturally sensitive resources:

> The County has the highest per capita Native American population of any county in California. Tribal governments in Humboldt County govern significant land area and are important partners in stewardship of natural resources. There is a rich cultural resource history associated with Humboldt County and culturally sensitive areas need tribal consultation when development proposals are being considered.[43]

Culturally sensitive areas exist on tribal, public, and private lands. While some locations are publicly identified, others are held as confidential information by local tribes. Any ground-disturbing activities on potential cultural sites must be reviewed by official tribal representatives to ensure protection of culturally significant sites. *See Appendix I, **Regulations and Compliance** for a list of tribal contact information for project review.*

Local tribes have been leading efforts to bring prescribed fire back onto the landscape in their traditional lands and beyond. The Cultural Fire Management Council[44] and the Karuk[45] Tribe's work with the Western Klamath Restoration Partnership[46] are both examples of innovative projects to restore native landscapes and the cultural use of fire.

> The mission of the Cultural Fire Management Council (CFMC) is to facilitate the practice of cultural burning on the Yurok Reservation and Ancestral lands, which will lead to a healthier ecosystem for all plants and animals, long term fire protection for residents, and provide a platform that will in turn support the traditional hunting and gathering activities of Yurok.[47]

*For more information on local indigenous burning practices, see **Native American Fire History,** in section 5.2.5 in the following chapter.*

5.1.5 COMMUNITY-IDENTIFIED LOCAL ASSETS

In late 2017, fourteen public workshops were held throughout the county as part of this CWPP process. At these events, local community assets from the 2013 CWPP were reviewed and confirmed, and in several cases, new assets were added. Some of the most important community assets and values identified at these and previous events included schools, community centers, churches, fire stations, hospitals, senior centers, neighborhoods, commercial districts, campgrounds, and more.

*Community-identified assets are detailed in each **Planning Unit Action Plan** and shown on their respective maps in Part 4 of this CWPP. Information about the identified assets can also be accessed on the **Humboldt County Web GIS Portal**: https://webgis.co.humboldt.ca.us/HCEGIS2.6_CWPP.*

5.1.6 CONFLICTS BETWEEN NATURAL ASSETS AND HUMAN OCCUPATION

Humans evolved with fire. In recent decades, that relationship has been characterized by conflict more often than symbiosis. This is especially evident in the wildland-urban interface (WUI), where a mix of fuel, weather, and topographical conditions create circumstances that could put a community at risk of wildfire, or alternatively where a community fire could threaten nearby wildlands. New developments in areas such as steep or windy canyons, or areas with limited ingress and egress put residents,

[43] Humboldt County General Plan. (2017). Chapter 3: Governance Policy, Section 3.3: Background. Retrieved from https://humboldtgov.org/205/General-Plan

[44] Cultural Fire Management Council: www.culturalfire.org

[45] Karuk Tribe, Official Website: www.karuk.us/index.php/departments/natural-resources

[46] Western Klamath Restoration Partnership: www.wkrp.network

[47] Cultural Fire Management Council. About Us. [Webpage]. Retrieved from http://culturalfire.org/our-mission

firefighters, and native ecosystems at risk. Human encroachment into wildland areas with higher fuel hazards creates conflicts that can threaten life, property, and the natural environment.

All vegetation types found within Humboldt County have the potential to burn. In fact, most vegetation communities in the county are dependent to some extent on frequent fire to remain healthy and viable, even the redwoods need fire to open their cones. As will be shown in the following chapter, decades of fire suppression means local fuel levels are often critically high.

Wildfire can cause destruction to homes located well inside of urban areas, especially in the case of large ember storms, as seen in many recent wildfires around the state. Given WUI communities' exposure and vulnerability to wildfire, taking steps to enhance local fire awareness and preparedness should be a top priority for local residents. Many residents around Humboldt Bay don't consider wildfire a threat to their safety and well-being, yet they live surrounded by high levels of flammable vegetation and in houses that could readily ignite in an ember storm.

Further, most wildfires occur in Humboldt County in late summer and/or early fall when water levels in local rivers and streams can be very low. Disagreements have arisen in the past over bucket dipping into, and water drafting out of rivers for firefighting during late summer when native salmon and steelhead and their habitat are most vulnerable.

Finally, the increase in temporary workers in the marijuana industry during this same higher-risk period—usually in the more remote areas of the county—is an example of another conflict between human occupation and natural assets. Many of these seasonal workers do not have experience living in high-fire-hazard rural environments, not to mention the simple increase in human occupation of wildlands and their related activities during the driest time of the year.

The consequences of human influences on *fire-adapted ecosystems* must be better understood to establish an ecological framework for planning and policy to reduce the threat of wildfire to Humboldt communities, especially in the WUI.

The following chapters of this *Risk Assessment* endeavor to improve our understanding of the factors that contribute to fire in Humboldt County. The resulting *Countywide Action Plan* in Part 3 is a summary of Humboldt County Fire Safe Council's efforts to prioritize steps to reduce these conflicts, and the risks and hazards of a wildfire conflagration in Humboldt County, while returning beneficial fire to its natural role in native ecosystems.

Fire-adapted ecosystems: 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 they inhabit and that allow them to survive and/or regenerate.

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5.2 WILDFIRE ENVIRONMENT

5.2.1 INTRODUCTION: WHY IS WILDFIRE AN ISSUE IN HUMBOLDT COUNTY?

Understanding wildfire's causes and behaviors, as well as its role in the ecosystem, can help residents to better prepare for and survive its inevitability. Wildfire is a natural ecological feature throughout Northern California. At the same time, it can threaten human safety and property, especially in the *wildland-urban interface* (WUI). Finally, wildfire suppression; land uses such as development, timber management, and grazing; and climate change, together are fundamentally altering wildfire behavior, often devastating ecosystem health and human communities.[1]

> ***Wildland-Urban Interface (WUI):*** The zone where structures and other human developments meet, or intermingle with, undeveloped wildlands.
>
> ***Wildlands:*** Areas in which development is essentially nonexistent, except for occasional roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered. Can include large cattle ranches and forests managed for timber production.

This chapter provides an introduction to Humboldt County fire history and the fire science used as a basis for planning, preparing for, and predicting fire effects on both human and non-human natural communities. It describes wildfire in Humboldt County, and the statewide context.

The landscapes of Humboldt County have adapted to and evolved with fire; fire will continue to shape them. It is not a question of *if* a wildfire will occur here, but rather *when*.

> "Fire is an integral part of most California landscapes. Many of our native plants, including trees, are adapted to burn periodically; they need fire to be healthy, reproduce, and survive. Fire suppression activities over the last 100–150 years have largely taken fire out of the system, causing far-reaching changes in habitats and forest health.[2]"

Compared to fire patterns before European settlement, it is generally accepted that fires in California today are more severe and more difficult to control. More catastrophic wildfire can impact ecosystem services such as wildlife habitat, carbon sequestration, and water and air quality.[3] Wildfire is among Humboldt County's most dangerous natural disasters, with wide-ranging potential for destruction.

5.2.2 GENERAL WILDFIRE ENVIRONMENT DESCRIPTIONS

Human activities and natural factors combine to affect *fire behavior* and its consequences throughout the county.

Human factors include:

- Home design and landscaping,
- Community hazardous fuel reduction and wildfire preparedness,
- Land-use planning, and
- Fire ignition management.

Natural features include:

- Topography,
- Weather, and
- Condition and type of vegetation and other fuels.

[1] State Board of Forestry and Fire Protection & California Department of Forestry and Fire Protection (2018). 2018 Strategic Fire Plan for California. (p. 6). Retrieved from http://cdfdata.fire.ca.gov/fire_er/fpp_planning_cafireplan

[2] California Forestland Stewardship Program. (2010). What can you do to protect your property from wildfire? Retrieved from http://calfire.ca.gov/foreststeward/fire_and_fuels

[3] Wimberly, M.C. & Liu, Z. (2014). Interactions of climate, fire, and management in future forests of the Pacific Northwest. *Forest Ecology and Management* 327: 270-279 (p. 277).

This section focuses on these natural features and other aspects of fire behavior, in order for Humboldt County residents to understand and reduce the negative impacts of wildfire and gain the *resiliency* to rebound when fires do occur.

Knowing the attributes of fire behavior is important when describing the threats from a fire and also in order to carry out effective fire control and mitigation. *Flame length, fire intensity, heat output*, *rate of spread*, *residence time*, and whether a fire burns on the surface (forest floor) or crown (tops of trees) are all ways to describe fire behavior. These factors can influence resulting damage as well as potentially positive impacts of fire. *See Appendix E,* ***Background for Wildfire Environment.***

Ecosystem functions: The processes and interactions that occur between organisms and the physical environment.

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**.**

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

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.

Resilient/Resiliency: The ability of an ecosystem or a community to return to its functionally balanced state after a disturbance.

Fire Behavior Characteristics:

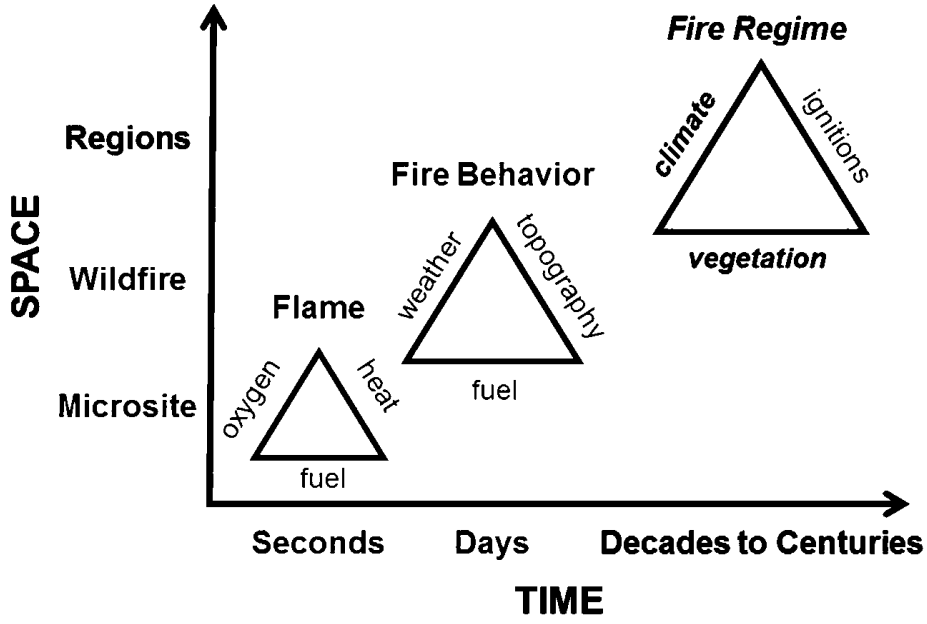
- **Flame length:** The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.
- **Fire intensity:** The amount of heat released by a fire in an area in any given time period. Fire intensity is usually related to flame length.
- **Heat output:** The total amount of heat a fire releases in a specific area during the passing of the flaming front.
- **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.
- **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.

Humboldt County is composed of several different ecosystem types, most of which have evolved with fire. **This is a *fire-dependent* environment. As this chapter will show, fire has played a prominent role in shaping the natural environment here. Wildfire will happen. Exclusion of wildfire is not an option.**

As stated above, topography, weather, and vegetation contribute to the type and intensity of wildfire, or fire behavior. Together they are known as the "fuel triangle." The graphic on the following page shows the difference between the fire triangle (flame), the fuel triangle (fire behavior), and finally a fire-regime triangle, which incorporates climate change. These concepts are all explained in this chapter. The following graphic helps to put them in a spatial and temporal context. *See Appendix E,* ***Background for Wildfire Environment*** *for a description of these concepts.*

Figure 5.2.1 Fire Triangles

"Conceptual model describing the controls of fire across spatial and temporal scales, adapted from Moritz et al. Much of fire science focuses on understanding fire behaviour, which is sensitive to weather, fuels, and topography. Fire regimes describe the characteristic patterns of wildfires over large spatial and temporal scales, and they are sensitive to changes in climate, vegetation, and ignitions."[4]



Topography

Humboldt County has a mixture of rugged mountains, rolling hills, and broad valleys. Elevations range from the coastal sand-swept streets of Manila, just 13 ft. above sea level, to Salmon Mountain, the county's highest peak at 6,962 ft. (in the Trinity Alps Wilderness of Six Rivers National Forest). The drier, more fire-prone areas of the county are also the steepest and most rugged. These steep drainages can act as chimneys, which can move wind and fire very quickly up a slope. Due to the remoteness and steepness of slopes within the county, fire equipment and personnel can be limited in their access to wildfires. This adds significant fire risk to Humboldt County communities.

For more information on local geologic features, and aspect and slope maps, see Appendix E, ***Background for Wildfire Environment.***

Weather

Humboldt County has moderate temperatures and considerable precipitation. The Pacific Ocean creates a cool, stable temperature regime along coastal areas. Further inland the marine influence is lessened and there is a wider variation of temperatures with lower humidity. Temperatures along the coast vary only 10 degrees from summer to winter. Freezing temperatures are experienced nearly every winter throughout the county, with colder temperatures prevailing in the interior. Maximum annual temperatures rarely exceed 80°F on the coast, while triple-digit days are common in the mountain valleys.

[4] Higuera, P.E. (2015). Taking time to consider the causes and consequences of large wildfires. Proceedings of the National Academy of Science, October 27, 2015. 112 (43) 13137-13138, Figure 1. Retrieved from *https://doi.org/10.1073/pnas.1518170112*

Historically, rainfall occurs during every month, although amounts are negligible from June through August. Seasonal totals average between 30 – 40 inches in the driest area along Humboldt Bay and exceed 90 inches in the wettest, in the Kings Range and along the ridges in the northeastern portion of the county. Because of the moisture and moderate temperature, the average relative humidity is high.

*See Map E.3, **Precipitation** in Appendix E for more information on local weather conditions, and section 5.2.6, **Climate Change and Wildfire in Humboldt County** below for more information on changing weather patterns.*

Inland, thunderstorm activity typically begins in June with wet storms. These storms often turn dry and are accompanied by lightning as the season progresses into July and August. The combination of these dry thunderstorms and the lack of marine influence increases the potential for summer fires in the eastern portion of the county.

Prevailing winds during Humboldt County's *fire season* (generally June through October) are out of the northwest. In July and August, local winds (slope winds and sea breezes) predominate, with the Pacific jet stream weak and well to the north. By September, weak to moderate north-to-northeast winds can become more prevalent. These winds are more critical for bringing in moist ocean air than in the late spring. The more easterly flows in particular are problematic, being significantly drier.

Fires during *foehn events*—or subsiding winds—usually result in extreme fire behavior as the winds are particularly strong and dry, reducing *fuel moistures*. This leads to easier ignitions and increased fire intensity and rate of spread. Foehn winds can also cause extreme fire behavior at night when fires normally die down.

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.

Foehn winds: A wind that blows warm, dry, and generally strong, creating extremely dry fuel and dangerous fire potential.

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.

Honeydew Fire burning down to the ocean in 2003.

An important local phenomenon is that which occurred with the 2003 Honeydew Fire in the King Range National Conservation Area. Instead of the usual and expected gradual cooling and humidity accumulation throughout the night, around midnight temperatures increased and relative humidity dropped for several hours, resulting in a more active nocturnal burning period. This increased nocturnal burning effect is well-known here. There are generally two burn periods: late afternoon and early morning.

The National Weather Service provides daily fire weather forecasting for Humboldt County from its Eureka office. All fire weather forecasts are available at the Eureka office main webpage: https://www.weather.gov/eka.

Vegetation and Fuels

Vegetation usually provides most of the fuel to feed wildfire, combined with other flammable materials such as buildings. However, in WUI fires, it is often the homes and other *urban fuels* that provide the most fuel for a fire.

Fuel includes anything that can burn: grass, shrubs, and trees, along with urban fuels such as fences, decks, furniture, cars, and houses. These can be described using *fuel models (see Appendix E),* or in terms of their size, volume, and arrangement:

- Light fuels (e.g. grass, foliage, kindling-size twigs, or baskets and brooms),
- Medium fuels (e.g. shrubs, branches, and fences), or
- Heavy fuels (e.g. logs, tree trunks, and houses).

Light, medium, and heavy fuel loadings describe fuel volume. Fuel arrangement is commonly discussed in terms of continuity—both horizontal and vertical. **Fuel continuity is an important concept for homeowner and community wildfire preparedness.** It is discussed in *Chapter 3.2,* the ***Wildfire Preparedness*** countywide action plan and *Appendix H,* ***Living with Wildfire*****.**

Nearly every major *fuel type* in California exists within Humboldt County, including grasslands, oak woodlands, brushlands, hardwood forests, mixed conifer forests, and conifer forests including the iconic redwood groves. Because of this ecosystem diversity, Humboldt County can experience virtually any type of wildfire that can occur in California, from fast-spreading grass fires to long-duration forest fires. *For more information, see Map 5.2.1* ***Surface Fuels,*** *and* ***Fuel Models*** *in Appendix E.*

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

Fuel Model: A standardized description of fuels available to a fire, based on the amount, distribution, and continuity of vegetation and wood.

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**.**

The virtual exclusion of widespread low- to moderate-severity fire *(see* ***Fire History*** *section below)* has affected the structure and composition of *vegetation types*. Conifer stands are generally denser, mainly in small- and medium-*size classes* of *shade-tolerant* and *fire-sensitive* tree species like Douglas fir and tanoak. Fuels have become more vertically continuous, contributing to more spatially homogeneous forests. Selective cutting of large overstory trees, intense fire suppression, and the relatively warm, moist climate during much of the twentieth century likely enhanced conifer seedling establishment and hardwood sprouting.

Vegetation Type: A standardized description of vegetation. The type is based on the dominant plant species and the age of the forest or ecosystem. It also indicates how moist a site may be and how much fuel is likely to be present.

Size Class: The division of trees in a forest by the size of their diameter, sometimes split into three categories—seedlings, pole, and saw timber—or by diameter in inches.

Shade-tolerant: Attribute of a species that is able to grow and mature normally in and/or prefers shaded areas.

Fire-sensitive: A species of tree or other plants that are more susceptible to fire damage. Sensitivity may be due to thin bark or easily ignitable foliage.

As described in *section 5.1.3,* the use of the "hack and squirt" or "frilling" forest practice is also increasing standing dead forest fuels, contributing to increased wildfire hazards in those areas. This practice leaves conditions similar to those seen by sudden oak death, as described in the following section.

Sudden Oak Death

A significant increase in hazardous fuels in the last two decades resulted from the introduction of *sudden oak death* (SOD). SOD is a plant disease caused by *Phytophthora ramorum,* an invasive forest pathogen introduced to California in the mid-1990s through the horticultural plant trade (especially through rhododendron, camellia, and viburnum species). It was first identified in Humboldt County in 2002 in the Redway area of Southern Humboldt. It has since spread throughout Southern Humboldt and the South Fork Eel River watershed to just north of Weott, and to the southeast of Blocksburg just into Trinity County. There is also a significant infestation around the community of Redwood Creek (assumed to be introduced through nursery species) that has spread downstream into Redwood National Park, as well as a small infestation upstream (further south) in that drainage. SOD has been spreading at an average rate of approximately 1,500 acres/year here since 2004. Detections of the pathogen have recently been found in the water, as well as in a limited number of trees in the Mad River and Mattole watersheds. A new and potentially more virulent strain from Europe was recently detected in a stream in McKinleyville.[5]

Snags: Snags are standing dead trees, which can be very flammable. They are often teeming with life such as insects and woodpeckers, and hence an important part of local forest biodiversity.

This pathogen has caused widespread dieback of tanoak *(Notholithocarpus densiflorus)* and several true oak species throughout coastal California counties. Bay laurel *(Umbellularia californica)* is a common host, infecting nearby oak stands. **Depending on the time since infection, and the specific rate of tree mortality, affected areas can have a significantly higher fire hazard due to higher proportions of dead fuels of all sizes, and a prevalence of *snags*.** This disease spreads easily by wind-driven rain events and the locally affected area is anticipated to grow substantially. Research over the past two decades has helped to characterize the nature of the risk and will help to guide firefighter response.[6]

Several factors make the spread of SOD a particular concern in Humboldt County: [7, 8]

- The pathogen continues to spread here. The small infestation detected in Redway in 2002 has since grown to include patches scattered over several dozens of square miles, directly impacting approximately 30,000 acres. It could continue to spread and eventually affect tanoak throughout much of the North Coast.
- Ecologists expect sudden oak death's impacts to local forest ecosystems (e.g. timber, tribal, wildlife, fire hazard, aesthetics, etc.) to be significant.
- Early response and pathogen control is limited to a narrow window from the point of detection.
- New species have recently been discovered to be affected by the disease, including chinquapin and several manzanita species.
- The European strain of the pathogen recently detected in Oregon and in a stream in McKinleyville may have the potential to affect conifers more severely than the North American strain present on the West Coast up to now.[9]

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[5] Valachovic, Y. (2018). "Managing Uncertainty: Sudden Oak Death and Other Pests, Fire, and Drought." Workshop, March 22, 2018, University of California Cooperative Extension (UCCE), Eureka, CA. USA.

[6] Valachovic, Y., Lee, C., Scanlon, H., Varner, J.M., Glebocki, R., Graham, B.D., & Rizzo, D.M. (2011). Sudden oak death-caused changes to surface fuel loading and potential fire behavior in Douglas-fir-tanoak forests. *Forest Ecology and Management* 261, 1973-1986. [PDF]. Retrieved from http://www.suddenoakdeath.org/?bibliography=sudden-oak-death-caused-changes-to-surface-fuel-loading-and-potential-fire-behavior-in-douglas-fir-tanoak-forests

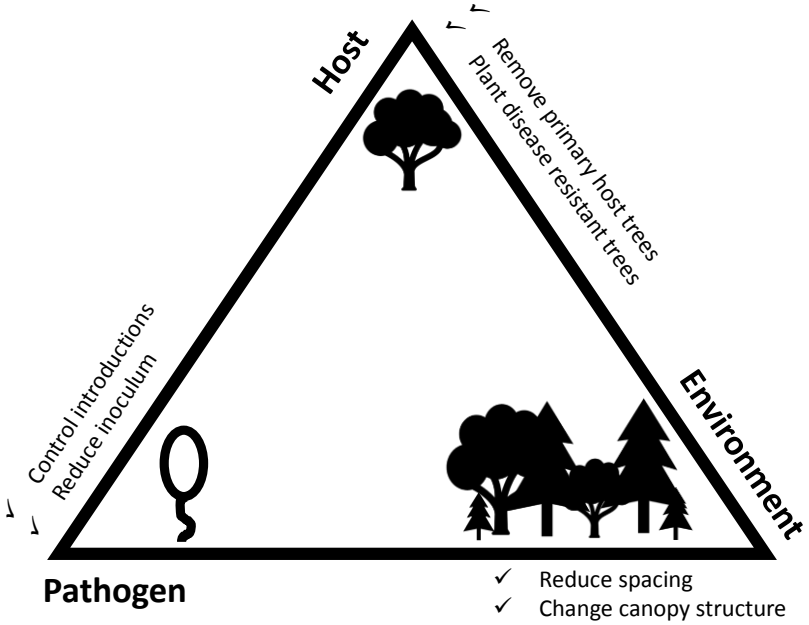
[7] Valachovic, Y., personal communications, August 31, 2012; August 2017; April 2018, and "Managing Uncertainty: Sudden Oak Death and Other Pests, Fire, and Drought." Workshop, March 22, 2018, UCCE, Eureka, CA. USA.

[8] For more see: UCCE: Humboldt – Del Norte Counties. (2012). Disease Locations and Pathogen Monitoring. Retrieved from http://cehumboldt.ucanr.edu/Programs/Forestry/Sudden_Oak_Death/Disease_Locations_and_Pathogen_Monitoring

Given these findings, the effect of sudden oak death on the wildfire environment in Humboldt County is significant. The disease and its ramifications in local ecosystems must be considered in fuel-reduction and other ground-disturbing activities in the county to minimize its negative effects.

The following graphic from the University of California Cooperative Extension (UCCE) shows the three sides of management actions required to control sudden oak death.

