CHAPTER 8 – FIRE HAZARDS: RISKS AND MITIGATION

CHAPTER CONTENT

About Chapter 8

Among California's three primary hazards, wildfire, and particularly wildland-urban interface (WUI) fire, has represented the third greatest source of hazard to California, both in terms of recent state history as well as the probability of future destruction of greater magnitudes than previously recorded. More recently, with the catastrophic wildfire events of 2017 and 2018, fire has emerged as an annual threat roughly comparable to floods. Fire and flood fire hazards are surpassed only by high magnitude earthquake hazards, which typically occur less frequently but can result in extreme disaster events.

For the 2018 State Hazard Mitigation Plan (SHMP), the fire hazards risk assessment has been expanded to include separate discussions on wildfire hazards and structural fire hazards. Structural fire hazards can occur as a cascading hazard emerging from wildfires or earthquakes, or as an independent hazard event. In either case, fire hazard mitigation actions are crucial in minimizing potential risk. Preparation and implementation of Local Hazard Mitigation Plans (LHMPs) with linkage to a jurisdiction's general plan, play an important role in the fire mitigation process.

For more information on the criteria and template used for hazard risk assessments and a discussion of the hazard classification system, see *Chapter 1: Introduction, Section 1.2.3*.

8.1 WILDFIRE HAZARDS, VULNERABILITY, AND RISK ASSESSMENT

8.1.1 IDENTIFYING WILDFIRE HAZARDS

In general, a wildfire is defined here as any free-burning vegetative fire that initiates from an unplanned ignition, whether natural (e.g., lightning) or human-caused (e.g., powerlines, mechanical equipment, escaped prescribed fires), where the management objective is full suppression. While wildfires can potentially lead to benefits to an ecosystem if within the range of natural variability for a given ecotype and geographical area, they can also lead to deleterious effects to both the natural and built environment.

In California, the combination of complex terrain, Mediterranean climate that annually facilitates several month long rain-free periods, productive natural plant communities that provide ample fuels, and ample natural and anthropogenic ignition sources, has created a land forged in fire. Excluding fires occurring in the desert, estimates of acreage burned prior to the arrival of European settlers range between 4.5 and 12 million acres annually[192] with frequency, size, and intensity varying based on ecotype and geographic area. These findings indicate the dramatic historical influence of natural wildfire, which supported and maintained ecosystem structure and function in California's wildlands.

[192] Stephens et al., 2007

Dramatic changes in fire activity accompanied the European settlement of California, partly due to agriculture, grazing, mining, and logging, particularly of older trees. These changes were magnified through land use practices (agriculture, urbanization) that removed natural fuel. At the turn of the 20th century, great debate ensued on whether the state should adopt the federal approach of total fire exclusion or to use "light burning" techniques that were historically practiced by the state's indigenous peoples. In 1923, the California Forestry Committee voted unanimously to adopt the federal approach to suppress all wildland fires, which has led to elevated fuel loading, and a shift to dense, younger trees, in large areas of the state's coniferous forests.

8.1.2 PROFILING WILDFIRE HAZARDS

Current and Historical Trends in Wildland Fire

While California has long been recognized as one of the most fire-prone natural landscapes in the world, the 2017 and 2018 wildfire years saw unprecedented wildfires, which eclipsed fire events from previous years. As noted throughout this chapter, the 2017 and 2018 wildfires were by far the most destructive and deadly in recent California history. During 2017, over 9,000 fires were ignited in California.[193] All other 2017 wildfire events were overshadowed by two fire events of catastrophic size and destruction; the Northern California Wildfire Complex in October 2017 and the Thomas Fire in December 2017; both of which were driven by extreme weather conditions coupled with large volumes of dry vegetation, affected by drought, in wildland-urban interface areas (WUI). The fires resulted in over 40 fatalities. The Thomas Fire, which burned through Ventura and Santa Barbara Counties, was the largest single recorded wildfire, by acreage, in California history to date as of January 2018, while the Tubbs Fire (part of the October 2017 Northern California Wildfire Complex) destroyed over 5,000 structures and took the lives of 22 people.

Palm trees burning during the 2017 Thomas Fire

Source: C. Dicus

As of the final writing of the 2018 SHMP in September 2018, over 5,700 wildfires have burned or are actively burning in California during the 2018 fire year.[194] This includes the catastrophic Mendocino Complex Fire, which has burned over 450,000 acres and is 98 percent contained as of September 12, 2018, surpassing the 2017 Thomas Fire in size

[193] http://cdfdata.fire.ca.gov/incidents/incidents_stats?year=2017
[194] http://cdfdata.fire.ca.gov/incidents/incidents_stats?year=2018

as the largest wildfire in California's history. The Carr Fire, which burned in Shasta and Trinity Counties in July and August 2018, destroyed over 1,600 structures, caused multiple fatalities, and burned 229,651 acres. Table 8.A lists the number of wildfires and the number of acres burned in California each year from 1987 to 2017. During this three-decade period, California annually averaged 8,782 fires that burned 555,762 acres. While the overall total number of fires per year has declined since 1987, the number of acres burned annually is highly variable between years, with an increase in larger single fires burning larger areas in some years, typically due to extreme weather conditions. An explanation of FRAs, SRAs, and Local Responsibility Areas (LRAs) is included in *Section 8.1.5.3*.

Table 8.A: California Wildfires and Acres, 1987-2017, as of January 2018

	CAL FIRE (SRA)		FEDERAL FIREFIGHTING AGENCIES (FRA)		LOCAL GOVERNMENTS (LRA)*		TOTAL	
	Number of Fires	Acres Burned	Number of Fires	Acres Burned	Number of Fires	Acres Burned	Number of Fires	Acres Burned
1987	8,062	87,000	4,374	744,000	1,040	42,000	13,476	873,000
1988	8,121	191,000	4,160	96,000	1,009	58,000	13,290	345,000
1989	6,635	73,600	2,547	87,800	842	12,000	10,024	174,400
1990	7,283	212,100	2,670	128,100	595	25,000	10,548	365,200
1991	6,271	23,100	2,681	18,800	657	2,300	9,609	44,200
1992	7,939	191,490	3,682	84,340	426	4,915	12,047	282,745
1993	6,688	122,606	1,774	67,646	227	119,527	8,689	309,779
1994	7,207	140,792	2,698	359,227	364	26,200	10,269	526,219
1995	6,601	121,198	1,563	78,414	328	10,203	8,492	209,815
1996	7,237	232,624	2,637	488,010	736	31,738	10,610	752,372
1997	6,835	57,788	2,180	198,431	487	27,666	9,502	283,885
1998	5,227	92,456	1,860	90,246	485	32,710	7,572	215,412
1999	7,562	285,272	3,139	865,621	424	21,957	11,125	1,172,850
2000	5,177	72,718	1,884	218,578	561	3,730	7,622	295,026
2001	6,223	90,984	2,567	275,152	527	11,203	9,317	377,340
2002	5,759	112,810	1,837	366,842	575	58,564	8,171	538,216
2003	5,961	404,328	1,783	399,635	543	161,807	8,287	965,770
2004	5,574	168,134	1,852	110,082	472	32,808	7,898	311,024
2005	4,908	74,004	1,604	139,399	725	65,811	7,237	279,214
2006	4,805	222,896	2,400	603,378	650	37,071	7,855	863,345
2007	3,610	434,667	1,932	990,730	501	95,565	6,043	1,520,362
2008	3,593	380,310	2,203	1,153,973	459	59,407	5,255	1,593,690
2009	2,858	75,960	1,820	339,908	2,332	36,101	7,010	451,969
2010	2,434	25,438	1,616	98,871	2,344	10,153	6,394	134,462
2011	3,056	51,889	2,021	73,124	2,655	103,586	7,732	228,599
2012	2,922	128,956	1,562	687,013	2,557	13,255	7,041	829,224
2013	3,672	114,473	2,213	450,126	3,004	37,036	8,889	601,635
2014	2,920	163,067	1,960	451,810	2,353	10,663	7,233	625,540
2015	3,231	291,282	2,184	577,115	2,868	6,137	8,283	880,899
2016	2,816	215,671	1,215	394,910	2,923	12,078	6,954	622,658
2017[a]	7,117[c]	505,956[c]	2,016[b]	742,650[b]	[a]	[a]	9,133	1,248,608