Figure 5.2.2 Sudden Oak Death Disease Triangle[10]



General land-management practices that are beneficial for fuel-hazard reduction are consistent with practices that may help reduce the infestation and spread of sudden oak death. These include, but are not limited to:

- Thinning the understory of forests, especially suppressed tanoaks,
- Removing dead and dying trees,
- Reducing ladder fuels,
- Reintroducing fire through prescribed burning, and
- Facilitating more air flow through forest stands to reduce their humidity has proven effective in anecdotal cases.

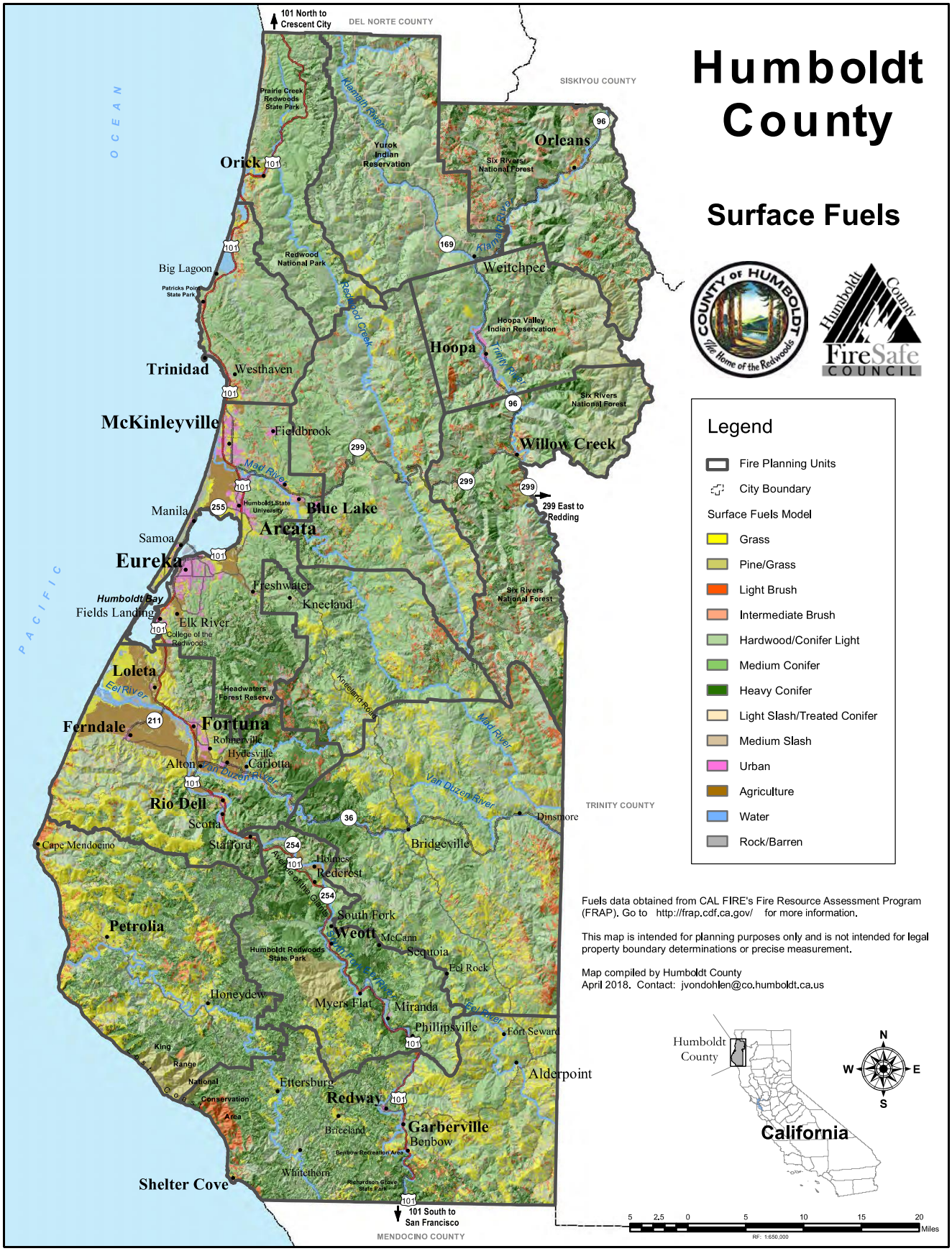
For more information on Sudden Oak Death:

- **Sudden Oak Death:** ***http://cehumboldt.ucdavis.edu/Sudden_Oak_Death*** University of California Cooperative Extension (UCCE): Humboldt – Del Norte Counties.
- **California Oak Mortality Task Force:** ***http://www.suddenoakdeath.org***
- **Best Management Practices:** ***http://www.suddenoakdeath.org/diagnosis-and-management/best-management-practices***
- **UCIPM, How to Manage Pests, Sudden Oak Death:** ***http://ipm.ucanr.edu/PMG/PESTNOTES/pn74151.html***

[9] LeBoldus, J.M., Sondreli, K.L., Sutton, W., Reeser, P., Navarro, S., Kanaskie, A., & Grunwald, N.J. (2018). First report of *Phytophthora ramorum* lineage EU1 infecting Douglas fir and grand fir in Oregon. *Phytopathology* 102 (2), (p. 455).

[10] Valachovic, Y. (2018). Workshop, March 22, 2018, UCCE, Eureka, CA.

Map 5.2.1 Surface Fuels



5.2.3 WILDFIRE HAZARD

The term "hazard" is used in relation to topography, introduced in the previous section, and *fuel complex. Fire hazard* is a description of the fuels available to burn in a given area and how they could burn. It can be influenced by past *disturbances* or management activities that alter the hazard for better or worse, including changing the site moisture. It is also affected by the volume and spatial arrangement of fuels. Fire hazard is distinct from *fire risk;* the latter incorporates the probability of wildfire occurrence, or ignitions.

Fuel complex: The volume, type, condition, arrangement, and location of fuels.

Fire hazard: A fuel complex that determines the degree of ease of ignition and of resistance to control.

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.

Stand-replacing fire: A fire that kills most or all of the trees in a section of forest

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

Fire Hazard Severity Zones

A site's fire hazard ranking shows the expected behavior of fire in severe weather (when wind speed, humidity, and temperature make conditions favorable for a *stand-replacing fire*). *Fire Hazard Severity Zones* (FHSZs) are how the state of California currently assesses and defines fuel hazards.[11] FHSZs range from Moderate to High to Very High.[12]

Humboldt County exhibits the complete range of severity classification from Moderate to Very High; *(see **Fire Hazard Severity Zone** map in Part 2).* In *State Responsibility Area* (SRA)[13] lands, **the map generally reflects a High rating in the western portions of Humboldt County,** where the fuel potential is high but the climate is damp. **Humboldt's Very High ratings are generally in the drier, eastern portions of the county, or in very steep terrain,** such as found along the Lost Coast. **Moderate ratings are in valley bottom areas,** which are generally urban or agricultural. Those areas with lower fire risk are concentrated in coastal and estuary lands. There are no Very High classifications in the *Local Responsibility Area* (LRA) in Humboldt County.

***Fire Hazard Severity* as Determined by CAL FIRE**

- The classification of a zone as Moderate, High, or Very High fire hazard is based on a combination of how a fire will behave and the probability of flames and embers threatening buildings.
- Zone boundaries and hazard levels are determined based on vegetation. For wildland areas, the current FHSZ model uses burn probability and expected fire behavior based on weather, fuel, and terrain conditions. For urban areas, zone boundaries and hazard levels are based on vegetation density, adjacent wildland FHSZ scores, and distance from wildlands.
- Each area of the map gets a score for flame length, embers, and the likelihood of the area burning. Scores are then averaged over the zone areas.

State Responsibility Area (SRA): The area in the state where the State of California has the primary financial responsibility for the prevention and suppression of wildland fires.
Local Responsibility Area (LRA): The area in the state where the financial responsibility of preventing and suppressing fires primarily rests on the local jurisdiction.

[11] FHSZ methodology is currently being updated by CAL FIRE. Ratings for Humboldt County are not expected to change significantly. *David Sapsis, personal communication, May 7, 2018.*

[12] *See Appendix E, **Background for Wildfire Environment** for a description of the attributes included in the California Department of Forestry and Fire Protection's (CAL FIRE's) Fire Hazard Severity analysis.*

[13] For more information on SRA vs. LRA, please see *Fire Protection Responsibility Areas in Chapter 5.3, **Wildfire-Protection Capabilities***.

Forty-five percent of Humboldt County is classified as Very High, 48% as High, and only 4% Moderate, the remainder being unclassified as unzoned or water, etc. The table below and the map on the following page illustrate the distribution of FHSZs in acres by planning unit and geographically throughout the county. *For a detailed map of FHSZ ranking for each Planning Unit, see Part 4,* ***Planning Unit Action Plans****.*

FIGURE 5.2.3 FIRE HAZARD SEVERITY BY PLANNING UNIT (ACRES AND PERCENTAGE)

PLANNING UNIT	*Very High*	*%*	*High*	*%*	*Moderate*	*%*	*Other*	*%*
Orick–Redwood Park (PU 1)	15,228	15	72,174	72	12,132	12	876	1
Upper Yurok Reservation (PU 2)	132,016	88	16,237	11	1,857	1	1,063	1
Mid Klamath (PU 3)	134,324	99	78	0	37	0	1,897	1
Hoopa (PU 4)	107,620	94	4,768	4	544	0	2,303	2
Trinidad (PU 5)	6	0	45,980	68	21,336	32	59	0
Redwood Creek (PU 6)	117,895	62	71,983	38	103	0	0	0
Willow Creek Area (PU 7)	163,937	97	3,921	2	114	0	376	0
Humboldt Bay Region (PU 8)	1,017	1	97,029	61	25,118	16	41,089	36
Kneeland–Maple Creek (PU 9)	79,578	65	43,553	35		0	0	0
Eel (PU 10)	2	0	133,267	70	24,138	13	65,653	35
Mad–Van Duzen (PU 11)	189,558	62	113,881	37	1,596	1	0	0
Mattole–Lost Coast (PU 12)	13,821	7	180,174	90	6,077	3	716	0
Southern Humboldt (PU 13)	58,028	23	194,740	76	1,964	1	402	0
Avenue of the Giants (PU 14)	19,508	13	120,897	82	6,780	5	0	0
Total	**1,032,538**	45%	**1,098,682**	48%	**101,793**	4%	**114,434**	0

**Other = Non-Wildland/Non-Urban or Urban Unzoned*

Fire Regime and Condition Class

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

Fire regime is a description of fire's historic natural occurrence, variability, and influence on vegetation dynamics in the landscape. The five historical fire regimes are classified based on the average number of years between fires (fire frequency) combined with the fire severity (amount of consumption of the dominant overstory vegetation). The difference in fire regime between pre- and post-European settlement is described by the *condition class,* or the degree of departure from the historical natural fire regime.

According to CAL FIRE, **Humboldt County primarily has Fire Regime I, which means a natural *fire-return interval* between 0–35 years of low severity fire. There are also scattered areas of Fire Regime III, with a 35–100+ year frequency of mixed severity fire, generally found on ridgetops, and more often in the eastern parts of the county.**

All three condition classes (1, 2, and 3) exist in Humboldt County. Condition class is generally within or near fires' historical range for the western and lower elevation/riparian areas of the county. As elevation increases, condition class changes from moderately altered to severely altered from historical range.

*See Appendix E, **Background for Wildfire Environment**, for a more detailed description and maps of both fire regime and condition class in Humboldt County.*

5.2.4 WILDFIRE RISK AND IGNITION SOURCES

As described in the previous section, fire risk differs from hazard in that in incorporates ignitions and fire history**. In California and elsewhere, people are responsible for starting most wildfires.** Major human-related causes include arson, recreational fires that get out of control, smokers' carelessness, debris burning, children playing with fire, and more recently industrial marijuana production.

*Map E.6, **Potential Incendiary Wildfire Ignition Sources**, in Appendix E* shows areas where fires are expected to start in Humboldt County. These potential ignition areas are generally around residential areas, commercial or industrial lands, power lines, and railroad lines. *Map E.6* shows that many of these potential ignition sources are located in the more populated, western areas of the county. However, that map does not include lightning occurrence areas, which is significant in the eastern areas of the county, (as is shown on the following map below). Future versions of this map should include the locations of industrial operations that pose a particular wildfire risk; these might include marijuana production and extraction sites, which are not currently included in this data set.

Alternatively, *Map 5.2.2, **Wildfire Starts*** below, shows that most actual wildfire ignitions (whether human- or lightning-caused) have been heaviest in the less populated, eastern areas of the county. Of all the fires that have occurred from 1974 to 2017 with known ignition sources, 60% were started by people including 35% as arson, and 12% by lightning. The remaining 28% were of unknown origin.[14] Interestingly, different fire-ignition causes have changed over the decades in Humboldt County. In the 1970s smoking lead to more fires than in later decades, arson fires peaked in the 1990s, and more recently vehicles, equipment, and powerline fires are on the rise.[15]

CAL FIRE data show that human activities directly cause most wildfires in Humboldt County.[16] The table following the map *(Figure 5.2.4 Humboldt County, Arson Ignitions by Month)* shows arson ignitions by month. **Arson, as defined by CAL FIRE, is the leading cause of ignitions in Humboldt County from June through October.[17]** There is an especially high number of incidents classified as arson on tribal land, as indicated on the map.

Marijuana

Wildfire ignition risk—the probability for a fire to start—can be great in the marijuana industry. Fire service personnel report that this risk has risen over the past decade with the increased number of people associated with marijuana "grow scenes" scattered in very remote places around the county, often in High and Very High Fire Hazard Severity Zones.[18] More people in remote areas during fire season, with the addition of spark-generating equipment such as vehicles and generators, means the probability of fire starts is greater. The number of fires started by marijuana operations is not tracked, so it is difficult to document the extent of this impact. It is also unclear how the legalization and regulation of this industry will impact associated wildfire risks.

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[14] CAL FIRE. (2018). Humboldt Del-Norte Unit Pre-Fire Planning Battalion (ignition data from National Fire and Aviation Management [FAMWEB] fire and weather data or FAMWEB).

[15] CAL FIRE. (2018).

[16] CAL FIRE. (2018).

[17] CAL FIRE. (2018).

[18] *See section 5.2.3 for more information on Fire Hazard Severity Zones.*

Map 5.2.2 Wildfire Starts

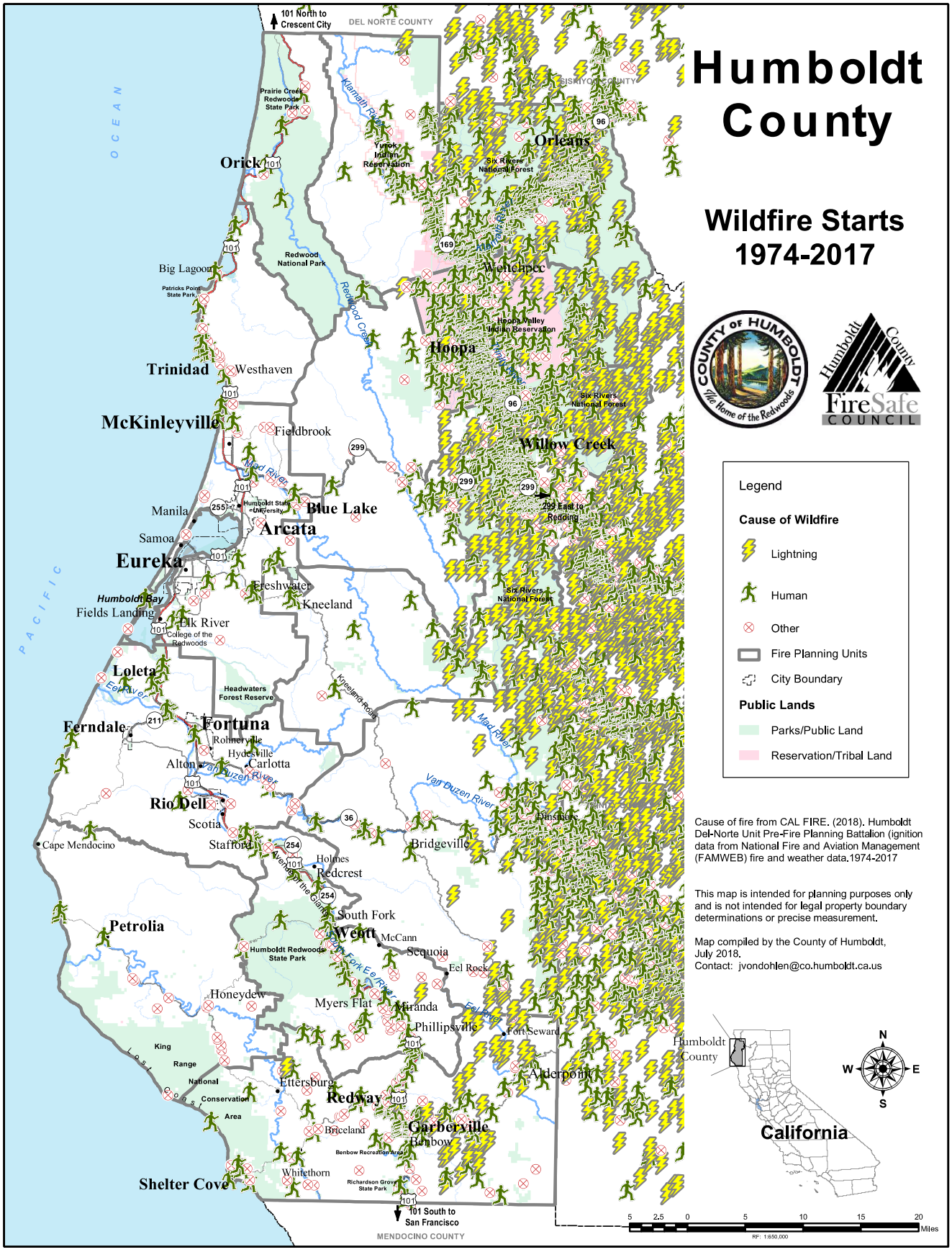
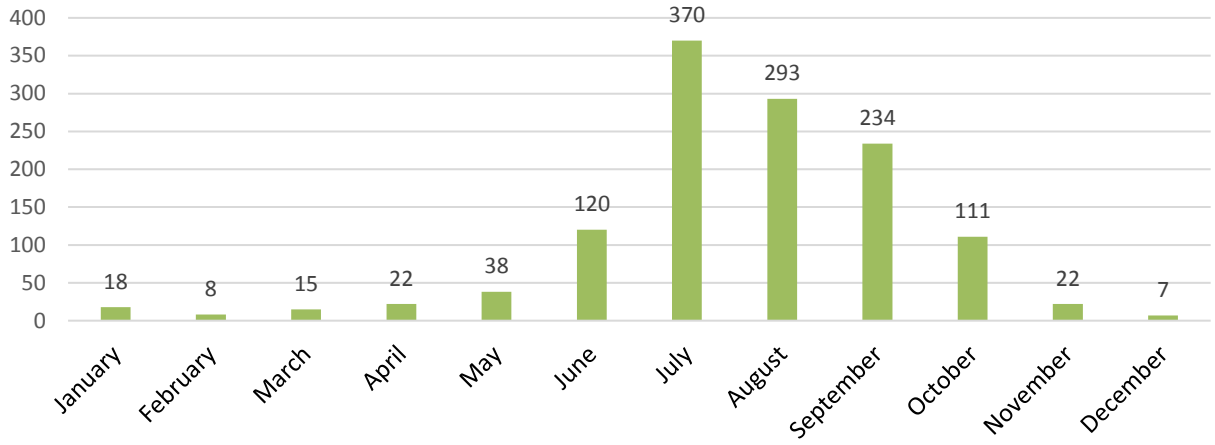


Figure 5.2.4 Humboldt County, Arson Ignitions by Month, 1974–2017[19]



Wildfire in the redwood forests, Canoe Fire 2003, photo: S. Underwood.

The wildfire season in Humboldt County historically began in June and ended in mid-October; however, today's fire season is expected to be longer. In most parts of the state, the fire season is now considered to be year-round. Drought, light snow pack, and local weather conditions can expand or shorten the length of fire season. As described below in *section 5.2.6* changing climatic conditions are beginning to change the local fire season, especially in terms of earlier snowmelt and increased night-time temperatures.

The following *Figure 5.2.5* shows the number of fire ignitions by month in Humboldt County, for the years 1974-2017. The greatest potential for ignitions occurs annually between June and October with the greatest number of ignitions occurring in July. *Figure 5.2.6* shows the average number of acres burned by month for the same years. The greatest potential for fires to grow to a large size happens in September. This is likely due to weather and fuel conditions, and the possibility that fire suppression resources could be stretched throughout the state in the fall.

[19] CAL FIRE. (2018). Humboldt Del-Norte Unit Pre-Fire Planning Battalion.

Figure 5.2.5 Humboldt County, Average Number of Ignitions by Month, 1974-2017[20]

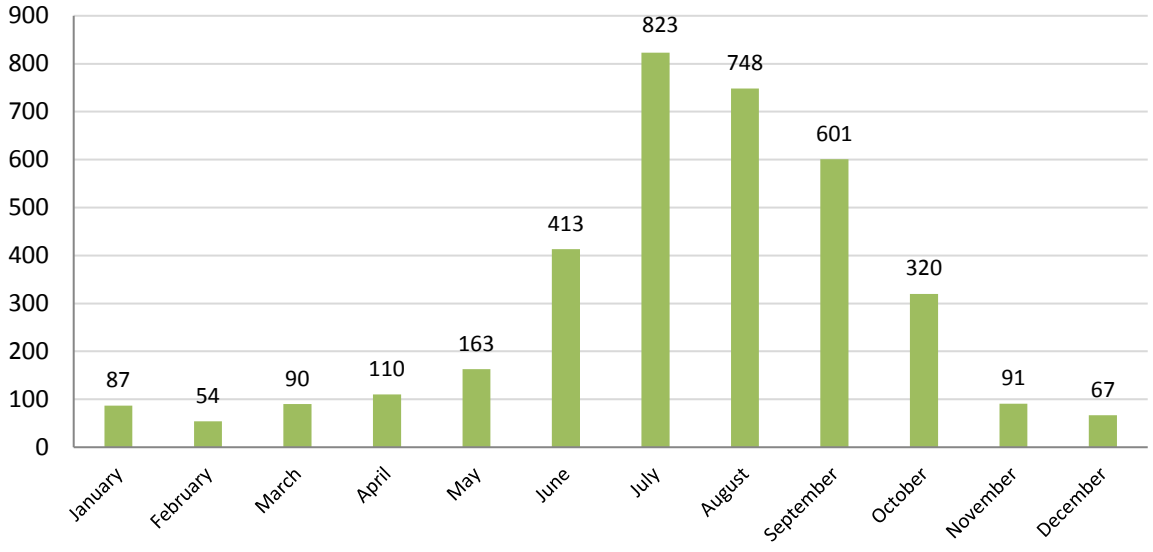
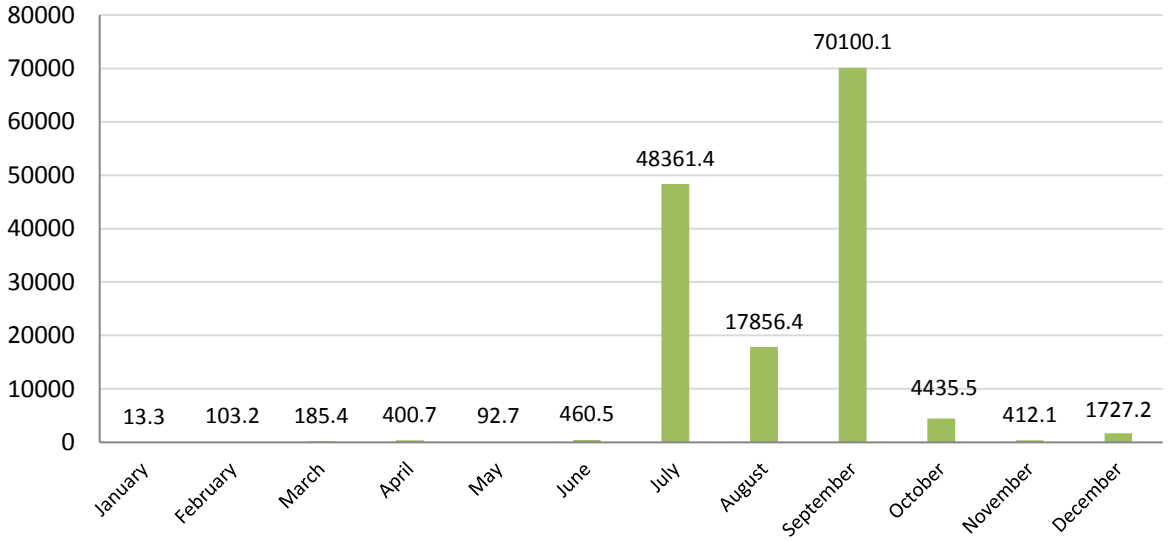


Figure 5.2.6 Humboldt County, Average Number of Acres Burned by Month, 1974-2017[21]



Coastal, or western, Humboldt County's wildfire season is typically shorter than that of the eastern half for a number of reasons:

- The western half of the county receives more rainfall;
- The western half has spring seasons that are wetter and cooler than the eastern;
- Temperatures in the eastern portion of the county are much higher in the summer months; and
- Much of the precipitation received in the east falls as snow during the winter, which under normal conditions, melts to provide water flow later into the year. *See section 5.2.6 for more information on changing snowmelt.*

[20] CAL FIRE. (2018). Humboldt Del-Norte Unit Pre-Fire Planning Battalion.