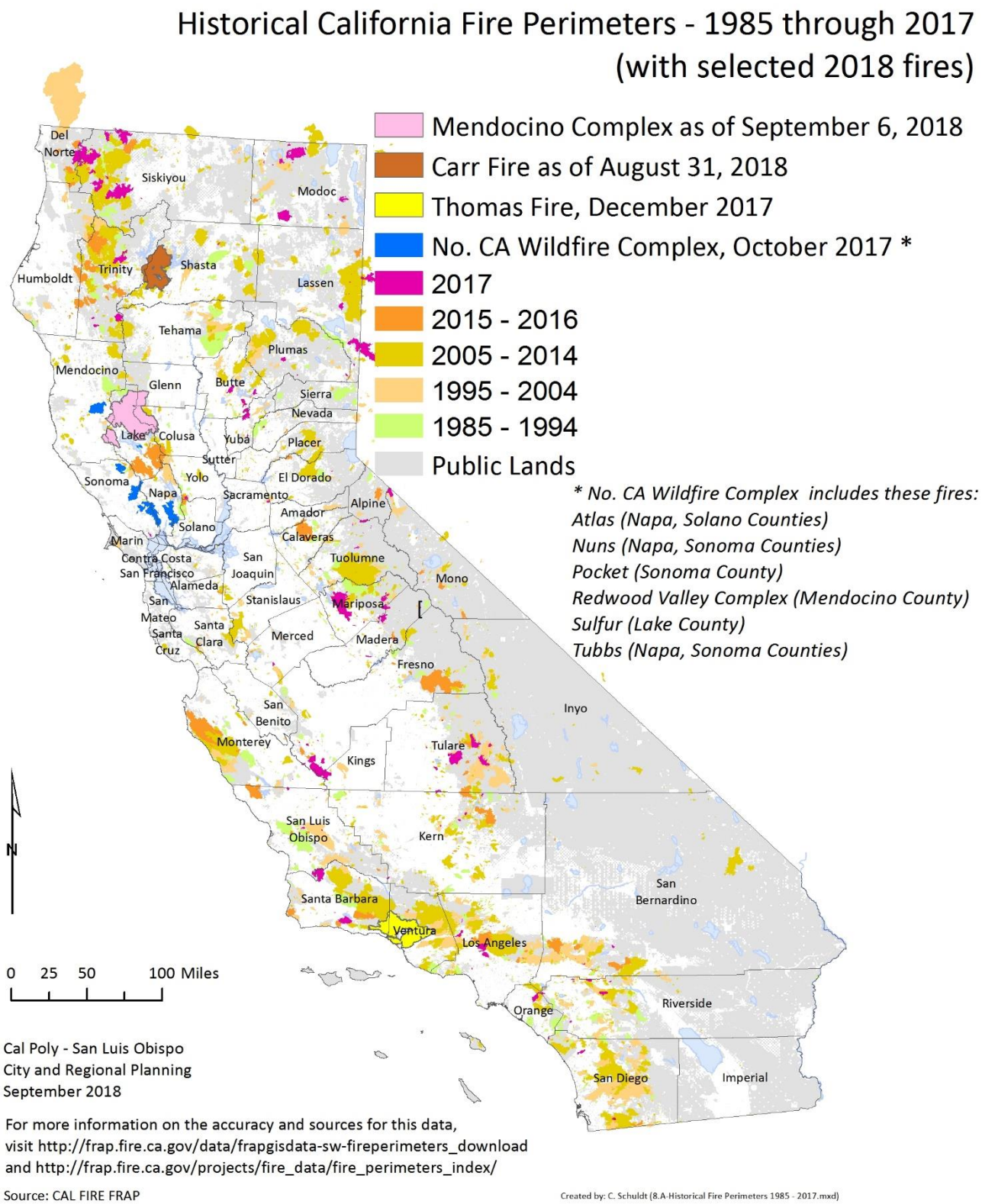
**This category includes county fire departments that protect State Responsibility Area (SRA) under contract in Kern, Los Angeles, Marin, Santa Barbara, and Ventura Counties. Starting in 2009, the "Local Governments" category also includes local fire departments that have a back contract with the California Department of Forestry and Fire Protection (CAL FIRE) for emergency response and fire protection.*

a: 2017 Local Responsibility Area (LRA) data pending publication of 2017 Annual Wildfire Activity Statistics Report (Redbook), not yet published as of May 2018. B: Preliminary data; does NOT include other Federal Responsibility Area (FRA) lands, including U.S. Bureau of Land Management (BLM), National Park Service, U.S. Department of Fish and Wildlife, or Bureau of Indian Affairs (BIA) lands (all in U.S. Department of Interior). c: SRA data preliminary.