[21] CAL FIRE. (2018).

5.2.5 FIRE HISTORY

It is essential to understand the fire history of an area to comprehend its potential for future fires. Under most conditions, it can be assumed that if there is a history of frequent fire in a particular location, fire will likely return there again.

Fire history discerned through fire scars on tree rings—under low or moderate severity fire regimes[22]—may indicate the way fires have changed over time, both in frequency and intensity. This can guide goals for future fuel conditions, and their potential for management or restoration to historic conditions.

Fire has been a significant factor throughout the region's history, even in redwood forests where fire scars date back over one-thousand years. Despite the generally damp climate in redwood forests, studies have suggested a historical fire-return interval of 12 to 50 years.[23]

Current fire history data are maintained by CAL FIRE's Fire and Resource Assessment Program (FRAP). The county's fire history map, *in Part 2 of this CWPP,* is based on FRAP data and includes the occurrence of several large fires along the coast from as early as 1908. **Although it is a common belief in the Humboldt Bay area that fires don't happen along our coast, several large, destructive fires occurred on the coast around the Trinidad area over the last century.** These include the 7,432-acre Luffenholtz fire of 1908, the 17,527-acre A-Line fire of 1936, and a 15,000-acre unnamed fire near Patrick's Point in 1945.

Trinidad Head fire, 1943.

Map 2.3.2, ***Humboldt County Fire History*** *(in Part 2)* shows these fires and others between 1908 and 2017. As described throughout this chapter, the highest occurrence of wildfire in the county is in the northeast and southwest areas, although several significant fires historically occurred along the northern coastal areas of the county.

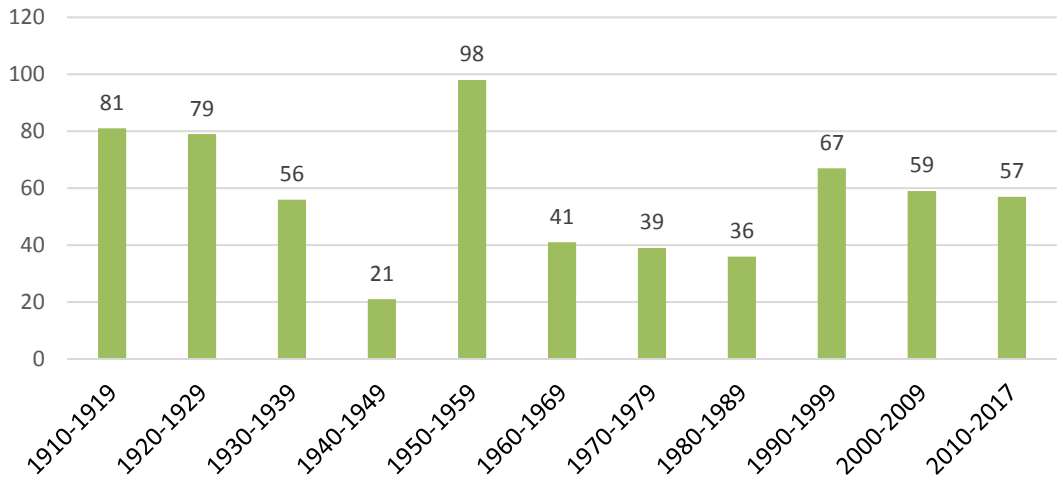
According to current CAL FIRE data, 554 wildfires burned in Humboldt County between 1908 and 2017. As shown in the *Figure 5.2.7,* the decade with the highest number of large fires was the 1950s, followed by the decades at the beginning of the 20th century. Although this data is generated by CAL FIRE, it is "a multi-agency…map of fire history. For CAL FIRE, timber fires 10 acres or greater, brush fires 30 acres and greater, and grass fires 300 acres or greater are included. For the USFS, there is a 10-acre minimum for fires since 1950."[24]

[22] More severe fires usually leave few trees where rings can be analyzed. See the previous section or *Appendix E* for more information on fire regimes.

[23] CAL FIRE: Humboldt – Del Norte Unit (HUU). (2017). Strategic Fire Plan Humboldt – Del Norte Unit 2017. (p. 9). Retrieved from *http://cdfdata.fire.ca.gov/fire_er/fpp_planning_plans_details?plan_id=270*

[24] CAL FIRE. (2017). Fire Resources Assessment Program (FRAP). State Fire Perimeters 1908-2017. Retrieved from *http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps*

Figure 5.2.7 Humboldt County, Large Fires by Decade, 1908–2017[25, 26]

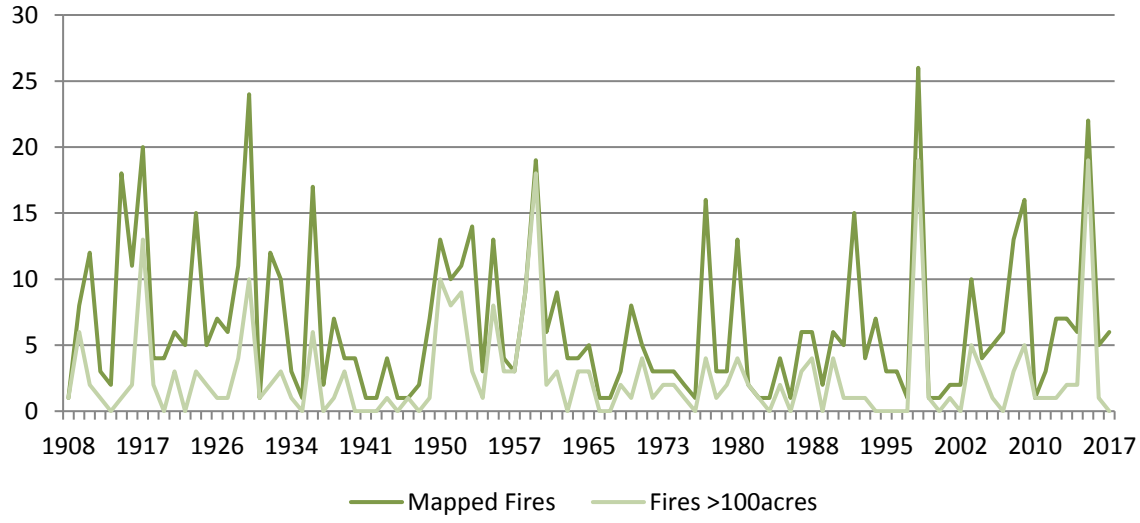


Recent decades do not show as many large fire occurrences as earlier in the last century. *Figure 5.2.8* below shows high fire occurrence in recent years. In terms of the numbers of fires, 1998 matched 1929, in that both saw 24 fires in Humboldt County, the most in any one year in recorded history. The 2015 fire season neared that record with 22 fires.[27] Of note is that lightning was primarily the cause of the 1998 and 2015 spikes.

Although there were only five wildfires in Humboldt County in 2016 and six in 2017, several large lightning fires burned just across the county line in 2017. These lightning fires are important to keep in mind, in terms of the potential for more lightning ignitions with climate change. Lightning can be particularly problematic if multiple ignitions occur around the same time. *See section 5.2.6,* ***Climate Change and Wildfire in Humboldt County*** *for more information.*

The following *Figure 5.2.8* shows all fires mapped by CAL FIRE since 1908, versus those of 100 acres or more. It is interesting to see that many of the years with the most fires over 100 acres, such as 1998 and 2015, were often the years with the highest number of fires.

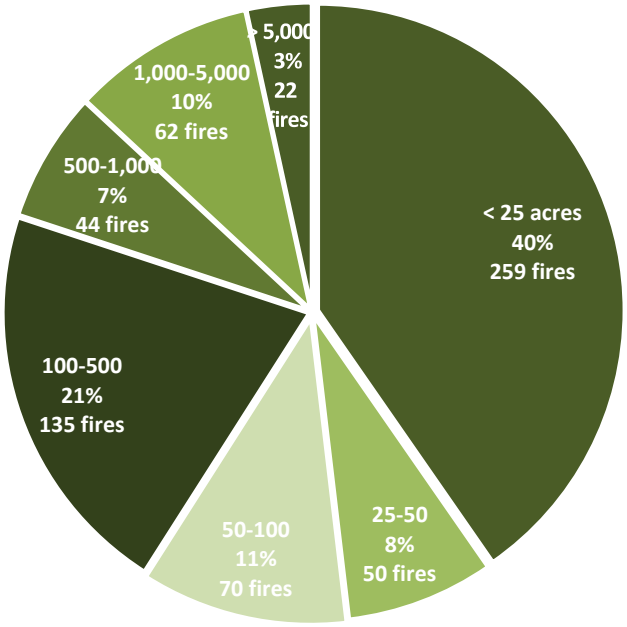
Figure 5.2.8 Humboldt County, Number of Fires per Year, 1908–2017[28]



[25] CAL FIRE. FRAP. (2018). State Fire Perimeters 1908-2017.
[26] Note that the last period, 2010-2017 was only 8 years, not 10.
[27] CAL FIRE. FRAP. (2018). State Fire Perimeters 1908-2017.
[28] CAL FIRE. FRAP. (2018). State Fire Perimeters 1908-2017.

The following chart, *Figure 5.2.9* shows the total number of fires by size, between 1908 and 2017. As expected, most fires (259 or 40%) are small, in this case less than 25 acres. Beyond these small fires, the largest number of fires (135 fires or 21% of all fires in Humboldt County between 1908 and 2017) were between 100 and 500 acres. The data indicate that there have been only 22 fires over 5,000 acres since 1908, or only 3% of wildfires in Humboldt County in recorded history. Of those 22 large fires, however, seven occurred since 1999.

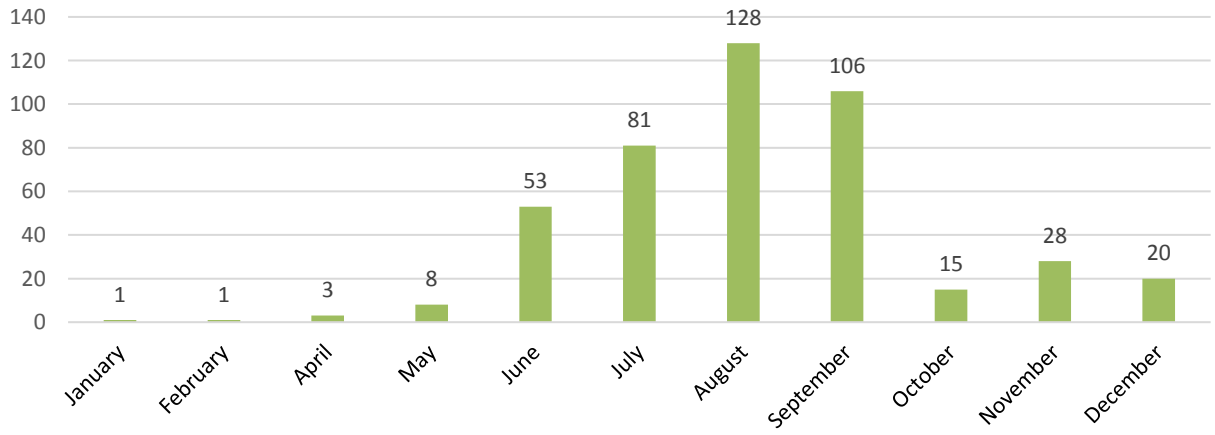
Figure 5.2.9 Humboldt County, Total Number of Fires by Acreage Range, 1908–2017[29]



Fire Caused by Natural Lightning

While lightning-caused fires are a significant factor in eastern Humboldt, they are generally much less prevalent in coastal Humboldt County. They do occur however. This was seen in recent decades in dozens of "lightning complex" fires from single storms in 2003, 2008, and 2015. *Figure 5.2.10* below shows that most lightning fire ignitions occur in late summer and early fall.

Figure 5.2.10 Humboldt County, Total Number of Lighting Ignitions by Month, 1974–2017[30]



[29] CAL FIRE. FRAP. (2018). State Fire Perimeters 1908-2017.

[30] CAL FIRE. (2018). Humboldt Del-Norte Unit Pre-Fire Planning Battalion.

The northeastern area of the county has the highest prevalence of lightning, which can be seen in *Map 5.2.2, Wildfire Starts.* Lightning fire ignitions are particularly problematic from a suppression standpoint, due to the likelihood of multiple ignitions within a few hours, and the increased likelihood of those starts (ignitions) occurring in more remote areas. Since 2015, most lightning-ignited larger fires have burned just beyond the county line.

In *Fire in California's Ecosystems*, Stephens, Kane, and Stuart write about the history and ecology of fire in the North Coast Bioregion:

> Whereas lightning does occur along the North Coast bioregion during the summer fire season, it is much less prevalent than on the higher ridges and mountains to the east (Keeley 1981). van Wagtendonk and Cayan (2008) found that lightning strike density ranged from 0.9 to 9.3 yr^{-1} 100^{-1} km^{-2}, with density increasing with distance from the Pacific Ocean and increasing elevation for the period between 1985 and 2000. Notwithstanding the lightning fire potential in northwestern California, ignitions by Native Americans likely accounted for most fires (Fritz 1931, Lewis 1993, Stephens and Fry 2005). [31]

Native American Fire History

It is generally accepted that the original inhabitants of North Coastal California actively stewarded and extensively managed their lands, including an active and deliberate use of cultural burning. The resultant frequent, low-intensity burns helped to keep pest populations down, improved the health of the acorn crop and other desirable forest products, and improved hunting grounds. It is assumed that Native American burning occurred here for many thousands of years prior to European colonization.

> The Native people of Hoopa Valley understood and used the natural cycle of burning. Cultural burning for clearing areas for crops, basketry material (Hazel and Beargrass), and hunting has been done for thousands of years in the region. According to tribal elders, traditional and naturally occurring fires were used to "cleanse" the land and were allowed to burn naturally without suppression. This resulted in fuel load reduction and decreases in fire severity and intensity.[32]

The acreage burned by California's earliest inhabitants was significant. Fire scientists Robert Martin and David Sapsis estimated that 5.6 to 13 million acres of California burned annually under both lightning and indigenous peoples' fire regimes.[33] However, fire scientists Scott Stephens, Sapsis, and others have since estimated lower numbers. Stephens et al. estimate that around 4.5 million acres were burned annually in California prior to 1800, excluding the southwestern deserts.[34] This estimate of prehistoric California annual area burned is close to (88% of) the total annual "extreme" wildfire area burned in the entire United States in the decade from 1994 to 2004.[35]

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[31] Stephens, S.L., Kane, J.M., and Stuart, J.D. (2018). North Coast Bioregion. In: van Wagtendonk, J.W., Sugihara, N.G., Stephens, S.L., Thode, A.E., Shaffer, K.E., Fites-Kaufman, J.A., & Agee, J.K. (Eds.). *Fire in California's Ecosystems, Second Edition* (p. 149). Berkeley: University of California Press.

[32] Hoopa Valley Tribe. (2016). Hoopa Valley Indian Reservation Community Wildfire Protection Plan. (p. 8).

[33] Martin, R. & Sapsis, D.B. (1992). Fires as agents of biodiversity: pyrodiversity promotes biodiversity. In *Proceedings of the conference on biodiversity of northwest California ecosystems. Cooperative Extension, University of California, Berkeley*, pp. 150-157.

[34] Stephens, S.L., Martin, R.E., & Clinton, N.E. (2007). Prehistoric Fire Area and Emissions from California's Forests, Woodlands, Shrublands, and Grasslands. *Forest Ecology and Management* 251: 205-216.

[35] Stephens, S.L., et al. (2007).

In contrast, from 1955 to 2017, the average annual area burned by wildfire in all vegetation types in California was approximately 383,341 acres per year, or only approximately 8.5% of what traditionally burned annually in pre-settlement times.[36] **Regardless of errors in either estimation, prior to modern fire suppression, very large amounts of land burned in California.[37] Skies may have been smoky much of the summer and fall during this period.**

Stephens et al. in 2018 surmise that Native American burning contributed extensively to local fire history:

> Fire history studies from the last 1,000 years reveal a variable pattern of fire frequencies throughout northwestern California. The most frequently burned landscapes were ignited on a near annual basis by Native Americans (Lewis 1993) and were generally in close proximity to villages or in areas cultured for food and basketry materials such as in grasslands and oak woodlands. Vegetation adjacent to Native American use areas experienced more frequent fire than would be found in the same vegetation type further away (Whitlock and Knox 2002). [38]

Native populations made use of fire and natural resources in many ways, including the active stewardship of prairies, oak woodlands, and forests. These burns improved wildlife habitat and enhanced the health and growth of tanoak for acorns, and plants used for basket making, such as bear grass.

> There is a long tradition of fire management by the Yurok for the purposes of increasing acorn-producing hardwood areas, basket material gathering sites, maintaining fuel breaks around villages and houses, and maintaining open prairies for insect population management, and agricultural areas. Federal authorities in the early 1900s forced the end of these practices, and the forest has, for the most part, invaded most open areas. Not only has this reduced the availability of basketry materials and food sources, but has increased the risks of both structural and timber losses to wildfires. Given this exclusion of fire, it is likely that some hardwood stands may be now slowly converting to conifer cover types.[39]

Local tribes are now leading efforts locally and nationally to return fire to the landscape as an effective and sophisticated management tool.


Understory burning on Yurok Tribal land in 2018. Photos: Cultural Fire Management Council.

[36] CAL FIRE. (2017). FRAP. State Fire Perimeters 1908-2017.
[37] Stephens, S.L. et al. (2007).
[38] Stephens, S.L. et al. (2018). (p. 153).
[39] Yurok Tribe. (2012). Yurok Indian Sustained Yield Lands Forest Management Plan. (p. 24). [PDF]. Retrieved from http://www.yuroktribe.org/departments/forestry/Documents/FMP2012DraftRev3.14.pdf

> The Karuk use of fire as a land management tool was complex and multi-faceted. As with other ceremonial and religious aspects of Karuk culture, the role of fire was one to be contemplated and learned from at the deepest levels.[40]
> …
> The Karuk People see the role of fire touching upon many aspects of their life. Fire caused by natural and human ignitions affects the distribution, abundance, composition, structure and morphology of trees, shrubs, forbs, and grasses (Skinner et al. 2006) which in turn can be beneficial or detrimental depending on habitat or resource needs and condition prior to disturbance.[41]

Fire scientists, ecologists, and others now recognize the importance of Native American burning practices and are exploring ways to reincorporate them into current land management practices. The forefront of this work is happening on the Humboldt – Siskiyou county border with the *Somes Bar Integrated Fire Management Project*[42] of the Western Klamath Restoration Partnership. *For more information on the use of fire as a tool, and tribal leadership with prescribed fire, see the Countywide Action Plan Chapter 3.5,* ***Restoration of Beneficial Fire****.*

European Settlement Fire History

European settlement and colonization in the area began with Spanish and Russian explorers in the late 1700s and early 1800s. The discovery of gold in the Klamath and Trinity mountains brought miners, traders, and explorers, and forever changed the region. The gold rush brought settlement, and mining was quickly replaced by timber as the dominant industry. Logging of the largest, oldest trees was common, with subsequent changes in forest structure and fuel volumes. By 1854, there were nine lumber mills around the county involved in exporting lumber worldwide. Dairy and cattle operations also became a large sector of the county's economy. Many forms of land management during this era (such as logging, grazing, development, and fire suppression) significantly influenced local fire history.

The town of Luffenholtz in 1907, along the original wagon trail to Trinity County gold area, now Westhaven road. Note the burned trees in the background. This area suffered a devastating fire in 1908, the following year. Photo courtesy of Trinidad Historical Society.

The arrival of European-descent settlers brought radical changes and destruction to the indigenous populations, as well as to the "natural" landscape here. In part because of the conflicts between colonists and indigenous land management, violence erupted in many areas, such as in the Mattole Valley in the southwestern corner of the county. To address the resulting crisis,

[40] Karuk Tribe Department of Natural Resources. (2010). Draft Eco-Cultural Resources Management Plan. (p. 3). Karuk Ethnographic Report 12-14, quoting from Salter 1981. Retrieved from *http://www.karuk.us/index.php/departments/natural-resources*

[41] Karuk Tribe Department of Natural Resources. (2010). Draft Eco-Cultural Resources Management Plan. (p. 4).

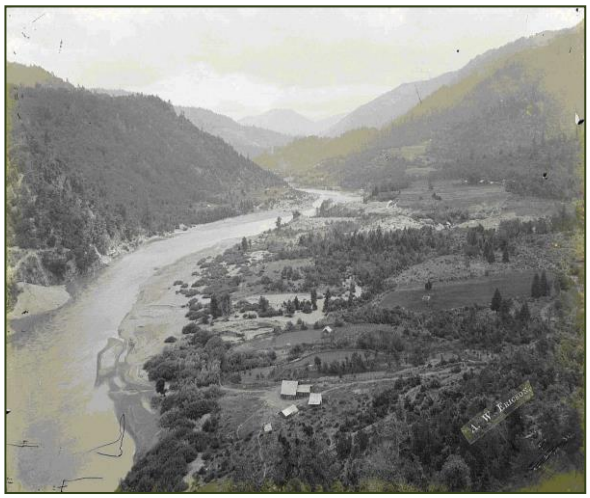
[42] Six Rivers National Forest. (2018). Somes Bar Integrated Fire Management Project, Final Environmental Assessment. [PDF]. Retrieved from *https://www.fs.usda.gov/nfs/11558/www/nepa/106291_FSPLT3_4291171.pdf*

Mattole colonizers decreed a resolution that was published in the September 18, 1858, *Humboldt Times,*[43] "that the Indians must not set fire to the grass on the hills..."[44] Therefore, burning in the Mattole Valley and other areas of the county was virtually stopped for a short time, until the late 1800s/early 1900s, when ranchers then reinstated it to improve grasslands. The following quote summarizes fire-management practices throughout Humboldt County at that time.

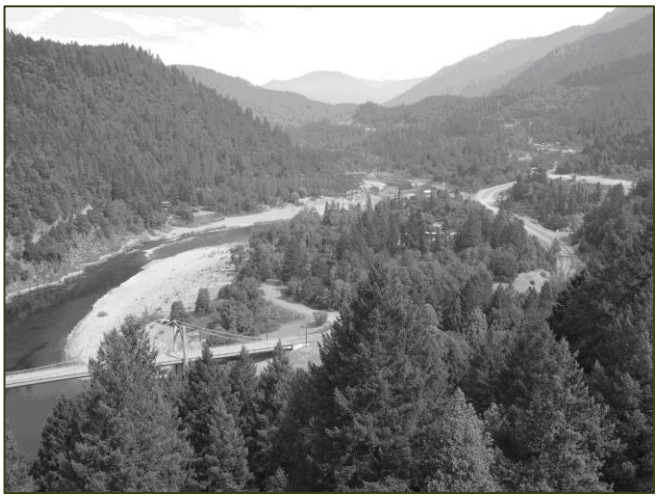
> During the settlement period (1875-1897) European settlers used fire for maintenance and enlarging the pasturelands and as a land clearing method. Major land activities during the post settlement period (1898-1940) were livestock grazing, farming, debarking of the tanoak for tannin production and logging of Douglas fir and coast redwood. Logging was clearly a dominant activity during this time period… In this time of unrefined mechanized equipment, the logging operations were simplified as much as possible. Logged areas were burned to assist with the removal of the logs and reduce the logging debris left behind. These fires were left to burn with no real control efforts. The same can be said for the area ranchers who commonly set fire to their land in order to maintain the grazing.[45]

The pattern of historic native and early colonial burning helps explain the presence of dense old-growth forests in the drainages and open meadows along the ridges throughout the county. This pattern can be seen in the earliest available aerial photographs from 1941.