Source: 1987-2016 data: California wildfires and Acres for all Jurisdictions, as of August 2017; http://cdfdata.fire.ca.gov/pub/cdf/images/incidentstatsevents_269.pdf;

2017 data: CAL FIRE Incident Information, 2017 Combined year-to-date; http://cdfdata.fire.ca.gov/incidents/incidents_stats?year=2017

MAP 8.A: California Fire Perimeters 1985-2017 and Selected 2018 Fires



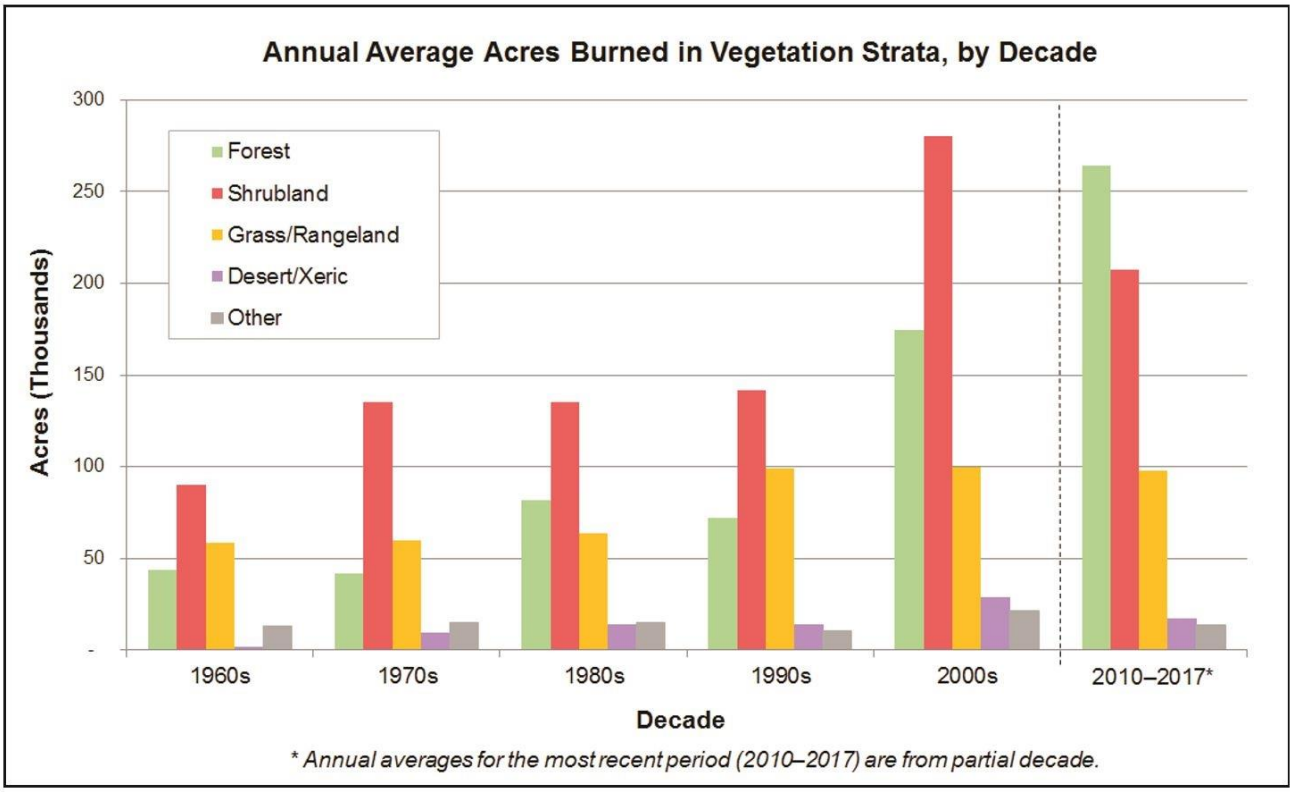
Map 8.A, based on CAL FIRE datasets shows fire perimeters from 1985 to 2017. Fires are shown by decade intervals, overlaid on public lands shown in grey. The most significant 2017 fires—the Thomas Fire, which burned the largest number of acres ever recorded, and the fires that make up the Northern California Wildfire Complex, which burned the largest number of structures on record—are delineated with special coloring on the map.