The following pictures from local fire scientist Frank Lake, show the dramatic changes to the Orleans area along the Klamath River, presumably due principally to the absence of indigenous burning.[46]



Looking north, up-river from Big Rock, Orleans, CA. Circa 1894. Photograph by A.W. Ericson. "View from Rattlesnake Rock, Orleans" No. 62 (Lake 2007).



Looking north up-river from Big Rock, Orleans, CA in September 2006. Photograph by F. K. Lake (Lake 2007).

[43] CalIndianHistory.org. (2010). September 18, 1958: "Mass Meeting in Mattole Valley". *Weekly Humboldt Times*. Retrieved from http://calindianhistory.org/1858-2

[44] Roscoe, J. (1985). An Ethnohistory of the Mattole, Humboldt County, California. (p. 33). Part of the Archaeology Field Survey Reports Contributed by BLM, Arcata Field Office. DOI: 10.6067/XCV8T72FX0.

[45] CAL FIRE: HUU. (2011). (pp. 5-6).

[46] Lake, F.K. (2007). Traditional ecological knowledge to develop and maintain fire regimes in northwestern California, Klamath-Siskiyou bioregion: management and restoration of culturally significant habitats, Doctoral Dissertation. Oregon State University, Environmental Sciences. Retrieved from https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/1z40kw515?locale=en

Some of these early prescribed fire practices are being reinstated in the grasslands of Humboldt County. *See the **Prescribed Fire** section below for more information*.

CAL FIRE summarizes the fire history during this period as follows:

> Reviews of area newspapers and various studies at Humboldt State University indicate that there was indeed a significant fire history from the late 1800s through early 1950s. Notable are 24 "fire seasons" between 1880 and 1952. During this time period the fire interval was 3.3 years. Some of these fires included entire towns being burned, such as the 1908 fire that destroyed the community of Luffenholtz. People were left homeless, local mills and railroad tracks all perished from these large severe fires.[47]

The Era of Intensive Fire Suppression

In response to several large destructive fires in the West and Midwest in the early part of the 1900s, fire was viewed as a major threat to lives, property, and natural resources, resulting in the "10 a.m. policy" adopted by the US Forest Service (USFS) in 1935. This policy sought to aggressively suppress fires and have them extinguished by 10 a.m. the morning following a fire being discovered.

> Civilian Conservation Corps began work in the Humboldt–Del Norte area in the mid 1930s, developing an improved local firefighting infrastructure. After 1945, the severity and number of fires began to decline significantly… World War II had taken the work force overseas; with the return of the soldiers came an active fire suppression program.[48]

Emanuel Fritz[49] summarized this time period well in 1951:

> In the early days of forestry we were altogether too dogmatic about fire and never inquired into the influence of fire on shaping the kind of forests we inherited.[50]

These policies and practices set the stage for the intensive fire suppression paradigm that is now beginning to change.

Recent Fire History

Intensive fire suppression since WWII, combined with other factors (e.g. increased development, lack of homeowner defensible space, logging of the largest trees), has led to an increase in the amount of flammable materials now accumulated throughout Humboldt County. It is widely accepted that fires burn longer and hotter than before European settlement.

> More area is burning at high intensity, and this is related, in part, to higher quantities and more homogeneous fuels caused by accumulation during the fire-suppression period.[51]

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[47] CAL FIRE: HUU. (2017). (p. 9).

[48] CAL FIRE: HUU. (2017). (p. 9).

[49] Professor Emeritus of Forestry at University of California Berkeley and Founding Director of the Regional Parks Association.

[50] Stuart, J.D. & Stephens, S.L. (2006). North Coast Bioregion. In: Sugihara, N.G., van Wagtendonk, J., Shaffer, K.E., Fites-Kaufman, J., & Thode, A.E. (Eds.). *Fire in California's Ecosystems* (p. 147). Berkeley: University of California Press.

[51] Skinner, C.N., Taylor, A.H., & Agee, J.K. (2006). Klamath Mountain Bioregion. In: Sugihara, N.G., van Wagtendonk, J., Shaffer, K.E., Fites-Kaufman, J., & Thode, A.E. (Eds.). *Fire in California's Ecosystems* (p. 179). Berkeley: University of California Press.

It is generally accepted that wildfire now only escapes suppression efforts less than 2% of the time[52]—but those few escaped fires find a choked, fuel-heavy landscape and result in the vast majority of damage caused by fire.

> More than 85 percent of Forest Service lands in NW California are burning either less frequently or much less frequently currently than under the pre-Euro-American settlement fire regime, as compared with 67 percent of Forest Service and National Park Service lands in the Sierra Nevada and 19 percent in southern California (Safford and Van de Water 2014).[53]

The following table, *Figure 5.2.11* lists all fires greater than 200 acres in Humboldt County over the last twenty years. Most, but not all, of these fires are part of that small percentage that have escaped suppression efforts.

FIGURE 5.2.11 WILDFIRES OVER 200 ACRES IN THE LAST 20 YEARS (1997-2017)[54]

Fire name	*Location*	*Year*	*Acres*	
			Humboldt	*Total*
Megram	West of Willow Creek and Hoopa	1999	59,272	125,073
1998[55] (no name)	Orleans	1998	19,880	20,282
Honeydew	King Range, Honeydew Creek	2003	11,770	11,794
Corral	Six Rivers National Forest (SRNF), northwest of Willow Creek	2013	11,719	12,541
Blake	SRNF	2015	11,425	11,439
Canoe	Humboldt Redwoods State Park, Canoe Creek	2003	11,044	11,044
Half	Sims Mountain, SRNF	2008	9,078	15,130
Lassics	SRNF, northeast of Blocksburg	2015	7,469	18,192
Somes	SNRF, west of Orleans	2006	6,544	15,506
Johnson	Trinity National Forest, north of Dinsmore	2015	5,139	17,821
Groves	Lone Pine Ridge (SRNF), east of Willow Creek	2015	4,023	6,803
Mill Creek 4	SNRF/Hoopa, east of Weitchpec	2009	2,831	2,831
Sims	Sims Mountain, SRNF	2004	2,021	4,036
LT-17 (Backbone)	Lone Pine Ridge (SRNF), east of Willow Creek	2009	1,779	5,194
Pine 1-44	Pine Mountain, SRNF	2015	1,660	1,773
East	SRNF, northwest of Willow Creek	2015	1,531	1,531

[52] Stephens, S.L., Collins, B.M., Biber, E. & Fulé, P.Z. (2016). US federal fire and forest policy: emphasizing resilience in dry forests. Ecosphere, 7(11): 1-19. Also see Husari, S.J. & McKelvey, K.S. (1996). Fire-management policies and programs. *In: Sierra Nevada Ecosystem Project, Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options. Davis, CA: University of California, Centers for Water and Wildland Resources. Report No. 37.* (pp. 1101-1118).

[53] Butz, R.J., Sawyer, S., & Safford, H. (2015). A summary of current trends and probable future trends in climate and climate-driven processes for the Six Rivers National Forest and surrounding areas. US Forest Service. (p. 13).

[54] CAL FIRE. FRAP. (2018). State Fire Perimeters 1908-2017.

[55] This table entry represents a conglomeration of fires ranging from hundreds to thousands of acres that burned all across the Yurok and mid-Klamath region in October 1998.

FIGURE 5.2.11 WILDFIRES OVER 200 ACRES IN THE LAST 20 YEARS (1997-2017)[54]

Fire name	*Location*	*Year*	*Acres*	
			Humboldt	*Total*
Steelhead 1-54	Eel River, Alderpoint	2015	1,403	1,403
Buck	SRNF, southeast of Dinsmore	2015	1,274	1,420
Nickowitz	SRNF, Del Norte County line	2015	1,263	7,576
Paradise	Southwest of Ettersburg	2008	1,072	1,072
Dobbyn 1-57	Fort Seward	2015	787	787
Tulley	Tulley Creek, Hwy 169	2016	607	607
Dance	Orleans	2013	577	577
Happy	NE (SRNF) and SE of Willow Creek	2015	547	68,095
Spanish	Spanish Flat, King Range National Conservation Area	2011	512	524
Friday	Above Sandy Bar	2003	389	389
Red	East of Maple Creek	2014	332	332
Flat	Spanish Flat, King Range National Conservation Area	2001	289	317
Pilot	North of Dinsmore	2004	287	287
Blocksburg 1-58	South of Blocksburg	2015	284	284
Wildcat 1-51	Wildcat Butte, west of Fort Seward	2015	283	283
Tuk	West of Elk Camp	2003	279	279
Tierney	Buck Mountain, SRNF	2015	248	248
10	King's Peak, King Range National Conservation Area	2003	213	213
Bald Hill 3	Hoopa Reservation, Hog Ranch Prairie	2014	210	210
Buckeye	Buckeye Mountain	2010	202	202

As shown in *Figure 5.2.8* earlier in this chapter, 1998 and 2015 were peak years for wildfire occurrence in Humboldt County. This could be an indication that Humboldt County is following the statewide trend of increased number, size, and severity of wildfires over recent decades. According to the 2010 Strategic Fire Plan for California, "Data suggests a trend toward increasing acres burned statewide, with particular increases in conifer vegetation types."[56]

Effective fire suppression in Humboldt County is one of the factors contributing to a buildup of hazardous wildfire fuels in both the wildlands and WUI areas. Factor in the projected impacts of climate change and sudden oak death to this equation, and Humboldt County could likely face larger and more destructive wildfires in the future—a threat to both natural and community resources.

[56] State Board of Forestry and Fire Protection & CAL FIRE. (2010, Revised 2016). Strategic Fire Plan for California.

Prescribed Fire

No discussion of fire history in Humboldt County would be complete without addressing the resurgence in *prescribed fire (controlled burning)* use. This practice has been utilized historically and more recently by tribes, federal and state agencies, local ranchers, logging companies, and to an increasing extent, homeowners, for fuel reduction and other landscape benefits.

Due to concerted and participatory fire-safety efforts led by local Fire Safe Councils (FSCs) *(see Chapter 5.4, **Community Preparedness**)*, as well as more regional progress and outreach by the Northern California Prescribed Fire Council, public acceptance of prescribed fire has increased in Humboldt communities. In the town of Orleans, for example, the Orleans/Somes Bar FSC has maintained over 1,400 acres of *shaded fuelbreaks* using prescribed fire in the last decade, with funding from the USFS, CAL FIRE, and others.

***Prescribed fire/burn**:* A fire that burns within a range of predetermined conditions (such as fuel moisture content, weather conditions, etc.) that will keep it controllable, at low intensity, and able to achieve its stated objectives. A written, approved prescribed fire plan must exist, and environmental requirements (where applicable) must be met, prior to ignition.

***Shaded fuelbreaks**:* A fuelbreak 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.

Broadcast burn: 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

Prescribed fire projects in the county range from small-scale, landowner-conducted individual burns to larger, more complex burns conducted by the county's federal and state agencies. Timberland managers also use fire throughout the county to burn piles or *broadcast burn* larger areas. In early 2018, local residents formed California's first prescribed burn association—the Humboldt County Prescribed Burn Association (HCPBA)—a cooperative group of landowners, non-governmental organizations, and other community members who work together to implement prescribed burns. *For more information on the HCPBA, see Chapter 5.4, **Community Preparedness**.*

State and federal agencies—including CAL FIRE, State Parks, Redwood National Park, the Bureau of Land Management (BLM), and the USFS—all use prescribed fire where appropriate and when possible to achieve a variety of land-management objectives. CAL FIRE is an active cooperator with other public agencies such as State and National Parks, providing equipment, crews, and other resources to assist with their burns. CAL FIRE often achieves these activities via their Vegetation Management Program, or VMP.[57] There are several prescribed-fire programs conducted on federal public lands. Redwood National Park has an active program that uses CAL FIRE resources, and BLM burns are usually coordinated with CAL FIRE.

Prescribed burn on grassland conducted by the HCPBA. Photo: HCPBA.

At the state level, there has been significant movement to scale up the use of prescribed fire on both public and private lands. The *Fire Memorandum of*

[57] CAL FIRE. (n.d.). Vegetation Management Program [Web]. Retrieved from http://calfire.ca.gov/resource_mgt/resource_mgt_vegetation

Understanding demonstrated a shared commitment to the use of fire as a tool, and included a long list of signatories, including the USFS, CAL FIRE, Sierra Forest Legacy, the Northern California Prescribed Fire Council, and many other federal agencies and non-governmental organizations. In 2018, the California Forest Management Task Force was created with a Prescribed Fire Work Group to address this issue statewide. Likewise, there have been several legislative actions to better support prescribed fire and there are more on the horizon. *For more information on countywide actions related to prescribed fire, see Chapter 3.5,* ***Restoration of Beneficial Fire.***

Understanding the local wildfire environment helps residents and decision makers to understand when to be on extra alert in terms of ignitions. As stated in this chapter, the highest number of ignitions in Humboldt County occur in July, with the largest wildfires occurring in September.

Considering the probability of significant increased wildfire threats, it is important that Humboldt County residents are increasingly vigilant regarding reducing wildfire risks and hazards in their homes and communities to improve their fire safety *(see Appendix H,* ***Living with Wildfire,*** *for an in-depth discussion on this topic).* Taking the steps recommended in this CWPP will decrease the vulnerability of communities to damage from wildfire. Fire-hardened homes and communities will provide an opportunity for more active use of prescribed fire as fuel-reduction tool, especially during the early and late fire season when conditions are good for low-intensity burning. This will also facilitate low-intensity wildfires to take their natural course without jeopardizing community and natural resources. Maintaining high-capacity fire services will continue to be important to manage all wildfires threatening communities. Actively prioritizing minimizing wildfire impacts in Humboldt County will likely make a significant difference in its effects here.

5.2.6 CLIMATE CHANGE AND WILDFIRE IN HUMBOLDT COUNTY

> Anyone who says they have a grasp on how climate change will impact future fire regimes possesses an impressive level of optimism.[58]

Predictions vary regarding how changing climate will affect northern California, and specifically Humboldt County, and what those changes might mean in terms of wildfire frequency and severity. This section summarizes current climate change literature as it relates to wildfire in Humboldt County. It quotes passages to which readers may want to refer for more information. A summary of that research can be found in *Appendix F,* ***Climate Research*****.**

Generally, it is expected that weather patterns will continue to get more extreme, especially in inland areas with less of a tempering marine influence. **Regardless of the model, it is largely agreed that "with projected climate change, we expect to face much more forest fire in the coming decades**."[59] The challenge for Humboldt County is how to proactively prepare for and adapt to these likely changes. As one group of researchers note, this region is unique in several ways:

> Northwestern California is a biogeographic and climatic transition zone, and very strong environmental gradients further complicate the picture. It is, therefore, unclear to what extent the region may mimic patterns in other parts of the West, or even other parts of the world with similar climates.[60]

[58] Keeley, J.E. & Syphard, A.D. (2016). Climate change and future fire regimes: Examples from California. *Geosciences* 6(3). (p. 10).

[59] Stephens, S.L., Agee, J.K., Fulé, P.Z., North, M.P., Romme, W.H., Swetnam, T.W., & Turner, M.G. (2013). Managing forests and fire in changing climates. *Science* 342(6154). (p. 41).

[60] Miller, J.D., Skinner, C.N., Safford, H.D., Knapp, E.E., & Ramirez, C.M. (2012). Trends and causes of severity, size, and number of fires in northwestern California, USA. *Ecological Applications* 22(1): 184-203, quote on p. 185.

A 2018 study for the North Coast Resource Partnership (NCRP)[61] predicts "an approximately 40% increase in probability of fire across the [7-county] region by end-century…"[62] Another NCRP report summarized local climate-change predictions regarding wildfire as follows:

> Although there are several factors that affect the size and frequency of wildfires, **the progressively warmer temperatures and associated drought stress projected for the region are expected to contribute to an increase in wildfire size and frequency that climate models predict will worsen over time** (Krawchuck and Moritz, 2012; Yoon et al., 2015)… Given that 13 of California's 20 largest wildfires over an 85-year period have occurred since 2000 (CAL FIRE, 2017), **it's not surprising that some scientists believe that the combined effects of increased heat and drought are already contributing to larger and more frequent wildfires in California** (Krawchuck and Moritz, 2012; Yoon et al., 2015). Interestingly, however, a 2012 study of the Klamath, Mendocino, Shasta-Trinity, and Six Rivers National Forests found that **although wildfire size and frequency have been trending upward, the severity of wildfires has not been** (Miller et al., 2012). This led the study's authors to conclude that**, under appropriate conditions, fire could be more extensively used in the region to achieve management objectives.**[63] [emphasis added]

Although temperatures and drought conditions are expected to increase, fire severity may not. The increased use of fire as a management tool in the face of climate change is consistent with the actions proposed in this CWPP. However, any fuel-reduction activities implemented based on this CWPP should strive for a net-carbon gain, using methods that minimize carbon emissions and maintain and/or restore ecosystem functions, processes, and health. *See the Countywide Action Plan, Chapter 3.5,* ***Restoration of Beneficial Fire*** *for more information.*

As many have observed, it is difficult to tease out the human influence as distinct from climatic influences in terms of increased fire frequency and severity, especially given the history and success of fire suppression:

> The success of fire suppression has, ironically, fostered changes in the composition and structure of many ecosystems that are among factors believed to contribute to the current increases in burned area (Biswell 1989, Agee and Skinner 2005, Arno and Fiedler 2005, Husari et al. 2006). At the same time, changing climates are also understood to play a major part in increased fire activity and area burned (Miller 2003, McKenzie et al. 2004, Westerling et al. 2006, Miller et al. 2009b). Indeed, **multiple lines of historical and contemporary evidence tell us that over the long term, changes in fire activity can primarily be explained by broadscale changes in climate, moderated by local changes in vegetation, fuel conditions, and human activities** (Power et al. 2008, Whitlock et al. 2008, Bowman et al. 2009, Marlon et al. 2009).[64] [emphasis added]

[61] The North Coast Resource Partnership (NCRP) is a stakeholder-driven collaboration among local government, Tribes, watershed groups, and interested partners in the North Coast region of California, comprising seven counties, Tribal lands, major watersheds, and a planning area of 19,390 square miles representing 12% of California's landscape.

[62] Micheli, E., Dodge, C., Comendant, T. & Flint, L. (2018). Climate and Natural Resources Analysis and Planning for the North Coast Resource Partnership: A Technical Memorandum Summarizing Data Products. Final Technical Report. USGS. (p. 26).

[63] Reza, K. & Tinsman, R. (2018). North Coast Regional Climate Adaptation Strategies. North Coast Resource Partnership. (p. 7). Retrieved from https://northcoastresourcepartnership.org/resources

[64] Miller, J.D. et al. (2012). (p. 184).

Looking further into the human vs. climatic influences on fire behavior and activity, a 2017 study analyzing fire activity in 37 regions across the continental US summarized:

> Climatic variation played a significant role in explaining annual fire activity in some regions, but the relative importance of seasonal temperature or precipitation, in addition to **the overall importance of climate, varied substantially depending on geographical context. Human presence was the primary reason that climate explained less fire activity in some regions than in others**.[65] [emphasis added]

This influence of human presence on fire frequency is not so clear for Humboldt County, however. As shown in *Map 5.2.2, Wildfire Starts* above, most fires ignite here along the eastern border, both by humans and climate (lightning). However, the *Fire History Map* in *Part 2,* shows more scattered fire activity throughout the county. That said, local experts expect more dramatic changes in climate and resultant fire behavior for the less-populated inland areas of Humboldt County, as compared to the coastal area, which is where the majority of the population resides.

Regional Climatic Data

In 2010 and again in 2015, regional Forest Service ecologists Butz, Sawyer, and Safford summarized current research regarding climate change and its impact to the Six Rivers National Forest and surrounding areas, placing emphasis on higher nighttime temperatures: [66, 67]

> Only two weather stations on the Six Rivers National Forest have adequate long-term temperature data available for analysis. While the average annual temperature at the Willow Creek station has remained relatively constant, average temperatures at the Orleans station have increased approximately 2° F (1.1° C) in the period 1931-2014. **This trend is driven by a highly significant increase in mean minimum (i.e., nighttime) temperatures, which have risen by almost 4° F (2.2° C) over the same period...** The increase in minimum mean (nighttime) temperature when compared to mean and maximum mean (daytime) temperatures [is] consistent with findings across California (Cordero et al. 2011, LaDochy et al. 2007).[68]
>
> …
>
> While most of the weather stations do not receive substantial amounts of snow, **all stations show declining trends in annual snowfall**, one of which is statistically significant (Willow Creek).[69] [emphasis added]

[65] Syphard, A.D., Keeley, J.E., Pfaff, A.H., & Ferschweiler, K. (2017). Human presence diminishes the importance of climate in driving fire activity across the United States. *Proceedings of the National Academy of Sciences* 114 (52): p. 13750.

[66] Butz, R.J. & Safford, H. (2010). A summary of current trends and probable future trends in climate and climate-driven processes for the Six Rivers National Forest and surrounding areas. US Forest Service. (p. 2010).

[67] Butz, R.J., Sawyer, S., & Safford, H. (2015). A summary of current trends and probable future trends in climate and climate-driven processes for the Six Rivers National Forest and surrounding lands. USDA Forest Service Pacific Southwest Region. (p. 3). [PDF]. Retrieved from *https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd490216.pdf*

[68] Butz, R.J. et al. (2015). (p. 3).

[69] Butz, R.J. et al. (2015). (p. 7).

This change in snowpack may be the most critical influence for wildfire activity in Humboldt County:

> Analyses of hydrometeorological data from the lower Klamath Basin show a **decrease in the percentage of precipitation falling as snow and accelerated snowpack melt, resulting in earlier peak runoff and lower base flows** (Hamlet et al. 2005; Mote et al. 2005; Regonda et al. 2005; Stewart et al. 2005; Mote 2006; Van Kirk and Naman 2008).[70] [emphasis added]

Lack of sufficient snowpack to provide adequate water flows in summer and into fall—during the same time as most local wildfire ignitions *(see **Wildfire Risk and Ignition Sources** section above)*—can substantially increase both local fire hazard (drier fuels) and fire risk (more ignitions, including lightning) for Humboldt County. The Six Rivers study further notes:

> **Although climate models diverge with respect to future trends in precipitation over NW California, there is widespread agreement that the trend toward lower *snow water equivalent* and earlier snowmelt will continue** (Leung and Wigmosta 1999; McCabe and Wolock 1999; Miller et al. 2003; Snyder et al. 2004; Barnett et al. 2005; Zhu et al. 2005; Vicuna et al. 2007; Van Kirk and Naman 2008).[71] [emphasis added]

Climate and Fire

In a 2012 analysis titled *Trends and Causes of Severity, Size, and Number of Fires in Northwestern California,* Miller et al. noted that the above-mentioned changing summer water flows and precipitation patterns are a driving force in increased fire activity in the region.

> Another intriguing trend in northwestern California is a strong temporal increase in the importance of lightning fires in the region. In the early part of the 20th century, lightning accounted for 42% of area burned in all recorded fires, but by the end of the century, 87% of area burned was caused by lightning…. **We suggest the increasing importance of summer precipitation later in the study period may be related to the increasing dominance of lightning caused fires**…. our analysis suggests that **amount of precipitation at the time of ignition has become more important in recent decades than seasonal drought in driving fire activity and fire area. Ironically, dry years in which large areas burn due to lightning-ignited fires are often years of relatively little lightning activity.**[72] [emphasis added]

As shown in the previous sections, fire frequency, size, and total area burned are increasing. This is likely due to a combination of climate change, past land management, and fire suppression. As Miller et al. continue, more and larger fires are expected in the region:

> [O]ur data suggest that fire frequency, size, and total burned area have strongly increased over the last 20 years, and that climate is associated with a growing proportion of the variance in these variables. We believe that this pattern is the product of a changing climate plus increasing and more fire-prone fuels in some forest types, the latter driven by a combination of human- (e.g., fire suppression, land management practices) and climate-

[70] Butz, R.J. et al. (2015). (p. 12).