With climate change future years are projected to see a continuation or worsening of fire events across California. In general, the highest annual acreage burned wildfires occurs when ignitions coincide with extreme fire weather events (e.g., the 2017 Thomas Fire and the 2007 Southern California fire sieges, both of which occurred during severe Santa Ana winds) or when numerous ignitions occurred simultaneously and overwhelmed fire suppression capabilities (e.g., the 2008 lightening outbreak).

Chart 8.A shows that shrublands have historically experienced the greatest number of acres burned in California, which is not surprising given the high-intensity nature of fires in this ecotype coupled with a geographic range that commonly occurs near higher urban populations in the state (which result in increased numbers of human-related ignitions).

However, coniferous forests are burning in larger acreages in recent decades, with a significant increase in forest acreage burned during the 2010-2017 partial decade, which may be due to increased fuel loading in that ecotype. The increased fuel loading has been caused in part by a century of fire exclusion policies that limited the occurrence and extent of once-frequent but low-intensity fires that reduced woody debris and understory vegetation that increases fire intensity and severity. At present, there is heightened risk of large, high-severity fires in California's coniferous forests after the five-year (2012 to 2017) statewide drought that, along with other factors, resulted in the die-off of over 100 million trees.

Chart 8.A: Annual Acres Burned by Vegetation Type and Decade, 1960-2017



Source: CAL FIRE, California's Forests and Rangelands: 2017 Assessment

Twenty-two fires greater than 125,000 acres in size have burned in California. While modern day fires still burn far fewer acres than in the past, in general, large, destructive wildfires are increasingly becoming the "new normal" in California, even with increased firefighting personnel, equipment, technology, and training.

As shown in Table 8.B, 19 of the largest wildfires in California history have occurred since 1987, including the largest ever recorded, the Mendocino Complex Fire which was ignited in July 2018.

The increasing trend is due to a myriad of factors, including:

- Increased fuel loading following a century of fire exclusion policies
- More human-caused ignitions
- Climate change, which is influencing drought
- Greater silvicultural insect and disease impacts
- Increased tree mortality
- Lengthening of the "fire season," or annual time frame during which vegetative fuels are receptive to combustion.

Table 8.B: Largest California Wildfires, 125,000 Acres Burned or Greater

	FIRE NAME (cause)	IGNITION DATE	COUNTY	NUMBER OF ACRES BURNED	STRUCTURES DESTROYED	DEATHS
1	*MENDOCINO COMPLEX* [a] *(UNDER INVESTIGATION)*	July 2018	Mendocino, Lake, Colusa, Glenn	459,123[a]	280[a]	1[a]
2	*THOMAS (UNDER INVESTIGATION)*	December 2017	Ventura, Santa Barbara	281,893	1,063	2
3	*CEDAR (HUMAN RELATED)*	October 2003	San Diego	273,246	2,820	15
4	*RUSH (LIGHTNING)*	August 2012	Lassen	271,911 (CA)	0	0
5	*RIM (HUMAN RELATED)*	August 2013	Tuolumne	257,314	112	0
6	*ZACA (HUMAN RELATED)*	July 2007	Santa Barbara	240,207	1	0
7	*CARR FIRE (HUMAN RELATED)* [b]	July 2018	Shasta, Trinity	229,651[b]	1,604 [b]	7[b]
8	*MATILIJA (UNDETERMINED)*	September 1932	Ventura	220,000	0	0
9	*WITCH (POWER LINES)*	October 2007	San Diego	197,990	1,650	2
10	*KLAMATH THEATER COMPLEX (LIGHTNING)*	June 2008	Siskiyou	192,038	0	2
11	*MARBLE CONE (LIGHTNING)*	July 1977	Monterey	177,866	0	0
12	*LAGUNA (POWER LINES)*	September 1970	San Diego	175,425	382	5
13	*BASIN COMPLEX (LIGHTNING)*	June 2008	Monterey	162,818	58	0
12	*DAY (HUMAN RELATED)*	September 2006	Ventura	162,702	11	0
15	*STATION (HUMAN RELATED)*	August 2009	Los Angeles	160,557	209	2
16	*ROUGH (LIGHTNING)*	July 2015	Fresno	151,623	4	0
17	*MCNALLY (HUMAN RELATED)*	July 2002	Tulare	150,696	17	0
18	*STANISLAUS COMPLEX (LIGHTNING)*	August 1987	Tuolumne	145,980	28	1
19	*BIG BAR COMPLEX (LIGHTNING)*	August 1999	Trinity	140,948	0	0
20	*HAPPY CAMP COMPLEX (LIGHTNING)*	August 2014	Siskiyou	134,056	6	0
21	*SOBERANES (ILLEGAL CAMPFIRE)*	July 2016	Monterey	132,127	68	1
22	*CAMPBELL COMPLEX (POWERLINES)*	August 1990	Tehama	125,892	27	0

Source: California Department of Forestry and Fire Protection (CAL FIRE), Top 20 Largest California Wildfires, retrieved on September 12, 2018: http://fire.ca.gov/communications/downloads/fact_sheets/Top20_Destruction.pdf

[a] As of September 12, 2018, the Ranch Fire, part of the Mendocino Complex Fire is actively burning, with 98 percent containment. Therefore final data for this fire will differ from the preliminary data listed above. See CAL FIRE 2018 Redbook, once published for final fire incident data for the Mendocino Complex.

[b] As of September 12, 2018, the Carr Fire is 100 percent contained. See CAL FIRE 2018 Redbook, once published for final fire incident data for the Carr Fire.

Historic fire perimeters, displayed in Map 8.A, indicate a pattern that many wildfires occur in the foothills of both coastal and interior mountain ranges, especially in mountainous regions near populated areas of Southern California. Highlighted in Map 8.A with special colors are the October 2017 fires in Northern California, which collectively burned more structures than any fire event in California history and the December 2017 Thomas Fire in Ventura and Santa Barbara Counties, which is the largest fire in recorded California history. Wildfire annual perimeters can be viewed using the online mapping tool at: http://frap.fire.ca.gov/data/frapgisdata-sw-fireperimeters_download or https://www.geomac.gov.

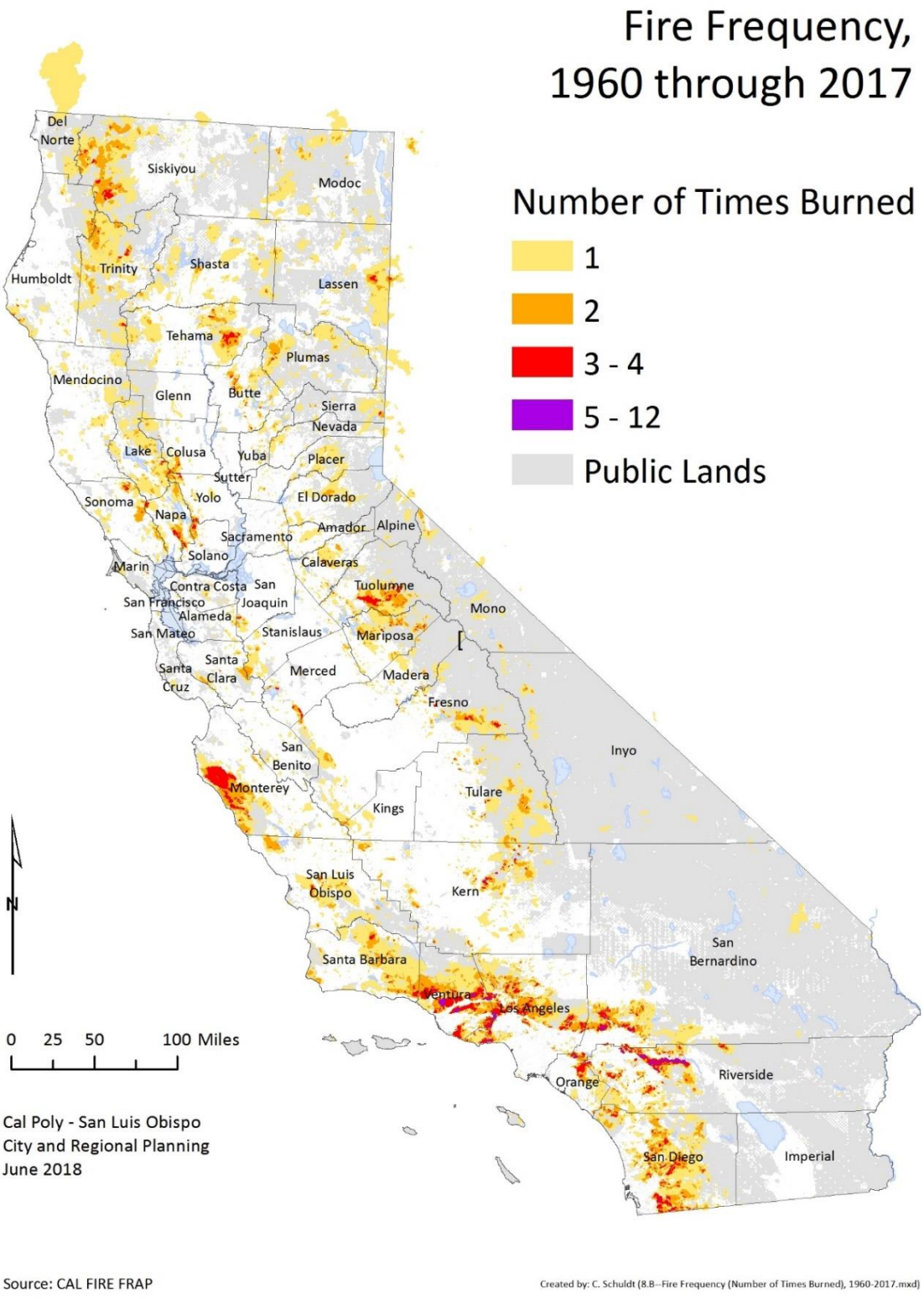
Map 8.B shows fire frequency from 1950 to 2017 across the state, based on datasets prepared by CAL FIRE. The analysis of number of repeat fires burned in a given area as shown in Map 8.B, illustrates that some areas in California are prone to burn with higher regularity than other areas and therefore have a heightened exposure to loss. This is of special concern in the South and Central Coast bioregions, which show the highest frequencies. These bioregions have significant amounts of shrubland plant communities (see Chart 8.A) where wildfires typically occur as high-intensity, stand-replacement fires.