[71] Butz, R.J. et al. (2015). (p. 16).

[72] Miller, J.D. et al. (2012). (pp. 194-195).

> related (e.g., warming temperature, drier fire seasons) factors. **Regardless, forested systems in northwestern California will burn under favorable weather conditions, and it is logical to expect more and larger fires under future climate change scenarios** (Lenihan et al. 2008, State of California 2009, Gedalof 2011).[73] [emphasis added]

Forest Service scientists concur with Miller et al.—based on the research of Westerling et al. (2006) and others—that increased fire activity is at least partially due to changing climate conditions:

> Data on forest fire frequency, size, and total area burned all show strong increases in California over the last two to three decades. Westerling et al. (2006) showed that increasing frequencies of large fires (>1,000 acres) across the western United States since the 1980s were strongly linked to increasing temperatures and earlier spring snowmelt. **Northern California forests have had substantially increased wildfire activity, with most wildfires occurring in years with early springs** (Westerling et al. 2006). This increase is likely attributable to both climate and land-use effects. Large percentage changes in moisture deficits in Northern California forests, according to Westerling et al. (2006), were strongly associated with advances in the timing of spring, but this area also includes substantial forested area where forest densification after fire exclusion, timber harvesting, and mining activities have led to increased forest densities and fire risks (McKelvey et al. 1996, Gruell 2001).[74] [emphasis added]

Although climate change is expected to bring more fire to the region, including Humboldt County, Miller et al. (2012) found that fire severity[75]—the effects of the fire on the ground, especially to the vegetation and soils—has only increased in younger forest stands in this area.

> Our study assessed trends and patterns in fire size and frequency from 1910 to 2008 (all fire 40 ha), and the percentage of high-severity in fire from 1987 to 2008 (all fire 400 ha) on the four national forests of northwestern California. **During 1910–2008, mean and maximum fire size and total annual area burned increased, but we found no temporal trend in the percentage of high-severity fire during 1987–2008.**
>
> **The percentage of high-severity fire in conifer-dominated forests was generally higher in areas dominated by smaller-diameter trees than in areas with larger-diameter trees.** For Douglas-fir forests, the percentage of high-severity fire did not differ significantly between areas that re-burned and areas that only burned once (10% vs. 9%) when re-burned within 30 years.[76] [emphasis added]

[73] Miller, J.D. et al. (2012). (p. 201).

[74] Butz, R.J. et al. (2015). (p. 13).

[75] Fire severity is a measure of the physical change in an area caused by burning (Sousa 1984). Whereas "fire intensity" is the heat output of the flaming front of the fire.

[76] Miller, J.D. et al. (2012). (pp. 184).

The California Fire Science Consortium summarized Miller's research with an emphasis on the importance of the relationships between climate, humans, and fire:

> [H]owever, fire severity results are somewhat surprising, suggesting no clear trends in fire severity over time and highlighting new understandings of the relationships between climate, humans, and fire.
> …
> Intriguingly, the study also showed that fire severity was greater in human-ignited fires than lightning-ignited fires. This is probably because human-ignited fires are isolated incidents that escape under more severe conditions and occur close to population centers, allowing swift and effective suppression and precluding the long, drawn-out, lower-severity events that are more typical of lightning-ignited wildfires. [77]

However, Van Mantgem et al. in their 2013 study of western US forests, showed that climatic stress could predict forest fire severity:

> Our findings show post-fire tree mortality of coniferous trees was influenced by climate across the western US, describing what appears to be a general, but overlooked, climate–fire relationship. This relationship appeared to be consistent across broad geographical regions, major genera and tree sizes. **Climate was predictive of tree mortality after accounting for fire damage and defenses,** supporting conceptual models of tree mortality that account for combined effects of multiple long- and short-term stressors (Franklin *et al.* 1987; Manion 1991). In our case, longer term climatic stress (5 years prior to fire) predisposed trees to be killed from short-term fire damage. **Pervasive warming can be expected to increase the incidence of high severity fire by creating conditions where lower fuel moisture results in fires of higher intensity. An important implication of our results is that chronic stresses on western forests, including continued warming, may also lead to *de facto* increases in fire severity independent of changes in fire intensity.** [78]
> [emphasis added]

This increasing climatic stress and potential increase in fire severity is negatively affecting post-fire regeneration in forests in the Klamath bioregion, especially after repeated burning of the same area. In 2017, Tepley et al. found in their study of post-fire recovery in the Klamath Mountains:

> An interaction between seed-source availability and climatic aridity drove substantial variation in the density of regenerating conifers. With increasing climatic water deficit, higher propagule pressure (i.e., smaller patch sizes for high-severity fire) was needed to support a given conifer seedling density, which implies that **projected future increases in aridity could limit postfire regeneration across a growing portion of the landscape. Under a more severe prospective warming scenario, by the end of the century more than half of the area currently capable of supporting montane conifer forest**

[77] California Fire Science Consortium. Research Brief for Resource Managers. Based on Miller, J.D. et al. (2012). Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications, 22: 184-203. Retrieved from http://www.cafiresci.org/research-publications-source/category/wildfire-trends-in-northwestern-california-forests-1

[78] van Mantgem P.J., Nesmith, J.C.B., Keifer, M.B., Knapp, E.E., Flint, A., & Flint, L. (2013). Climatic stress increases forest fire severity across the western United States. *Ecology Letters,* 16: 1151-1156. (quote p. 1154).

> **could become subject to minimal conifer regeneration in even moderate-sized (10s of ha) high-severity patches**….[79]
>
> **Failure to achieve abundant conifer recruitment within the first few years could almost inevitably lead to protracted recovery taking several decades to more than a century to re-establish forest cover** (Lauvaux et al., 2016; Russell et al., 1998; Wilken, 1967)…. [T]oward the more severe end of potential warming scenarios (RCP 8.5), more than half of the area currently capable of supporting mixed-conifer/mixed-evergreen forest could soon be at risk of poor initial postfire conifer recruitment (Figure 6). In these areas, **forest loss to high-severity fire could be nearly irreversible if fire activity increases to the point where these areas are prone to reburn severely before a new conifer canopy develops** (Odion et al., 2010; Thompson & Spies, 2010).[80] [emphasis added]

Such a change in post-fire regeneration could significantly alter Klamath forests. This would create profound effects on ecosystem processes including fire, as well as the resultant reverberations to nearby human and wildlife communities. **Local practitioners in the Klamath Mountains have been seeing this change for decades and are actively promoting low-intensity prescribed fire following wildfires to help reduce later fire severity and hence support native conifer regeneration.**[81]

Finally, a potentially positive effect of climate change in the Klamath Mountains is an interesting phenomenon where increased fire frequency creates an inversion layer that cools temperatures and increases humidity, which both aid fire-suppression efforts. This is also a bonus for salmonid populations dependent on cool water. Miller et al. (2012) summarize the effects of such a temperature inversion:

> ‘In northwest California, fire intensity historically was lowest on lower slopes and north- and east-facing aspects, and greater on mid- and upper-slope positions, especially on south- and west-facing aspects, where higher temperatures and afternoon winds promote drier conditions (Weatherspoon and Skinner 1995, Taylor and Skinner 1998, Alexander et al. 2006). **Long-term temperature inversions under stable air masses that are common within the region during the summer can trap smoke in valleys, leading to cooler temperature and higher humidity, and resulting in less severe fire effects at lower slope positions** (Robock 1988, 1991). Reduced fire intensity, less crowning, and more surface fire are more common under temperature inversions.[82] ’

As described in this section, current data and future predictions show that temperatures, precipitation, fire frequency, and possibly severity are changing in Humboldt County, although perhaps not as much, or as quickly, as in the rest of California. This all adds up to less predictable fire behavior here and statewide. In Humboldt County, there may be more frequent and more erratic fires inland, perhaps with a decrease of wildfire along the coastal areas of the county. Such changes and uncertainty make community-based fire-safety efforts all the more important and timely. Continued research and modeling are necessary to better understand the impacts of climate change on the fire environment throughout Humboldt County and to inform adaptation strategies.

[79] Tepley, A.J., Thompson, J.R., Epstein, H.E., & Anderson-Teixeira, K.J. (2017). Vulnerability to forest loss through altered postfire recovery dynamics in a warming climate in the Klamath Mountains. *Global Change Biology* 23(10), 4117-4132. (p. 1).

[80] Tepley, A.J. et al. (2017). (p. 14).

[81] Will Harling, Mid-Klamath Watershed Council, personal communication, July 16, 2018.

[82] Miller, J.D. et al. (2012). (p. 198).

For a list of relevant research on the relationship between fire and climate change for Humboldt County and north coastal California, see Appendix F, ***Climate Research.***

5.2.7 THE NEED FOR COORDINATED APPROACHES TO WILDFIRE PREPAREDNESS IN THE FACE OF CLIMATE CHANGE

Leading scientists around the state and nation have done the research and arrived at similar conclusions. While guaranteed predictions are impossible, there are trends that must be addressed to coexist with wildfire. Focusing mitigation efforts in the wildland-urban interface is key among the findings.

> Wildfires across western North America have increased in number and size over the past three decades, and this trend will continue in response to further warming. **As a consequence, the wildland–urban interface is projected to experience substantially higher risk of climate-driven fires in the coming decades**….[83] [emphasis added]
>
> Together, these gradually changing variables—climate change, fuels build-up, and residential development—interact with rapid combustion to increase wildfire risks and costs to society and some ecosystems substantially.[84]

The question is whether and to what level mitigation and management actions can alter the trend of increasing fire frequency and severity in the country as well as more locally.

> A major question is whether we can influence the intensity at which future forest fires will burn, and thereby minimize the negative ecosystem effects of fire while maximizing the positive effects.[85]

Management Recommendations

These questions have prompted the evaluation of the effectiveness of landscape-scale fuel-reduction efforts while wildfire damage continues to increase. The results of these studies question the effectiveness of targeting fuel reduction efforts at the landscape scale, versus closer to communities.

> Managing forest fuels is often invoked in policy discussions as a means of minimizing the growing threat of wildfire to ecosystems and WUI communities across the West. However, the effectiveness of this approach at broad scales is limited. Mechanical fuels treatments on US federal lands over the last 15 years (2001–2015) totaled almost 7 million ha [hectares] (*Forests and Rangelands, https://www.forestsandrangelands.gov*), but the annual area burned has continued to set records. Regionally, **the area treated has little relationship to trends in the area burned, which is influenced primarily by patterns of drought and warming** [86] (Westerling et al. (2006); Dennison et al. (2014); and Abatzoglou & Williams (2016)). [emphasis added]

[83] Schoennagel, T., Balch, J.K., Brenkert-Smith, H., Dennison, P.E., Harvey, B.J., Krawchuk, M.A., Mietkiewicz, N., Morgan, P., Moritz, M.A., Rasker, R., & Turner, M.G. (2017). Adapt to more wildfire in western North American forests as climate changes. *Proceedings of the National Academy of Sciences* 114(18). (p. 4582).

[84] Schoennagel, T. et al. (2017). (p. 4583).

[85] Miller, J.D. et al. (2012). (p. 201).

[86] Schoennagel, T. et al. (2017). (p. 4586).

This means treatment areas need to be strategically focused on a network of landscape-scale fuel breaks for managing wildfire, and around communities for direct fire protection. In terms of forest management—a critical issue for Humboldt County—the 2018 North Coast Resource Partnership report recommends:

> According to researchers at the USFS Pacific Northwest Research Station, **"planning needs to embrace managing forests for adaptation to new conditions by promoting the resistance of a forest to change, resilience of a forest in the face of change, and response options that facilitate the transition of forests to new conditions"** (Anderson and Palik, 2011). In other words, forest managers need to consider potential climate effects, spatial scale of response, timing, and prioritization of adaptation efforts. As with conservation lands management, prioritization and planning are key to identifying vulnerabilities and developing a suite of potential actions to address those vulnerabilities.[87] [emphasis added]

Hessburg et al. (2015) emphasizes the need to ensure ecosystem and landscape resiliency, a goal that is explored in this CWPP's *Countywide Action Plan, Chapter 3.5,* ***Restoration of Beneficial Fire.***

> Wildfires and insect outbreaks are an inevitable part of future landscapes. **Future management should aim to restore more resilient vegetation patterns that can help to realign the severity and patch sizes of these disturbances, promote natural post-disturbance recovery, reduce the need for expensive active management, and drastically reduce the role and need of fire suppression.**[88] [emphasis added]

Finally, in a 2018 issue of *Forestland Steward,* Moritz urged implementing changes now:

> We need the foresight to help guide these ecosystems in a healthy direction now so they can adjust in pace with our changing climate … That means embracing some changes while we have a window to do so.[89]

One of the most important changes being embraced in California towards this end is the active use of fire as a land management tool. It is at the forefront of current management discussions locally, nationally, and internationally:

> Increasing the use of prescribed fires and managing rather than aggressively suppressing wildland fires can promote adaptive resilience as the climate continues to warm.[90]

[87] Reza, K. & Tinsman, R. (2018). North Coast Regional Climate Adaptation Strategies. North Coast Resource Partnership. (p. 27).

[88] Hessburg, P.F., Churchill, D.J., Larson, A.J., Haugo, R.D., Miller, C., Spies, T.A., North, M.P., Povak, N.A., Belote, R.T., Singleton, P.H., & Gaines, W.L. (2015). Restoring fire-prone Inland Pacific landscapes: Seven core principles. *Landscape Ecology 30*(10), pp. 1805-1835. (quote p. 1829).

[89] Changing wildfire patterns require a new mindset for living in the West. *Forestland Steward*, Winter 2018. (p. 5). [PDF]. Retrieved from http://calfire.ca.gov/foreststeward/pdf/Foreststeward%20Winter%202018%20Master.pdf

[90] Schoennagel, T. et al. (2017). (p. 4586).

How to manage wildland fires to meet long-term fuel reduction goals is one of the paramount challenges facing public land managers and fire protection agencies. Fire scientists Miller et al. concluded:

> Overall, the evidence suggests that, **under the right meteorological, ecological, and political circumstances, wildland fires might be more extensively used in northwestern California to achieve management objectives such as reducing landscape-scale fire hazard, and restoring the ecological role of fire by increasing forest heterogeneity and sustaining biodiversity in fire-adapted forests. We recommend that managers consider these conclusions in developing fire management plans.**[91] [emphasis added]

Local and regional fire scientists concur that actively using prescribed fire must be a key element in reducing fuels to reduce fire severity:

> Climate change may also impose greater constraints on the use of prescribed fire, including both planned ignitions and managed wildfires (Wimberly and Liu 2014). **Prescribed burning is a critical component of fuel treatments in drier forests of the Klamath Mountain region and has proven more effective than thinning alone at reducing the severity of large fires** (Agee and Skinner 2005, Raymond and Peterson 2005, Wimberly et al. 2009, Prichard et al. 2010, Prichard and Kennedy 2012).[92] [emphasis added]

To facilitate reducing these fuels and potential fire severity, political support and resources must be dedicated to prescribed fire.

> Increasing both funding and public support for prescribed burning will be critical for sustaining critical ecosystems processes and reducing fire risk in the dry forests of the Pacific Northwest (Ryan et al., 2013).[93]

This Humboldt County CWPP embraces the challenges of applying prescribed fire and managed wildfire to local landscapes. Strategic action steps are outlined in the *Countywide Action Plan, Chapter 3.5 Restoration of Beneficial Fire. Chapter 3.6, Integrated Planning* identifies policy actions to support this and other priorities to better prepare Humboldt County to live with fire. The following findings are consistent with the proposed actions in this CWPP's *Countywide Action Plan*:

> Our key message is that **wildfire policy and management require a new paradigm that hinges on the critical need to adapt to inevitably more fire in the West in the coming decades….** We suggest an approach based on the concept of *adaptive resilience,* or adjusting to changing fire regimes (e.g., shifts in prevailing fire frequency, severity, and size) to reduce vulnerability and build resilience into SESs (social-ecological systems). **Adaptive resilience to wildfire means recognizing the limited impact of past fuels management,**

[91] Miller, J.D. et al. (2012). (p. 201).

[92] Butz, R.J., Sawyer, S., & Safford, H. (2015). A summary of current trends and probable future trends in climate and climate-driven processes for the Six Rivers National Forest and surrounding lands. USDA Forest Service Pacific Southwest Region. (p. 19).[PDF]. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd490216.pdf

[93] Wimberly, M.C. & Liu, Z. (2014). Interactions of climate, fire, and management in future forests of the Pacific Northwest. *Forest Ecology and Management* 327: 270-279. (p. 277).

acknowledging the important role of wildfire in maintaining many ecosystems and ecosystem services, and embracing new strategies to help human communities live with fire…[94]

Overall, a shift in resources from the defense of the WUI from wildfire to the mitigation of wildfire hazards and risks in advance of events will build a safe operating space for fire-prone communities that increases adaptive resilience to wildfire. **Encouraging development away from fire-prone areas, reducing fuels on private lands in and near communities, and retrofitting and building homes to withstand ignition will increase the adaptive capacity for managing more wildfire** (Calkin et al. 2014), similar to adaptive approaches for other natural hazards such as flooding and earthquakes (Moritz et al. 2014) …. **We also can change how we build, live, and work in fire-prone landscapes to keep our communities safe, healthy, and vibrant.** [95] [emphasis added]

Knowledge enables appropriate action. There are still many unknowns to living with wildfire within a changing climate. It is clear that preparing communities to coexist with fire, both planned and unplanned, must be at the center of any effective strategy. The *Countywide Action Plan* in *Part 3* of this CWPP, addresses this challenge from a variety of approaches. In addition, as this CWPP is implemented it will be important to track evolving climate science and make every effort to plan action that supports effective climate change adaptation and wildfire resilience. Careful consideration of greenhouse gas emissions and impacts on carbon sequestration associated with wildfire hazard mitigation will also be important to ensure that they are minimal or outweighed by the benefits.

[94] Schoennagel, T. et al. (2017). (p. 4583).
[95] Schoennagel, T. et al. (2017). (p. 4588).

Table of Contents: Risk Assessment—Wildfire-Protection Capabilities

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5.3 WILDFIRE-PROTECTION CAPABILITIES

5.3.1 INTRODUCTION TO FIRE PROTECTION IN HUMBOLDT COUNTY

Wildfire protection and emergency response capabilities are evaluated in this CWPP by identifying, defining, and analyzing the delivery of services and level of coverage provided by current fire-protection organizations in Humboldt County. The following sections discuss the level and type of emergency response provided in Humboldt County, and the critical needs to sustain these services and ensure community safety.

Local and tribal fire protection organizations in Humboldt County provide all-risk fire protection. Firefighters are called upon to:

- Provide structural fire protection,
- Manage wildland fire,
- Respond to medical emergencies,
- Perform technical rescue,
- Respond to hazardous materials incidents, and
- Assist with general disaster management.

State and federal firefighters also respond to a broad array of emergencies beyond wildfire—depending on their availability—with their primary responsibility being protecting federal and state wildland areas.

The following pages contain details about local, tribal, state, and federal fire and rescue resources.

Fire Protection Responsibility Areas

Only a small portion of the county is classified as Local Responsibility Area, or LRA. Most local fire agencies contain State Responsibility Area, or SRA, lands within their jurisdictional boundaries (many are only SRA). Fire-related districts are responsible for structural fire protection and wildland fires in the LRA. The California Department of Forestry and Fire Protection, or CAL FIRE, is responsible for wildfires in the SRA. CAL FIRE also assists local districts with the management of wildfires in the LRA based on mutual-aid agreements.

There are three specific land classifications to identify the agency with the financial responsibility for preventing and suppressing wildfire.

- **Local Responsibility Area (LRA)** is primarily the responsibility of the local jurisdiction, i.e. local fire departments.
- **State Responsibility Area (SRA)** is primarily the responsibility of the state, or CAL FIRE.
- **Federal Responsibility Area (FRA)** is primarily the responsibility of a federal government agency, such as the US Forest Service (USFS) and Bureau of Land Management (BLM).

See Map 5.3.2 ***State and Federal Fire Protection*** *later in this chapter for LRA vs. SRA vs. FRA designations in Humboldt County.*

Mutual Aid and Other Cooperative Agreements

> ***Mutual aid*** is 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.
>
> ***Automatic Mutual Aid***, or **auto aid agreements** dictate that within specified areas of a fire department's response area or for certain types of incidents, their automatic mutual aid partner will be automatically dispatched to an emergency and a special request for help will not be necessary.

To provide quick and adequate response to fires, the Humboldt County Fire Chiefs' Association developed, approved, and maintains a Countywide Mutual Aid Agreement. It is a Memorandum of Understanding (MOU) made and entered into by and between all local fire-service providers in the county and CAL FIRE. The MOU states that the equipment, facilities, and trained personnel of each fire department are available to the other participants in the agreement on an as-requested basis. The MOU facilitates quick, decisive dispatch of resources and defines expectations and responsibilities for the requesting and receiving parties. Additionally, several local fire-service providers have auto-aid agreements. Depending on the specific incident, fires may be managed under a unified command between multiple departments or one department may simply assist another, depending on who has the protection responsibility.

Fire departments near either National Forest or National Recreation Area lands have mutual aid agreements with the USFS and BLM. *See Appendix G.2, for details regarding these agreements:* ***Statewide and Regional-Level Cooperative Fire Agreements, Six Rivers National Forest (SRNF) Forest-Wide Fire Assistance Agreements and Local Operating Plans****, and* ***SRNF Agreements with Humboldt County Local Volunteer Fire Departments for Fire Suppression Assistance and Assistance-By-Hire for Wildfire Incidents.***

Under a cooperative agreement, federal and state agencies have exchanged protection responsibilities in specific areas. These areas are known as Direct Protection Areas, or DPAs. For example, fire protection on most FRA public land managed by the BLM, including the King Range National Conservation Area, is the responsibility of CAL FIRE. Additionally, the communities of Willow Creek and Orleans are within the protection responsibility of the SRNF for wildfires, even though these communities are in SRA. *See Map 5.3.2* ***State and Federal Fire Protection*** *later in this chapter for an illustration of these DPA protection areas.*

5.3.2 FIRE-PROTECTION ORGANIZATIONS AND LEVEL OF SERVICE

> ***Level of Service*** is defined here as the ability to provide, on a countywide basis, adequate and appropriate levels of emergency service to meet community needs. Level of Service should be commensurate with the community's risks and the public safety responsibilities of the local fire-protection organization.

Humboldt County receives fire protection and related emergency services from a variety of fire organizations. Given the diverse range of community characteristics and emergency service needs throughout the county, each fire-service organization provides an emergency response and deployment system that reflect its constituents' expectations, needs, and local risks, within its revenue and support constraints. The following sections describe the fire-protection agencies and organizations in Humboldt County and the *Level of Service* they provide.

Local Fire Protection Services

Local fire protection and rescue services are provided year round by local fire departments and companies. According to the *2017 Humboldt County Fire Chiefs' Association Annual Report,* local fire service is provided by forty fire departments and companies. The service areas of these local fire departments and companies are shown on *Map 5.3.1, Local Fire Protection,* later in this chapter.

Department vs. Company

In this CWPP, with a few exceptions, local fire and rescue service providers associated with a special district are called **Volunteer Fire Departments,** as they receive some tax or fee revenue. Those volunteer organizations not receiving tax revenue and being funded primarily through fundraisers and donations, are called **Volunteer Fire Companies**.

Special districts are formed to provide services within a specific jurisdictional boundary with support from a combination of taxes, fees, grants, and fundraising. Many of these jurisdictional boundaries were created as far back as the 1930s. Since then, neighborhoods, scattered subdivisions, and rural residential development have expanded beyond district boundaries. This newer development requires year-round fire protection and emergency services, which it receives in a variety of ways. Special districts that deliver fire and rescue services are identified on *Map 5.3.1* as "District" and are shown in green.

There are many areas outside the boundaries of an established district that receive fire protection from district resources responding beyond their jurisdiction. This type of service, which is often referred to as "goodwill service," is identified in *Map 5.3.1* as "Out of District" and shown in yellow. District fire departments provide service to these areas even though they are under no obligation to do so and receive no compensation for their service, other than donations. This practice can strain already limited resources. Furthermore, property owners within the district may question why their taxes are supporting out-of-district residents.

Finally, many areas outside the boundaries of an established district receive fire protection from a volunteer fire company. They receive no tax revenue, hence they are identified on *Map 2.3.1* as "Non-Tax," and shown in orange. The survival of volunteer fire companies depends on revenue generated from community donations, fundraisers, and grants. Some communities are more supportive of their local fire companies than others; support can fluctuate dramatically depending upon local economic conditions.

The following table lists all of the local fire-protection organizations in Humboldt County and summarizes their current resources.

FIGURE 5.3.1 LOCAL FIRE SERVICE: STATION, APPARATUS, AND STAFFING CAPABILITY[1]

LOCAL FIRE ORGANIZATION[2]	FIRE STATIONS[3]	FIRE APPARATUS[4]	FIREFIGHTERS	
			CAREER	VOLUNTEER
Alderpoint Fire Company	1	4	0	17
Arcata Fire Protection District	3	10	22	17
Briceland Fire Department	3	8	0	19
Blue Lake Fire Department	1	6	1	21
Bridgeville Fire Department	1	4	0	12
Carlotta Fire Department	2	6	0	13
County Service Area No. 4[5]	1	1	10	0

[1] Humboldt County Fire Safe Council. (2018). Humboldt County Fire Chiefs' Association Annual Report, 2017. Retrieved from https://humboldtgov.org/Archive.aspx?AMID=75

[2] The label "Fire Department" identifies service associated with a special district and "Fire Company" identifies non-tax, non-district organizations. (There are some exceptions).

[3] Local fire stations, particularly in remote rural areas, may only be a basic fire apparatus shelter or even apparatus that is stored at a volunteer firefighter's home.

[4] Fire apparatus includes: water tenders, engines, ladders, quick attack, and rescue vehicles.

[5] Services for CSA No. 4 are provided by CAL FIRE. The numbers here are year-round available resources. During fire season there are 2 fire engines and 14 firefighters available.

FIGURE 5.3.1 LOCAL FIRE SERVICE: STATION, APPARATUS, AND STAFFING CAPABILITY[1]				
LOCAL FIRE ORGANIZATION[2]	FIRE STATIONS[3]	FIRE APPARATUS[4]	FIREFIGHTERS	
			CAREER	VOLUNTEER
Fieldbrook Fire Department	1	4	0	23
Ferndale Fire Department	1	7	0	29
Fortuna Fire Department	3	15	3	77
Fruitland Ridge Fire Company	1	3	0	7
Garberville Fire Department	1	3	0	15
Honeydew Fire Company	4	5	0	16
Hoopa Fire and Rescue	1	6	0	15
Hoopa Fire Department	1	6	19	6
Humboldt Bay Fire Department[6]	5	16	53	5
Kneeland Fire Department	1	3	0	9
Loleta Fire Department	1	7	0	23
Miranda Fire Department	1	3	0	12
Myers Flat Fire Department	1	2	0	3
Orick Fire Department	1	4	0	13
Orleans Fire Company	1	4	0	13
Palo Verde Fire Company	1	2	0	30
Petrolia Fire Department	1	7	0	22
Phillipsville Fire Company	1	3	0	2
Redcrest Fire Company	2[7]	2	0	8
Redway Fire Department	1	5	0	13
Rio Dell Fire Department	1	6	0	27
Salmon Creek Fire Company	1	2	0	12
Samoa Peninsula Fire Department	2	4	0	17
Scotia Fire Department	1	6	0	10
Shelter Cove Fire Department	1	9	0	16
Sprowel Creek Fire Company	2	2	0	20
Telegraph Ridge Fire Department	1	3	0	12
Trinidad Fire Department	1	3	0	10
Westhaven Fire Company	1	5	0	8
Whale Gulch Fire Company	1	3	0	20
Whitethorn Fire Department	1	4	0	11
Willow Creek Fire Department	1	5	0	14
Yurok Wildland Fire Department	1	*unknown*	*unknown*	*unknown*
Yurok Volunteer Fire Department	1	1	0	4
Total	**56**	**199**	**108**	**621**

[6] Humboldt #1 Fire Protection District and City of Eureka Fire combined their resources under the name of Humboldt Bay Fire but have not yet officially consolidated their jurisdictions.

[7] The Redcrest Fire Company is providing an organizational umbrella for a new fire station and associated group of volunteers in the community of Shively.

Local fire service in Humboldt County, although primarily responsible for community fire protection, plays a pivotal role in wildfire management. Local firefighters train and are equipped for wildfire response, often being called to assist CAL FIRE during wildfires. Local firefighting resources respond from over fifty locations throughout the county, so they can be well situated to supplement CAL FIRE, which may have a longer *response time*. Local firefighters are frequently the first on the scene and able to assume command of the incident, provide initial assessment, and initiate suppression actions until CAL FIRE arrives. This helps keep the fires to a manageable size. Many local fire organizations provide station coverage for CAL FIRE when they are called away to wildfires outside of the county. During station coverage assignments, local firefighters fill CAL FIRE's wildfire management role.

> ***Response Time*** is the time that elapses between the moment a 9-1-1 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, put on their personal protective equipment (PPE), and prepare the apparatus), and travel time.

There is one local-government Type-3 Engine Strike Team composed of several local fire organizations in the county. CAL FIRE hires this Strike Team to supplement their resources during wildfire events both inside and outside the county. Local fire department equipment is also rented by the state and operated by CAL FIRE personnel when needed. Local fire service financially benefits from this arrangement, both to the participating fire department and individual firefighters, and by circulating the funds into the local economy. Indirect benefits to local firefighters, including volunteers, include gaining valuable wildfire management experience, which also benefits local communities by developing more confident, capable local firefighters. Firefighters learn about wildfire management strategies, emergency radio communications, working together, training needs, and the physical demands and expectations required by CAL FIRE and the USFS. This experience increases the ability of local firefighters to quickly and efficiently organize resources, should a large wildfire event happen here.

Telegraph Ridge Volunteer Fire Department.

The Humboldt County, Southern Humboldt, and Eel River Valley Fire Chiefs' Associations are vital local organizations working to address common challenges and improve Level of Service throughout the county. They do this via increased coordination, communication, standardization, and support. The work of these chiefs' associations has enabled the growth of productive and effective relationships that have proven to be beneficial to all parties.

Collaboration within and among these groups has led to many advancements, including:

- A stronger voice for the fire service to help secure support and resources,
- Auto-aid agreements,
- Communications plans,
- Pre-fire plans, and
- Administrative and operational improvements.

These associations continue to work together to ensure all departments and companies benefit from recent advancements; they also tackle new projects such as the development of a website and other social media platforms.

Star Hotel fire, Fortuna.

The Public Safety and Essential Services half-cent sales tax, passed by Humboldt County voters in 2014 through Measure Z, provided critical fire and rescue support funding over the last three years, facilitating a spirit of cooperation between local fire organizations. Over $5.5 million in Measure Z funding has been awarded to purchase firefighting equipment, pay dispatch fees, and continue a multiyear sustainable fire-services planning effort. Measure Z purchases and activities have benefitted volunteer, and especially rural fire organizations, to increase the safety and capability of firefighters within the county.

Equipment purchases are bringing local fire service up to nationally recognized minimum-level safety equipment and emergency-response apparatus standards. Updated equipment helps responders be better prepared, and decreases the risk of injury while increasing the ability to protect the public. Equipment purchases include fire engines, self-contained breathing apparatus (SCBA), wildland- and structural-fire personal protective equipment (PPE), and fire hose. Additionally, permitting and purchasing structures to protect fire equipment that was historically stored outdoors or in unsecured locations has been funded. These improvements will have a direct impact on fire departments' ability to improve their Insurance Services Office (ISO) Fire-Suppression Rating Schedules, which can in turn, lower homeowner fire insurance rates. The Public Safety and Essential Services sales tax was renewed by voters in 2018 through Measure O and will continue to be an important source of funding, depended upon by local fire and rescue service providers.

Westhaven Volunteer Fire Department.

There have been significant improvements in local fire-protection organizations' ability to efficiently, effectively, and safely deploy fire-protection resources since what was reported in the 2013 CWPP. However, these organizations continue to experience a high degree of variability in their training levels, amount and quality of their equipment, and number of firefighting personnel at their disposal. Such differences make it challenging to identify Level of Service standards that are realistically achievable for all local fire-service providers. This is slowly being addressed by updating standards to consider pragmatic expectations by area type (e.g. rural, suburban, or urban).

Many local fire departments continue to face these common challenges:

- Volunteer recruitment and retention;
- Access to appropriate levels and types of training and local facilities, including fire academy, driver-operator training, and other on-going skills;
- Ever increasing mandatory requirements and standards;
- Limited administrative capacity to address growing organizational requirements;
- Limited pre-fire planning resources such as response-area maps and pre-fire attack plans; and
- A lack of capital to cover growing expenses, including:
    - The replacement of aging safety equipment,
    - Dispatch fees and communication infrastructure improvements,
    - Insurance and worker's compensation,
    - Training, and
    - Maintaining and establishing fire stations.

The top need identified by local fire service is a more robust and ongoing volunteer recruitment and retention strategy. All local fire departments in the county depend fully or partially on volunteers. Many have indicated that recruiting and retaining these volunteers is their biggest challenge. This challenge includes:

- Ever-increasing training and performance demands on volunteers;
- An increasing volume of calls that put volunteers in dangerous situations, threatening their physical safety and mental health;
- Uncertainty about a stable local economy; and
- Limited community awareness and support.

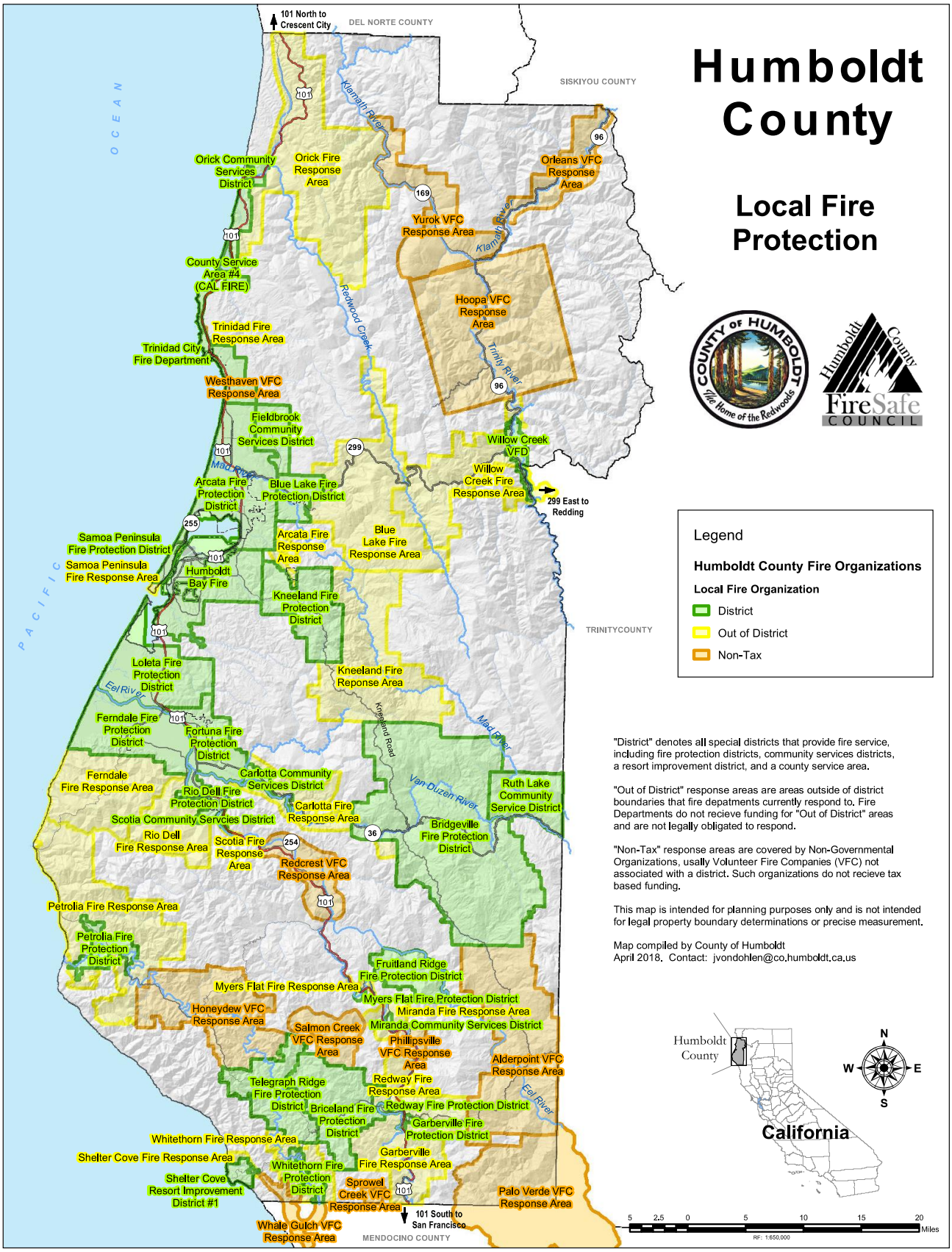
Local residents and businesses depend heavily on local fire and rescue services. More community resources and volunteers are needed to ensure their survival. When firefighter numbers fall, services suffer. In recent years, some fire companies have closed their doors, leaving neighboring departments impacted as they try to fill in for these areas. This issue is not unique to Humboldt County; the sustainable delivery of community fire and rescue services is a challenge in many other areas of the state and nation. It is complex and likely cannot be resolved quickly. Investing now to ensure future emergency services for the citizens of Humboldt County is a priority of this CWPP.

More detailed information about each local fire organization, including their recent accomplishments, can be found in each relevant ***Planning Unit Action Plan*** *in Part 4 of this CWPP, and in the current version of the* Humboldt County Fire Chiefs' Association Annual Report, available at *https://humboldtgov.org/Archive.aspx?AMID=75*.

Scotia Volunteer Fire Department.

Humboldt Bay Fire Department.

Map 5.3.1 Local Fire Protection



Tribal Fire-Protection Services

Tribes located in Humboldt County provide fire and rescue services to their communities through a variety of means. Some maintain their own community fire protection and wildfire management services, while others coordinate with local fire protection districts, CAL FIRE, and/or federal agencies to provide these services. The following describes several local tribal fire-service situations.

Hoopa Fire-Protection Services

The Hoopa Fire Department strives to develop programs and processes for the protection of the Hoopa Indian Reservation and the community of Hoopa, through an aggressive fire suppression and prevention program. The Department responds to fires and provides additional all-risk response assistance when requested. The Hoopa Fire Department also participates in national suppression efforts through cooperative agreements and mutual aid, with firefighters traveling around the country providing suppression assistance.

The Department is building a larger workforce to staff its three Type-3 fire engines, two Type-4 quick attack engines, and its Type-1 water tender. Each engine is staffed seven days a week with five firefighters during fire season. The staffed positions are a combination of permanent and temporary employees with all levels of qualifications, from entry-level firefighter to engine captain. Finally, the Fire Department hosts the Tribal Office of Emergency Services, tasked with year-round operational responsibilities. Both programs are under the leadership of the Department Chief.

The Hoopa Reservation also receives fire protection services from Hoopa Volunteer Fire and Rescue, a community-based volunteer fire company established in the late 1970s by the Hoopa Valley Tribal Council and the Bureau of Indian Affairs (BIA). It is an all-risk organization, with its primary mission being structural fire protection. Services are provided by 13 volunteer firefighters using one Type-2 fire engine and two Type-1 engines. Hoopa Fire and Rescue needs more volunteers to help meet their service demands.

Upper-Yurok Reservation Fire-Protection Services

The Yurok Wildland Fire Department operates out of the Tully Creek Fire and Fitness Center in Weitchpec. In addition to providing fire-protection services to the Upper Yurok Reservation, the Department has some staff and resources for contract wildland firefighting throughout the region. The Tribe also maintains an agreement with CAL FIRE to provide wildfire protection for trust lands in this area.

The Yurok Volunteer Fire Department was formed in 2004 with supporting grant funding to build two fire stations in the Upper Yurok reservation. The Yurok Tribe has also provided funding, equipment, and facilities for the Department as it is able. Volunteers have worked with Reservation citizens to establish fire programs and awareness efforts to mitigate Reservation fire danger. The Tribe has attempted to maintain fire-protection services reservation wide, but funding and challenges recruiting and retaining volunteers make it difficult to provide this service at the desired level. The Volunteer Fire Department is working to recruit more volunteers, secure much-needed additional equipment, and improve response communications.

Karuk Fire-Protection Services

The Karuk Tribe supports a fire and fuels program in their Department of Natural Resources with offices in both Humboldt (Orleans) and Siskiyou (Happy Camp and Yreka) counties.[8] They manage forty to fifty National Wildfire Coordinating Group (NWCG) qualified personnel, including their partners such as the Mid-Klamath Watershed Council, Salmon River Restoration Council, and the Cultural Fire Management Council. The Tribe has sponsored one twenty-person NWCG-qualified

[8] The aboriginal territory of the Karuk people spans both Humboldt and Siskiyou counties.

Type-2 Initial Attack Wildland Fire Crew for over twenty years. This crew is operated under the BIA for reimbursement purposes for federal wildland fire and emergency dispatches, and follows all federal guidelines.

The fire and fuels program recently added a ten-person fuels crew, which is working towards becoming qualified as a Wildland Fire Use Module[9]. Most fire and fuels projects are grant funded, involving hazardous fuel reduction by hand treatment or prescribed fire, to reduce the risk of catastrophic wildfire and increase cultural and natural-resources resilience, emphasizing Eco-Cultural Revitalization. The Wildland Fire Crew is dispatched by the Klamath National Forest for federal emergencies. Karuk tribal members living in the Orleans area also receive fire and rescue services from the Orleans Volunteer Fire Department, and firefighting resources from Six Rivers National Forest as available.

Blue Lake Rancheria Fire Protection Services

The Blue Lake Rancheria Tribe maintains a memorandum of understanding with the Blue Lake Fire Protection District, which provides fire, medical, and rescue response to the Rancheria. Over the years, the Tribe has provided support to the Blue Lake Volunteer Fire Department for the purchase of equipment, production of educational materials and community events, and operational needs.

Federal and State Agencies

California Department of Forestry and Fire Protection (CAL FIRE)

CAL FIRE maintains a significant presence in Humboldt County in fire protection, fire prevention, and resource management. The CAL FIRE Humboldt–Del Norte Unit (HUU) Administrative Headquarters is located in Fortuna and is home to the Fortuna Interagency Command Center (FICC) dispatch center, *(more details are provided about FICC in section 5.3.3 below).* CAL FIRE HUU staffs an engine in Trinidad year-round under an Amador Agreement[10] with the County of Humboldt, as well as two state-mission engines year round. In 2018, these engines were housed in Weott and Trinidad but their location could change at any time or on any given year based on state need. The remaining Humboldt County-based CAL FIRE stations are staffed only during fire season and include Elk Camp (Orick area), Fortuna, Bridgeville, Alderpoint, Mattole, Thorn (Whitethorn), and Garberville.

CAL FIRE operates two local Conservation Camps jointly with the Department of Corrections and Rehabilitation, Eel River Camp in Redway and High Rock Camp in Weott. Inmates serve out their sentences performing firefighting and conservation-related tasks. The crews are an all-risk department resource used both locally and statewide. During non-emergency response times, these crews work on fuel-reduction and other projects as requested by public agencies. They are trained in emergency response for fires and floods and utilized for various emergencies as needed.

CAL Fire extinguishing a beach fire near Trinidad.

CAL FIRE also operates the Rohnerville Air Attack Base, the Kneeland Helitack Base, and a fire lookout at Grasshopper Peak during times of high fire danger. During past fire seasons, CAL FIRE has also operated the Schoolhouse Peak Fire Lookout in Redwood National Park.

[9] For information on the definition and history of fire use modules, see: *https://en.wikipedia.org/wiki/Fire_use_module*

[10] Amador Agreement: A contract that continues CAL FIRE staffing and station coverage through the winter off season.

CAL FIRE HUU (including areas outside of Humboldt County), maintains fourteen frontline engines, three engines in reserve, two dozers, fifteen inmate crews, one helicopter, one air attack, and one air tanker for fire suppression efforts. There are approximately one-hundred permanent fire-suppression personnel, twelve resource-management personnel, and six clerical personnel to support these efforts. Additionally, HUU hires approximately ninety limited-term and seasonal personnel to supplement permanent staff during fire season.

All HUU aircraft provide rapid initial attack and are especially valuable in the county's remote areas where steep terrain and narrow, winding roads greatly increase ground-response times. In such situations, aircraft are often at the scene and applying water or retardant before engines or bulldozers arrive, cooling the fire and giving ground resources the ability to achieve initial-attack success. Aircraft also provide "eyes in the sky" for ground crews, noting spot fires and giving helpful directions.

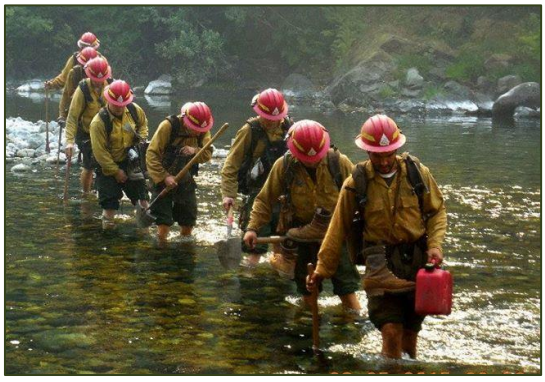
CAL FIRE's objective is to successfully contain 95% of all wildfires within the SRA and DPA at 10 acres or less. During declared fire season, CAL FIRE engines are staffed 24 hours/day. In addition to fire engines, CAL FIRE's initial dispatch response includes fire crews, bulldozers, air tankers, helicopters, air-tactical supervisors, and Chief Officers. Dispatch levels for any given incident are based on the current fire-behavior indices as developed through the *Fire Danger Operating Plan.*

Six Rivers National Forest (SRNF)

Six Rivers National Forest is a "service first" organization.[11] It works in agreement with Redwood National Park (RNP) to protect both federal and state lands as Direct Protection Areas. They operate as one fire-management organization, supporting each other's fire and land-management objectives.

SRNF protects the wildland and manages fire on the landscape, while considering multiple-use land-management objectives, Federal Fire Policy, and the agency mission. It seeks to create resilient landscapes and fire-adapted communities through effective risk-based decision-making for wildfire response. SRNF works closely with CAL FIRE Humboldt-Del Norte Unit, Hoopa Wildland Fire Department, other federal agencies, neighboring National Forests, tribal governments, and multiple volunteer and local fire departments throughout Humboldt and nearby counties.

Staffing levels are based on level of fire danger, with the greatest staffing May through October and reduced staffing the rest of the year. During periods of increased fire danger, SRNF staffs twelve engines, thirteen patrol and prevention units, two Type-1 hand crews, one Wildland Fire Module, four water tenders, one bulldozer, and four lookouts. These firefighting resources are spread over SRNF's four-county jurisdiction, employing approximately three hundred emergency responders in a variety of operational and non-operational roles. These include primary firefighters as well as support personnel in logistics, planning, resource advising, and public information. SRNF also has an agreement with Fortuna-based California Conservation Corps to mobilize a Type-2 hand crew with members from both agencies.



SRNF fire crew.

[11] USDA Forest Service. (2016). Service first, working together [Webpage]. Retrieved from https://www.fs.fed.us/servicefirst

Redwood National Park (RNP)

The RNP is also a "service first" organization and works directly with SRNF as one fire-management organization, supporting each unit's fire and land-management objectives.

During declared fire season, RNP staffs two engines, five days a week from 9:30 AM to 6:00 PM. Firefighting equipment is maintained at the Wolf Creek Fire Cache in Orick. If RNP is experiencing extreme fire indices, (based on readings from two Remote Automated Weather Stations, or RAWS), the acting Duty Officer will determine if longer staffing hours are needed.

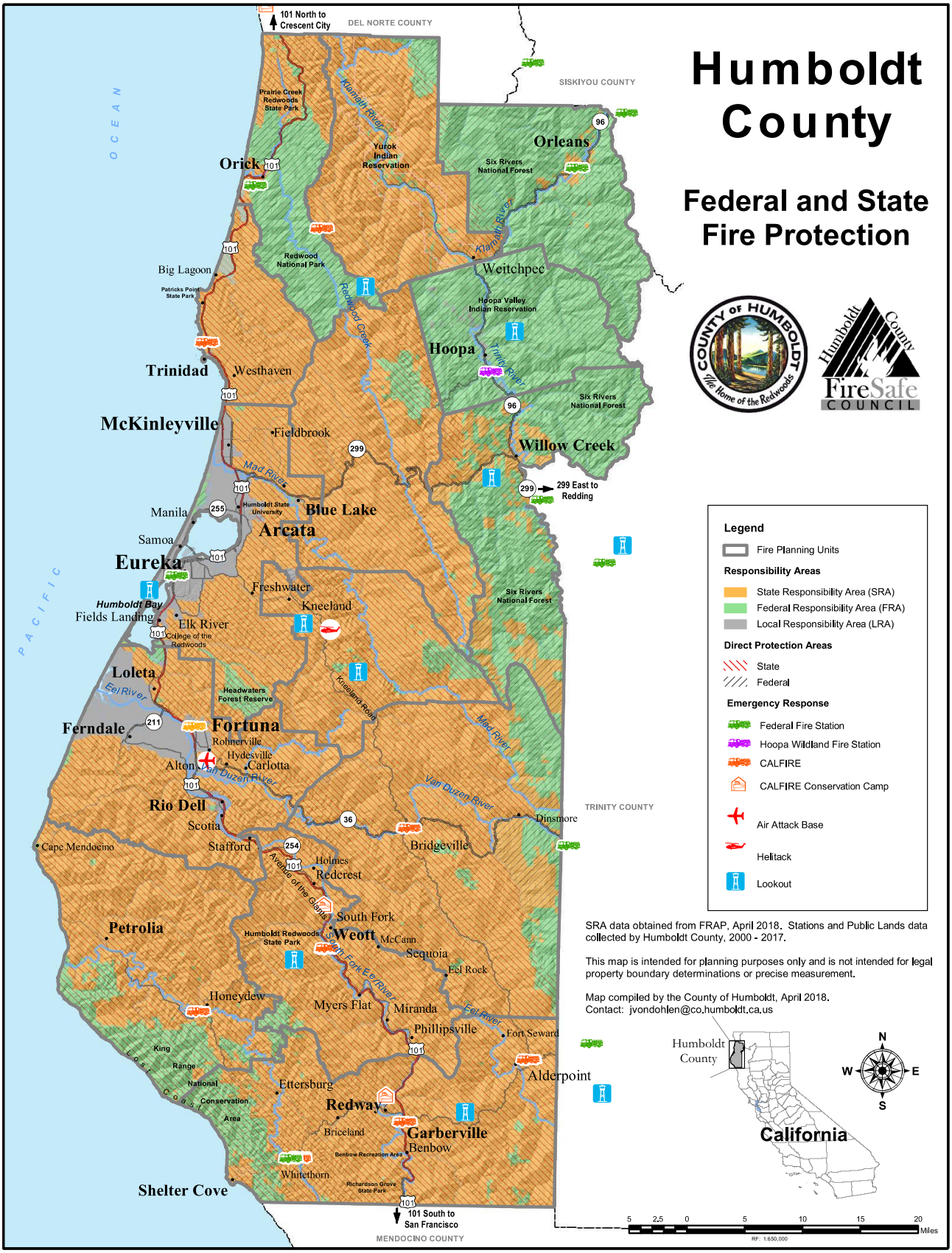
RNP's daily staffing level is based on the Park's Preparedness Plan. This Plan determines thresholds for Low, Medium, High, Very High, and Extreme fire danger based on daily Energy Release Component (ERC) predictions. The Park currently uses RAWS stations located near the far north and south ends of the Park to determine its daily ERC's.

National Park Service policy is to meet or exceed a 95% initial-attack success target. Standard dispatch for any given incident in RNP is determined by its Preparedness Plan. It generally includes one engine module; the Duty Officer will request additional resources through FICC, if conditions warrant.

Bureau of Land Management (BLM)

The BLM-Arcata Field Office administers 126 square miles of public lands in Humboldt County including the Headwaters Reserve, the King Range National Conservation Area, Samoa Dunes Recreation Area, and the Lost Coast Headlands. The CAL FIRE HUU, through the *California Cooperative Fire Protection Agreement,* provides wildfire protection for BLM lands in Humboldt County. The BLM augments CAL FIRE's initial attack resources during fire season by providing one Type-3 engine and crew at the BLM King Range Project Office at Whitethorn Junction.

Map 5.3.2 State and Federal Fire Protection



5.3.3 EMERGENCY SERVICES DELIVERED

Fire protection organizations in Humboldt County provide a range of emergency-response services requiring extensive coordination within and among emergency service providers. The following highlights a selection of key services provided.

Initial Response and Dispatching Services

In order to initiate an emergency response, a call must go out, notifying first responders of an incident. This call can be initiated based on a variety of detection sources. For example, the detection mechanisms utilized by the SRNF include fire lookouts, fixed-wing reconnaissance aircraft, vehicle patrols during high fire danger, and automated lightning detection. Structure fires and medical emergencies are most often called in by citizens who are involved in or witness an incident.

When **9-1-1** is dialed, the call goes to one of two locations, depending on where the call initiated. 9-1-1 calls that originate from cell phones are initially routed to the California Highway Patrol (CHP); calls that originate from a landline will be answered by a Public Safety Answering Point (PSAP). Some cities have their own PSAP (e.g. Eureka, Arcata, and Fortuna as well as Humboldt State University), while unincorporated areas are answered by the Sheriff's Department. The Sheriff's Department, the applicable PSAP, or the CHP will then determine the nature of the emergency call. If the incident requires fire and/or ambulance response, the call will be transferred to the appropriate dispatching facility. The choice of dispatch center depends on the location of the incident and the dispatching service utilized by the nearest fire protection organization and/or ambulance service.

The Fortuna Interagency Command Center (FICC) is the Command and Control point for many emergency agencies in Humboldt and Del Norte Counties. CAL FIRE and the USFS personnel jointly staff the FICC, with CAL FIRE staff available 24 hours/day, 7 days/week. The FICC is the dispatch center for wildland-fire emergencies in the SRA in Humboldt and Del Norte Counties as well as for all SRNF lands. Finally, the FICC is the centralized logistical ordering point for all federal agencies with wildfire potential on their lands, including Hoopa Valley tribal lands, Redwood National Park, and Humboldt Bay National Wildlife Refuge.

Due to limitations in the current incident reporting methods as well as insufficient data, it is not possible to provide an exact number for the percent increase in emergency calls for the entire county. However, there is consensus among firefighting personnel that demand for fire service is increasing here.

Fire protection organizations have, thus far, managed to respond to the service demand with excellent service. However, if the annual rate of calls for service continues to increase, options for expanding service capabilities will need to be explored. Dispatch providers indicate that if demand for services continues to increase, they will need additional funding, staffing, and expanded facilities, as well as an increased financial contribution from some.

Wildland Fire Response

Wildland fire response is typically the primary responsibility of the state and federal agencies within the SRA and FRA. It is described in terms of "Preparedness Levels," fire-hazard considerations (such as weather), available resources, and fire-management response objectives. Federal, tribal, and state fire agencies have fire-suppression responsibilities within the SRA and FRA. In many cases, local fire departments are the first on scene or are asked to assist in wildland fire suppression by the responsible agency. However, local fire departments do not typically have the resources to manage a large wildfire incident, nor is wildfire protection a primary responsibility of most local departments.

On National Forest lands, wildland fires can be managed for one or more objectives based on the *Land and Resource Management Plan* and/or *Fire Management Plan* direction. These objectives range from protection of life and property by aggressively suppressing fires to managing fires to meet resource-management objectives. All wildfires receive an initial dispatch response based on fire danger,

resource availability, and response-area characteristics. The response may change with changes in the fire's management objectives. Most fires escaping initial attack will initiate the *Wildland Fire Decision Support System*[12] and the agency administrator will clarify its intent, as well as incident objectives and management requirements for managing the fire.

While wildfires constitute a small percentage of the overall demand for emergency services, demand placed on local, state, and federal firefighting resources by wildfires can be substantially greater than most of the other types of calls combined. Wildfires can last for several days or even months, and can cost tens of millions of dollars. Wildfires frequently require aircraft of various types as well as fire engines, hand crews, and other specialized equipment. Acquiring these precious resources in an organized and timely manner involves coordination with multiple agencies around the state and country.

Wildfire Disaster Response

Wildfires in Humboldt County may be proclaimed a "Local Emergency" by the local Director of Emergency Services (County Sheriff), and/or the Board of Supervisors, and are guided by the *Humboldt County Emergency Operations Plan*[13] (EOP). The maintenance and implementation of the EOP is supported by the Humboldt County Office of Emergency Services (OES) in the Sheriff's Office. OES functions are administered by the Emergency Services Manager.

When wildfires have the potential to become disasters by threatening life and safety, procedures are initiated to support the safe evacuation of people, domestic animals, and livestock from potentially hazardous areas. Evacuation procedures are outlined in the *Wildland Fire Checklist* in the *Operations Plan.* Law enforcement or the fire Incident Commander calls for an evacuation order, which is communicated to emergency responders and affected residents. Field responders and/or Emergency Operations Center (EOC) personnel generate the event's evacuation plan. Evacuation decision points, routes, locations, and support resources are then identified and communicated to the public and media.

A *Voluntary Evacuation Advisory* is called when a fire reaches an area determined to be the "outermost decision point" and may continue towards inhabited areas. A *Mandatory Evacuation* is announced during an immediate or imminent fire situation, when residents are in imminent danger of life-threatening events. The Sheriff's Office is responsible for implementing evacuation procedures in unincorporated areas, and the County EOC is responsible for coordinating sheltering and mass care for evacuees. There is no statute that can be used to force residents from their homes. However, once residents evacuate they can be refused re-entry. In rare cases, unaccompanied minors within a *Mandatory Evacuation* area may be taken into protective custody by law enforcement until a parent or guardian can be located.

Voluntary Evacuation Advisory: A threat has been identified by fire service and/or law enforcement personnel which may affect the population under Voluntary Evacuation. Mandatory evacuation may be ordered at any time. Individuals with access and functional needs, households with pets or livestock, and residents on roads without alternative evacuation routes should consider evacuating upon a Voluntary Evacuation Advisory.

Mandatory Evacuation Order: An imminent threat to life and safety requires the immediate evacuation of identified areas. Residents outside of evacuation zones will not be permitted inside the perimeter.

When an Evacuation Advisory or Order is issued, the public and media are notified via direct mass-notification alerts, social-media posts, and news releases. Escalating evacuation scenarios, including changing a Voluntary Advisory to a Mandatory Order, also require direct notification of residents in evacuation zones by fire and law enforcement personnel, and in some cases, community volunteers. Upon the identification of actual or anticipated resource needs of evacuated populations, an evacuation center or mass-care shelter may be established.

[12] Wildland Fire Decision Support System (WFDSS) Homepage: https://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml

[13] County of Humboldt, OES. (2015, March). Wildland Fire Checklist. Humboldt County Emergency Operations Plan, Part 2: Initial Response Operations. Retrieved from https://humboldtgov.org/DocumentCenter/View/51861

When large wildfires necessitate regional resources, the Governor's Office of Emergency Services (Cal OES) Fire and Rescue branch may provide support. Fire Mutual Aid is coordinated by the primary responding jurisdiction. Depending on the location of the fire(s), CAL FIRE or the USFS may assume command, or establish Unified Command for incidents with multiple responsible agencies.

The following agency actions would facilitate improved evacuation in Humboldt County:

- Multi-jurisdictional evacuation mapping.
- Evacuation support incorporated into local fire-service training programs.
- Continued improvement in coordination and pre-incident planning between law enforcement/OES and CAL FIRE field personnel (Incident Commander) to facilitate seamless communication and quick response during an evacuation.

Finally, these issues are common challenges facing successful evacuations in Humboldt County:

- Limited rural ingress and/or egress throughout the wildland-urban interface, or WUI.
- Communication deficiencies in rural areas preventing timely dissemination of information.
- Narrow and damaged roads with heavy traffic.
- Roads with excessive amounts of flammable vegetation growing up to the roadside.
- Diminished visibility and air quality due to heavy smoke.
- Evacuees with access and functional needs.
- Public misunderstanding of local threats, resulting in evacuations by populations outside of actual evacuation zones.

*Specific information related to potential evacuation routes is identified in each of the **Planning Unit Action Plans** in Part 4 of this CWPP. See Appendix H, **Living with Wildfire** for more information on preparing for safe evacuation, as well as evacuation planning for pets and livestock.*

Community (Structural) Fire Response

Community fire protection is the suppression of structure fires and the protection of structures and other community resources from wildfire. Community fire-protection response—typically the responsibility of local fire departments and companies—is often described in terms of *response time.*[14]

When a fire involves a structure or is determined to be a threat to a community, the local fire-protection organization and its automatic-aid partners are dispatched based on the fire's location. Additional resource orders occur at the discretion of the Incident Commander (often the local fire chief).

CAL FIRE often aids in community fire protection when needed or requested. Their ability to assist varies depending on the time of year and the availability of their resources. CAL FIRE often responds to local incidents when either requested by the local fire department or company, or the California Master Mutual Aid Agreement, or when there could be a significant threat to SRA wildlands.

Medical Response

The primary focus of this plan is on wildfire and fires that threaten the wildland, however fire-service organizations and agencies play an important role in medical emergencies. The medical emergency services provided by fire-protection organizations are provided under the authority of the North Coast Emergency Medical Services Authority (North Coast EMS). North Coast EMS is a Joint Powers Authority created to develop a regional Emergency Medical Services (EMS) system to reduce death and disability on the North Coast.

Generally, when an emergency medical dispatch is requested, the closest local fire departments are called in, along with local ambulance services. CAL FIRE also responds to medical aid calls in rural areas when available, under the "closest resource" concept. CAL FIRE has both mutual-aid and automatic-aid agreements with local agencies to respond to fires and medical aids jointly. North Coast EMS tasks CAL FIRE with coordinating helicopter responses for medical aids in Humboldt County.

[14] *See page 5 for a definition of Response Time.*

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5.4 COMMUNITY PREPAREDNESS

Each year, there is a window of high fire risk for every Humboldt County community when conditions are just right for a single fire ignition to have potentially devastating consequences. Firefighters worry about the perfect storm of high fire danger during the wildfire season when local and state firefighting resources are committed to other incidents. A wildfire ignition during one of these periods could potentially spread quickly, threatening citizens' lives, as well as homes, schools, and businesses. **This chapter focuses on community preparedness efforts to mitigate wildfire losses and help Humboldt residents adapt to living in a wildfire environment.**

Many Humboldt County residents live in what is commonly referred to as the *Wildland-Urban Interface,* or WUI, where homes are intermixed with a wildland, or natural environment. For people living in these areas—especially, but not exclusively, in the hotter, dryer, inland areas—preparing for the inevitable wildfire is a very serious issue. Fire-prevention activities such as creating defensible space and restoring fire-adapted landscapes must be incorporated into home maintenance routines and family emergency plans.

Wildland-Urban Interface (WUI): The zone where structures and other human developments meet, or intermingle with, undeveloped wildlands.

Fuel Load: The amount of available and potentially combustible material, usually expressed as tons/acre.

Although a number of communities have taken initiative to increase their fire preparedness, many more Communities at Risk still have multiple unmet hazard-mitigation needs. While public understanding of fire prevention, fire safety, and evacuation planning is increasing in Humboldt County, education is still needed, especially among the smaller, more remote Communities at Risk.

Relatively cool summer temperatures and coastal influences create a false sense of security for many local residents. Population centers in Humboldt County, particularly along the coast, have not experienced a damaging wildfire recently. However, unmanaged *fuel loads* are a growing hazard.[1] Local wildfire history shows that forest fires can burn right down to the ocean. Contrary to common perception, redwood forests do burn, as with the 2003 Canoe Fire *(see picture below).* The community outreach process for this Community Wildfire Protection Plan (CWPP) confirmed that many residents are still unaware of their wildfire vulnerability; even fewer are prepared for the eventuality of wildfire. While wildfire has been and will continue to be an integral part of the local landscape, it does not have to mean disaster for local communities. Actively engaging in wildfire preparedness will greatly reduce the potential for the loss of life, property, and other community and natural assets.

Redwood forest fire, Canoe Fire 2003.

Well-prepared communities contribute to the feasibility of the safe reintroduction of fire across the landscape, a practice that is needed to reduce fuel loads and is generally supported in Humboldt County. The more prepared a community is, the more comfortable residents will be with methods of restoring historic fire patterns to the landscape, including cultural and/or prescribed burns, and careful and strategic wildfire management. *(For more information on reintroducing beneficial fire, see Chapters 5.2, and 3.5.)*

There are several local organizations that have been working to prepare their communities for wildfire for over a decade. They are presented in this chapter, with more information for each group in their respective *Planning Unit Action Plan* in *Part 4* of this CWPP. The Humboldt County Fire Safe Council (HCFSC) supports these local groups by bringing them together to share experiences and develop

[1] *See Chapter 2.2 for more information on wildfire risks.*

collaborative strategies to help their communities become more resilient to wildfire.

The organizations and agencies discussed in this chapter are working to prepare Humboldt County communities and are providing a strong framework for executing projects, attracting funding, and educating the community. However, there is still, and will continue to be, more to be done to increase the effectiveness of these groups. In some cases, the local groups below are made up of just a few passionate volunteers. Additional members could boost organizational capacity to increase the number and scale of projects, apply for funding, and increase their reach within the community. Likewise, increased membership can enhance the stability and longevity of an organization. These benefits may also be achieved by nesting the local organization under a larger and/or more established host organization.

A key part of enhancing community preparedness is community-buy in and cooperation. Much of the hazards that threaten communities exist on private land. Private landowners have a responsibility to mitigate these hazards around their own homes and are encouraged to reach out for assistance and information from any one of the groups discussed below. Many of these groups are interested in helping landowners help themselves. Alternatively, landowners may choose to collaborate with one another to reduce fire hazards in their neighborhoods. Such a group could choose to pursue recognition as a Firewise community, as discussed in *section 5.4.2*.

5.4.1 FIRE SAFE COUNCILS

Fire Safe Councils (FSCs) are voluntary organizations that form to support fire preparedness in their communities or neighborhoods. FSCs also provide the ideal forum for communities to discuss, analyze, and solve fire-related issues before they become a crisis. They provide opportunities for local jobs, community partnerships, and wide-spread community involvement. To learn more about forming and sustaining a FSC visit the California FSC website at *http://www.cafiresafecouncil.org/fire-safe-councils*.

Humboldt County Fire Safe Council

The Humboldt County Fire Safe Council (HCFSC) was established by the Humboldt County Board of Supervisors in 2002 and has been active ever since. The primary purpose of the HCFSC is to guide the maintenance and implementation of this plan, the Humboldt County CWPP. When appropriate, it also informs and makes recommendations to the Board of Supervisors. In 2018, the HCFSC consisted of 16 appointed members representing a diversity of expertise and perspectives. The table below outlines current membership.

Humboldt County Fire Safe Council Mission

Serve as a forum for the implementation of Humboldt County's CWPP, share fire-safety information, assess fire risk, promote community fire-safe planning and coordination, link fire-prevention programs, and support the fire service and local FSCs.

HCFSC meetings provide the agencies and organizations working on fire prevention and protection an opportunity to regularly share information. At each quarterly meeting, members and partners can provide a summary of their recent work. This information-sharing process is a critical contribution of the HCFSC towards increased collaboration and communication in the county.

*Section C.1 in Appendix C, **Accomplishments** highlights some of the key accomplishments of the Humboldt County Fire Safe Council since 2013.*

The **HCFSC** meets quarterly to discuss progress on projects and share ideas. Special presentations are often made by a wildfire mitigation, management, or community preparedness experts. All are welcome to these public meetings. *Meetings dates and locations, and more information about the HCFSC is available at humboldtgov.org/firesafecouncil*.

FIGURE 5.4.1 HUMBOLDT COUNTY FIRE SAFE COUNCIL 2018 MEMBERSHIP

Four at-large appointees, currently representing:

- Southern Humboldt Fire Chiefs' Association
- Southern Humboldt FSC
- Van Duzen Watershed FSC
- Willow Creek FSC

Five appointees, one by each member of the Board of Supervisors, currently:

- District 1: Lower Mattole Fire Safe Council and the Honeydew Fire Company
- District 2: Briceland Fire Protection District and the Southern Humboldt Technical Rescue Team
- District 3: Humboldt Bay Fire
- District 4: Local Insurance Industry
- District 5: Orleans/Somes Bar FSC

Four appointees representing specific agencies or organizations:

- California Department of Forestry and Fire Protection (CAL FIRE)
- Hoopa Valley Tribe
- Humboldt County Fire Chiefs' Association
- Humboldt County Office of Emergency Services

Three non-voting appointees representing specific agencies:

- Bureau of Land Management
- Humboldt County Public Works Director, or designee, acting as a liaison for communication between the HCFSC and the Board of Supervisors
- Six Rivers National Forest

The HCFSC oversaw the creation and implementation of the 2006 Master Fire Protection Plan and the 2013 Community Wildfire Protection Plan (CWPP). *(See section 1.1.4 for more information on these plans.)* Since then, its work has focused on plan implementation.

The HCFSC formed several subcommittees around the 2013 CWPP Action Plan to ensure implementation of its recommendations. The 2013 Implementation Committees are shown in the following table. In 2017, these committees were disbanded and new Work Groups were created around the current CWPP *Countywide Action Plan.* The 2017-2018 Work Groups are also shown on the following table. *For more detailed information on the current HCFSC Work Groups, see section 1.2.1* ***CWPP Work Groups*** *in Chapter 1, and Appendix B.2.*

FIGURE 5.4.2 HCFSC COMMITTEES AND WORK GROUPS

HCFSC COMMITTEES 2013-2017	HCFSC WORK GROUPS 2018
Helping Firefighters Help You	Wildfire Ignition Prevention
Ensuring Adequate Water Supplies for Fighting Fire	Wildfire Preparedness
Managing Hazardous Fuels	Disaster Preparedness
Maintaining Air Quality	Fire Protection
Firewise® Communities	Restoration of Beneficial Fire
Planning for Safe Evacuation	Integrated Planning

Local Fire Safe Councils

There are six local FSCs in Humboldt County, in addition to the HCFSC. These FSCs all contribute in their own way to moving their communities closer to living safely within a wildfire environment. There is some variety in how these FSCs are organized, as well as their approach to and philosophy about community wildfire preparedness. These unique approaches are detailed in the *Planning Unit Action Plans* in *Part 4* of this CWPP.

The following table lists currently active local FSCs and their contact information. *Map 5.4.1* later in this chapter shows where most local FSCs operate.[2] This map also includes the areas potentially served by developing tribal FSCs or equivalent organizations for the Hoopa Valley Reservation and Upper Yurok Reservation.

The following areas are where there is potential for a new Fire Safe Council to form:

- Avenue of the Giants (Planning Unit 14),
- Eel (Planning Unit 10), and
- Humboldt Bay Area (Planning Unit 8), specifically the WUI areas around McKinleyville, Fieldbrook, Arcata, Blue Lake, and Eureka.

FIGURE 5.4.3 LOCAL FIRE SAFE COUNCILS IN HUMBOLDT COUNTY

FIRE SAFE COUNCIL NAME	FORMATION DATE	COUNTY CWPP PLANNING UNIT	CONTACT INFORMATION
Orleans/Somes Bar FSC A program of the Mid-Klamath Watershed Council	2001	Mid Klamath (Unit 3)	**530-627-3202** *mail@mkwc.org* *www.mkwc.org/index.php/programs/fire-fuels*
Southern Humboldt FSC	2002	Southern Humboldt (Unit 13)	**707-923-9109** *bille@asis.com*
Lower Mattole FSC A program of the Mattole Restoration Council	2002	Mattole-Lost Coast (Unit 12)	**707-629-3514** *firesafe@mattole.org* *www.mattole.org/programs/land-management/fire*
Van Duzen Watershed FSC A program of the Bridgeville Community Center	2004	Mad-Van Duzen (Unit 11)	**707-496-4530 or 707-777-1775** *jlc4660@gmail.com*
Crooked Prairie FSC	2005	Southern Humboldt (Unit 13)	**707-986-7705** *kw@asis.com*
Willow Creek FSC	2007	Willow Creek Area (Unit 7)	**707-499-0767** *admin@willowcreekfsc.org* *www.willowcreekfsc.org*

*Information about each local FSC and its recent accomplishments can be found in Appendix C and in each relevant **Planning Unit Action Plan** in Part 4 of this CWPP.*

[2] *Map 5.4.1* does not show the operational area of the Humboldt County FSC, which operates throughout the entire county.

Tribal Fire Safe Councils

The following tribes have been building functional FSCs:

- **Hoopa Valley Reservation**. The Hoopa FSC was formed in 2013 to assist with the development and implementation of a local CWPP. Members of the Hoopa Fire Department and Office of Emergency Services are working to rebuild the FSC as a venue for implementing the Hoopa Valley Indian Reservation CWPP and educating community members about wildfire preparedness.

- **Upper Yurok Reservation**. In 2013, the Yurok tribe recognized the need for a FSC during the update of their Hazard Mitigation Plan. A steering committee/FSC was formed to provide Hazard Mitigation Plan oversight as well as guidance for the development of the associated local CWPP. Although not directly overseen by Tribal governance, the Cultural Fire Management Council currently fills many of the roles of an FSC for communities in the Upper Yurok Reservation area.

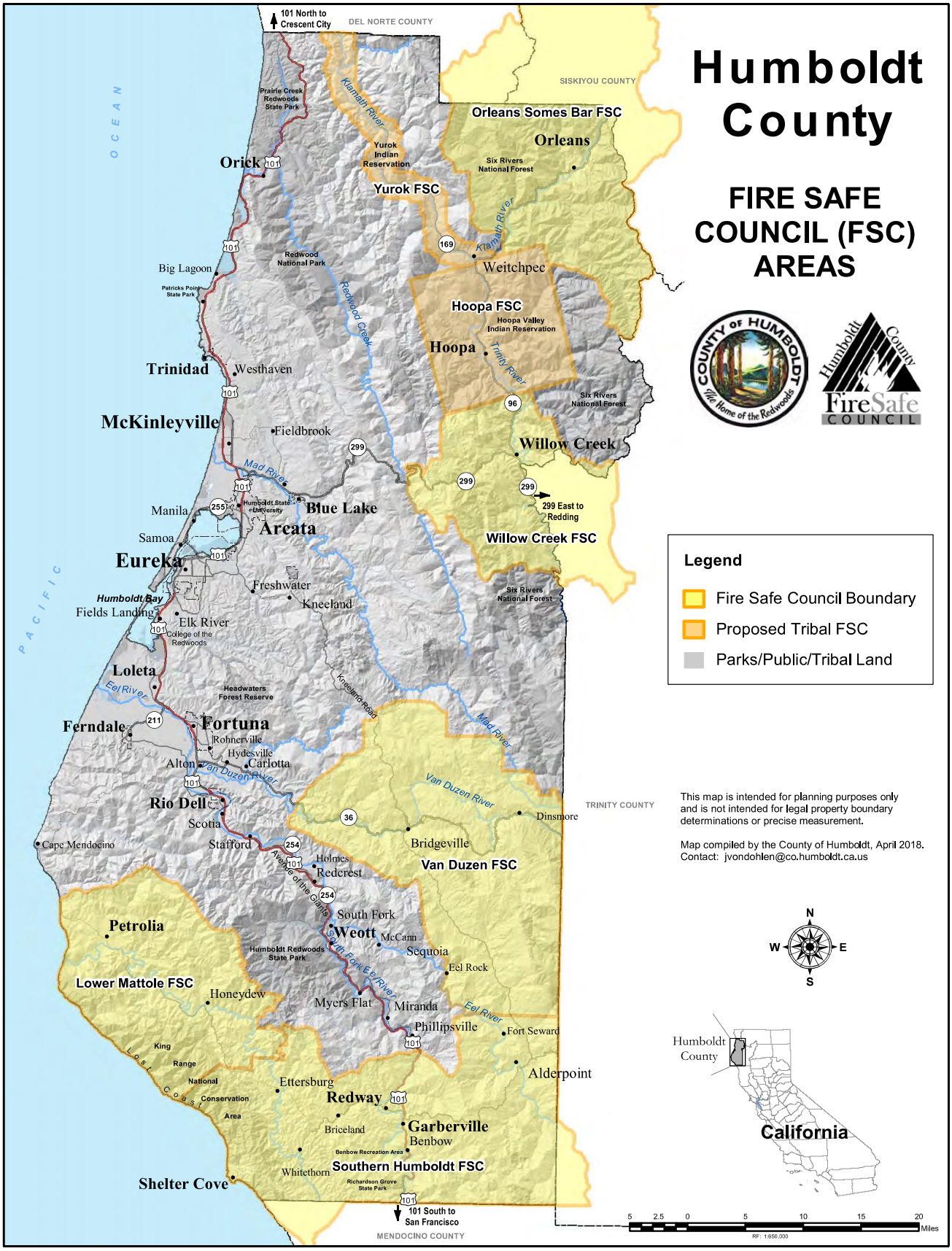
More information about the **Hoopa FSC** or its community wildfire preparedness efforts can be found by calling the Hoopa Fire Department at **530-625-4220,** or by emailing Fire Chief Rod Mendes at *hoopaoes@gmail.com*.

More information about community wildfire preparedness in the **Upper Yurok Reservation** can be found by contacting the **Yurok Tribe** at **530-625-4130.** Information on local cultural burning is available at *culturalfire.org*.

*Information about each tribal FSC can be found in each relevant **Planning Unit Action Plan** in Part 4 of this CWPP.*

Hoopa Valley prescribed fire.

Map 5.4.1. Fire Safe Council Areas



5.4.2 LOCAL COMMUNITY PREPAREDNESS ORGANIZATIONS

Firewise® Communities

The HCFSC and County staff have worked closely with local communities to gain recognition as Firewise® Communities/USA sites. The National Fire Protection Association's (NFPA) Firewise® Communities program teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action to prevent losses. The program provides many tools and resources to local communities and neighborhoods.

These four new communities gained Firewise® recognition since the 2013 CWPP publication:

- Hydesville,
- Kneeland,
- Redwood Valley/Chezem, and
- Shelter Cove.

This brings the list of existing nationally recognized Firewise® Communities in Humboldt County to ten, with the inclusion of these previously recognized communities:

- Bridgeville, pending renewal
- Honeydew,
- Orleans,
- Petrolia,
- Upper Jacoby Creek, and
- Willow Creek.

This plan recommends that the following communities consider becoming recognized Firewise® Communities within the next five years:

- Alderpoint
- Avenue of the Giants individual communities
- Blue Lake and greater area
- Blue Lake Rancheria
- Briceland
- Ettersburg
- Garberville/Redway area
- Hoopa
- Orick
- Westhaven/Trinidad
- Whitethorn
- Table Bluff Reservation

The HCFSC continues to reach out to new communities to offer support for entering the recognition process. Recognition includes the formation of a committee or board, the development of an action plan based on a community wildfire risk assessment, a minimum per capita investment in wildfire-risk reduction activities, and the production of at least one annual educational event.

*Information about the recent accomplishments of each Firewise® Community, can be found in Appendix C, and in each relevant **Planning Unit Action Plan** in Part 4 of this CWPP.*

Humboldt County Prescribed Burn Association

The Humboldt County Prescribed Burn Association (HCPBA) is a collective of landowners, non-governmental organizations, volunteer fire departments, and other community members working together to implement prescribed burning. HCPBA projects include burning for habitat restoration, invasive plant control, fuel reduction, and more. The group was officially formed in March 2018, with a Board of Directors and by-laws. It is currently working towards non-profit status and developing a project prioritization process.

The HCPBA is the first official prescribed burn association (PBA) in California, joining more than sixty PBAs nationwide. The HCPBA will be able to leverage the energy and resources of individual landowners and community members, and attract outside funding and support where needed, to scale up the use of fire throughout the county and surrounding areas.

For more information on the **Humboldt County Prescribed Burn Association**, contact Lenya Quinn-Davidson, University of California Cooperative Extension, Area Fire Advisor, **707-445-7351**, *lquinndavidson@ucanr.edu*.

Humboldt Community Emergency Response Team (CERT) Coalition

The Humboldt CERT Coalition (HCC) was formed in April 2014 as an ad-hoc group of CERT Team and Program Leaders to offer peer support, guidelines, collaboration for training opportunities, and refreshers. A Community Emergency Response Team, or CERT program educates volunteers about disaster preparedness and trains them in basic response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Neighborhoods and communities within the county that have the potential for becoming isolated during a large wildfire event are good candidates for reaching out to HCC and forming a CERT. Local CERT members gain awareness of the potential impacts of natural disasters, which can be shared with their fellow community members to help them prepare for disasters.

HCC team members actively promote preparedness in local communities through tabling at local events and participating in like-minded groups and organizations. It facilitates community training by applying for grants to support the 23-hour course, equipment, instructors, logistics, and supplies. There are currently 12 local instructors who have graduated from the nationally approved CERT *Train-the-Trainer* course. One advantage of local instructors is their ability to train agencies that work volunteer teams, in addition to their ability to train more local CERT members.

Many rural areas of Humboldt County that have the greatest need for, and interest in, establishing CERTs lack the agency sponsorship required to form a team. The County CERT currently being developed by the Humboldt County Office of Emergency Services in partnership with HCC, will provide CERT training, support, and sponsorship for remote communities. It will function as an incubator for new CERTs and an umbrella for CERT-trained community volunteers without a locally sponsored team.

FIGURE 5.4.4 LOCAL COMMUNITY EMERGENCY RESPONSE TEAMS (CERTS)

➢ Arcata Police Department	➢ Humboldt Bay Fire
➢ Blue Lake Rancheria	➢ Humboldt State University
➢ City of Blue Lake	➢ Shelter Cove Resort Improvement District/Fire Department
➢ Fortuna Fire Protection District	➢ McKinleyville (interested)
➢ Hoopa	➢ Trinidad (interested)

Learn more about completing the **CERT** training and joining the **Humboldt CERT Coalition** by contacting their chairperson, Linda Nellist at *linda.nellist@humboldt.edu* or by looking for the "Humboldt CERT Coalition" on Facebook. To learn more about CERTS in general, visit *https://www.ready.gov/community-emergency-response-team*.

5.4.3 LOCAL AGENCY FIRE EDUCATION AND PREVENTION PROGRAMS

Fire prevention and education programs can reduce the chance of fire occurring and the cost of damage from fires while supporting fires suppression efforts. Several local agencies provide fire prevention and education programs and are summarized here. Additional programs throughout the county similar to those presented below would benefit Humboldt residents.

Humboldt County Fire Chiefs' Association Fire Prevention Officers Section

Most local fire protection agencies include a division focused on fire prevention and preparedness. The Fire Prevention Officers Section of the Humboldt County Fire Chiefs' Association brings together the fire prevention officers of their fire departments throughout the county.

More information about the **Fire Prevention Officers Section** of the Humboldt County Fire Chiefs' Association can be found by emailing Chief Lon Winburn at *lwinburn@fortunafire.com*.

Humboldt Bay Fire

The fire prevention and safety education activities of Humboldt Bay Fire are closely tied to the themes of the National Fire Protection Association. Humboldt Bay Fire's Fire Prevention Division provides public education in schools, at fairs and other events, and during fire prevention week. It also provides specialized fire-safety classes on fire extinguisher use, first aid, and hazardous materials (for both awareness and operator level). The Community Risk Reduction Division provides information on weed abatement. It can assist with complaints about overgrown vegetation that, if ignited, could endanger nearby properties.

Humboldt Bay Fire can be contacted by calling **707-441-4000** or by sending an email to: *info@HBFire.org*. More information can also be found by visiting their website at *hbfire.org*.

Arcata Fire Protection District

The Arcata Fire Protection District has an active fire prevention and safety education program. District representatives visit local schools to share fire-prevention information. They also host an annual "Open House" where community members can learn more about its services and collect educational materials. The Arcata Fire Protection District also conducts fire-safety inspections at businesses, multi-family residences, schools, daycare centers, and senior residential-care units.

The **Arcata Fire Protection District** can be contacted by calling **707-825-2000** or sending an email to *info@arcatafire.org*. More information can be found by visiting their website at *arcatafire.org*.

Fortuna Volunteer Fire Department

The Fortuna Volunteer Fire Department (VFD) provides fire prevention and safety services through their Fire Prevention and Public Education Divisions and sponsors a Community Emergency Response Team (CERT). The VFD implements community-outreach programs to inform the public about fire prevention, provide safety presentations on a range of topics, and distribute informational materials at local community events. In addition, the VFD conducts fire-safety inspections at businesses, residences, schools, daycare centers, and senior residential-care units.

The **Fortuna Volunteer Fire Department** can be contacted by calling **707-725-5021** or sending an email to Fire Chief Lon Winburn at *lwinburn@fortuanfire.com*. More information can also be found by visiting their website at *fortunafire.com*.

5.4.4 STATE AGENCY FIRE EDUCATION AND PREVENTION PROGRAMS

CAL FIRE Humboldt-Del Norte Unit

The prevention goals of the CAL FIRE Humboldt-Del Norte Unit (HUU) are to reduce wildfire ignitions through education, information, planning, and enforcement. Hence, the CAL FIRE Prevention Bureau, among other duties: enforces state forest and fire laws, oversees defensible space inspections, conducts public education and outreach, and coordinates media outreach.

Defensible space inspections (also known as DSIs, or LE-100 inspections, after the form used to record the information) can be a source of important information for residents who aren't sure how to prepare for wildfire. Inspections can be requested by contacting CAL FIRE. *(See CAL FIRE's local contact information below.)*

HUU's Pre-Fire Planning Battalion supports local community-wildfire preparedness in a variety of ways. Pre-Fire Planning staff provide a variety of planning functions including, but not limited to:

- Environmental review,
- HCFSC member participation,
- Local FSC support,
- *Unit Strategic Fire Plan*[3] maintenance,
- Hazardous fuel-treatment project development,
- Expert analysis for specific County Planning projects,
- State-funded, local fire-prevention project's grant management,
- Geographic Information Systems (GIS) map development, and
- Prescribed burning support and collaboration to reduce wildfire hazards and promote forest health.

For more information about **CAL FIRE's Fire Prevention Unit** and **Pre-Fire Planning** programs, contact Pre-Fire Planning Battalion Chief Chris Ramey at *chris.ramey@fire.ca.gov*, visit the Unit webpage at *www.fire.ca.gov/HUU*, or call **707-725-4413.**

North Coast Unified Air Quality Management District

The North Coast Unified Air Quality Management District (NCUAQMD) is the regional environmental regulatory agency with jurisdiction over air quality in Humboldt, Del Norte, and Trinity Counties. NCUAQMD is on the front lines with public health agencies responding to catastrophic wildfire smoke events by providing air quality status and recommendations to the general public.

During wildfire season NCUAQMD provides Public Service Announcements, Advisories, and Alerts to protect public health. If needed NCUAQMD can access air-monitoring instrumentation from the State Air Resources Board cache to supplement existing stationary and temporary instrumentation. They also maintain a Facebook page and a website, *http://www.ncuaqmd.org*, to educate the public about open burning, burn regulations, and how to obtain a burn permit. The website is a communication point for wildfire information.

NCUAQMD is responsible for the regulation of stationary sources of air pollution, including overseeing activities such as prescribed burning, agricultural burning, and residential open burning.

[3] CAL FIRE: Humboldt – Del Norte Unit (HUU). (2017). Strategic Fire Plan Humboldt – Del Norte Unit 2017. Retrieved from *http://cdfdata.fire.ca.gov/fire_er/fpp_planning_plans_details?plan_id=270*

Open burning is the use of outdoor fires for disposing of vegetation. *More information on burn permits is available in Appendix I, **Regulations and Compliance**.*

Each year on average, the District issues about 7,300 burn permits, 700-900 burn authorizations, reviews 150-170 smoke management plans, and receives about 200 open burning complaints. Three dollars ($3) of each Standard burn permit fee is passed through to the local fire district.

For more information about the **North Coast Unified Air Quality Management District (NCUAQMD)**, contact Debra Harris, Burn Program Coordinator, by calling **707-443-3093 x122,** or visit their webpage at *www.ncuaqmd.org*.

University of California Cooperative Extension

The University of California Cooperative Extension (UCCE) Humboldt-Del Norte Counties chapter devotes time, research, and resources to improving fire safety and achieving a greater understanding of the role of fire in human and natural communities. Through its Forestry, Fire, and Forest Health program, UCCE offers science-based information and technical expertise to local landowners, natural resource professionals, and community groups, all in the interest of increasing forest health and resiliency. The program's Area Fire Advisor is a particularly important resource for local groups interested in wildfire preparedness and resiliency. The Fire Advisor works closely with and connects the efforts of the California Fire Science Consortium,[4] the Northern California Prescribed Fire Council,[5] the Fire Adapted Communities Learning Network,[6] and the formation of the Humboldt County Prescribed Burn Association *(see above)*. UCCE is leading efforts to create much-needed information for Humboldt County residents on how to use prescribed fire to reduce fuels on their properties.

More resources and information can be obtained by visiting the Forestry, Fire, and Forest Health program of the **UCCE Humboldt-Del Norte Counties** website: *http://cehumboldt.ucanr.edu/Programs/Forestry*, or calling **707-445-7351.** Lenya Quinn-Davidson, the Area Fire Advisor can be reached at *lquinndavidson@ucanr.edu*.

5.4.5 FEDERAL AGENCY FIRE EDUCATION AND PREVENTION PROGRAMS

Six Rivers National Forest Wildland Fire Prevention Program

The US Forest Service, Six Rivers National Forest (SRNF) Wildland Fire Prevention Program focuses primarily on:

- Wildfire detection,
- Wildfire origin and cause investigations,
- State commercial burning permit issuance,
- Public education, and
- Community fire-safety awareness.

SRNF has responded to increasing wildfire severity and duration attributed to excessive fuel buildup, climate change, and increased lightning activity with a fuels program that prioritizes strategically reducing hazardous fuels near communities. Community protection projects and strategic fuel breaks are managed through mechanical treatments and the use of prescribed fire. This strategy is

[4] California Fire Science Consortium: *www.cafiresci.org*

[5] Northern California Prescribed Fire Council: *www.norcalrxfirecouncil.org*

[6] Fire Adapted Communities Learning Network: *www.fireadaptednetwork.org*

implemented through close collaboration with FSCs and Resource Advisory Committees. SRNF is also an active collaborator in the Western Klamath Restoration Partnership[7] and has maintained advisory membership on the HCFSC since its inception.

More information on the **SRNF Wildland Fire Prevention Program** can be found by visiting their website at *www.fs.usda.gov/main/srnf/home*, calling **707-441-3604,** or by sending an email to Fire Prevention Officer Robert Rivelle at *rrivelle@fs.fed.us*.

Bureau of Land Management

The Bureau of Land Management (BLM) Arcata Field Office's wildland fire-prevention efforts are concentrated on community fire-safe awareness. They also educate the public on the benefits of fire prevention and the necessity for a proactive hazardous fuel-management and reduction program.

More information on the **BLM's** wildland fire prevention efforts in Humboldt County can be obtained by contacting District Fire Management Officer, Walter Herzog at *wherzog@blm.gov*, calling **530-224-2151,** or the Arcata Field Office at **707-825-2300** or visiting their website at *https://www.blm.gov/office/arcata-field-office*.

5.4.6 EVACUATION PREPAREDNESS

Despite fire's natural and beneficial role in the local environment and ongoing efforts to prepare communities to live safely with fire, there will inevitably be wildfire events that require evacuation. The rugged terrain and remote nature of many Humboldt County communities can complicate access to and from residences. Additionally, issues with rural communication infrastructure may prevent timely notification of residents in an emergency. Fire officials and community members have identified many narrow, one-way-in-and-out roads as one of the biggest hazards facing Humboldt County in the event of a large wildfire. Furthermore, historic developments were not created with current fire-safety standards. These older developments, combined with the general disparate nature of Humboldt's rural communities, increase the number of people with challenging evacuation circumstances.

The importance of being prepared and evacuating early during extreme wildfire events cannot be overemphasized. Surviving an extreme event is supported by the following:

- Understanding of the situation at the time of evacuation (situational awareness),
- Confidence in the actions of emergency personnel,
- Clear communications with emergency personnel,
- Adequate pre-planned preparations, and
- A relatively safe location to which one can evacuate.

Despite the best planning, there may be times when residents and visitors may not be able to reach designated evacuation sites. In such cases, people may need to make decisions on their own about seeking shelter where they can survive the passage of the wildfire. Residents should seek shelter as a last resort, when evacuation is not an option. It can be very difficult to determine the right thing to do as the fire approaches, which is why it is so critical to **have a plan** and to **evacuate early**, if possible. Before a wildfire threatens, community members should research options and talk to fire and emergency service representatives about evacuation procedures, expected fire behavior in their neighborhood, and

[7] Western Klamath Restoration Partnership: *www.wkrp.network*

what to do if they get trapped.[8] If residents are forced to take shelter, the horrific sound, smoke, and heat of a passing wildfire may be physically and emotionally difficult to endure. It may bring some solace and may help combat the natural urge to flee knowing that all possible measures have been taken to increase the odds of survival.

One of the most important first steps for Humboldt residents' evacuation preparedness is signing up for the Humboldt ALERT emergency notification system through the Humboldt County Office of Emergency Services (OES).

Humboldt Alert: Humboldt County's Mass-Notification System

- The best way for emergency personnel to alert you of an emergency in your geographic area.
- You may choose to be contacted by email, text message, landline, or cellphone – or all four.
- It is geographically targeted. You will only receive alerts relevant to your geographic area, which is based on the address(es) you provide. The system can hold multiple addresses under one account (e.g. home, office, child's school).
- The service is completely free of charge.
- To sign-up visit: ***https://humboldtgov.org/alerts*** or contact the **Humboldt County Office of Emergency Services** at **707-268-2500**.

REMEMBER, WE CAN'T ALERT YOU IF WE CAN'T REACH YOU.

Humboldt County OES is drafting a *Countywide Evacuation Plan.* It has been working closely with the HCFSC to reach out to community members to identify:

- Evacuation barriers such as one-way-in-and-out access roads,
- Potential evacuation shelter sites, and
- Residents who are willing to volunteer as Community Liaisons.

In addition to ongoing evacuation planning, County OES is completing community profiles for high-risk, populated rural areas. These profiles are being coordinated with local volunteer fire departments, community volunteers, and planning partners. Community profiles assess available resources and gaps in communities to pre-identify needs to more efficiently order and assign resources during and following disasters.

*Specific information related to potential evacuation routes is identified in each of the **Planning Unit Action Plans** in Part 4 of this CWPP. See Appendix H, **Living with Wildfire** for more information on preparing for safe evacuation and evacuation planning for pets and livestock.*

[8] CAL FIRE and Idaho Firewise offer advice on what to do if you become trapped: http://www.readyforwildfire.org/What-To-Do-If-Trapped and http://idahofirewise.org/evacuation/if-you-get-trapped.

Deciphering the Jargon

Evacuation sites and routes are designated at the time of an incident by law enforcement in conjunction with firefighters. These areas generally cannot be designated ahead of time, as they depend greatly on the local weather and other current conditions. Terms like "Safety Zone" and "Temporary Refuge Area" are used operationally by firefighters and not intended to describe locations for public refuge. These areas are identified during wildfire management operations by experienced firefighters and change frequently with conditions and fire line construction progress.

Evacuation center/site: A safety zone located within a community—usually on a large, flat, open area—where community members can go in cases of emergency evacuation; oftentimes, temporary shelters are established, and food, water, and medical supplies are distributed at these locations.

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 enlarged areas which can be used with relative safety by firefighters and their equipment in the event of a blowup in the vicinity.

Temporary refuge area: A preplanned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter in the event that emergency egress to an established Safety Zone is compromised. Examples: lee side of structure, inside of structure, large lawn or parking area, cab of apparatus.