While higher fire frequency has historically occurred in mixed-conifer forests, those fires were commonly low-intensity surface fires. However, given fuel buildup following a century of fire exclusion, a lengthened fire season predicted by many climate change models, forest management practices which removed many of the older, larger trees, and massive tree die-off following epidemic bark beetle infestations, fires in mixed-conifer forests are likely to continue to grow in both size and intensity.

California National Guard Helicopter Water-Drop Efforts During the Carr Fire, August 2018

Source: U.S. Army National Guard photo by Army Sgt. Lani O. Pascual

MAP 8.B: Fire Frequency (Number of Times Burned), 1950-2017



Map 8.B shows the distribution of burn frequency from 1950 to 2017. The South and Central Coast bioregions which have significant amounts of shrubland plant communities (see Chart 8.A) show highest burn frequencies.

Wildland Fire vs. Wildland-Urban Interface Fires

Fire science distinguishes between two types of wildfires: "wildland" fires, which burn predominately in undeveloped areas, and "wildland-urban Interface" (WUI) fires. This distinction is important because mitigation, damage, and actions related to the two types may differ significantly.

Wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may be beneficial to the landscape if they burn within the historic range of variability for fire size and intensity. Many species are adapted to California's natural fire regimes and flourish after a low or mixed severity burn. These fires also enhance ecosystem function by creating landscapes that have more variation, are more resilient to other disturbances, and are better able to withstand extremes in precipitation. The wildland fire may result in secondary negative impacts in the form of air pollution, soil erosion (resulting in siltation of streams and lakes), or mudslides, though these impacts tend to be far less than would occur following high severity fires in areas of historic fire suppression. However, unless these fires or their related secondary impacts occur in or near developed areas (see Map 8.C), they are rarely classified as disasters because they do not affect people or the built environment. Wildland fires, regardless of size, that burn primarily on federally managed lands are only rarely classified as disasters. For example, the 2007 Zaca Fire (240,207 acres) and 2009 Station Fire (160,577 acres), both of which burned on U.S. Forest Service lands, were enormous in size but did not result in federal disaster status. Those fires stand in contrast to the October 2017 Northern California wildfires, which were smaller in acreage but much more destructive, due to their proximity to larger urbanized areas.

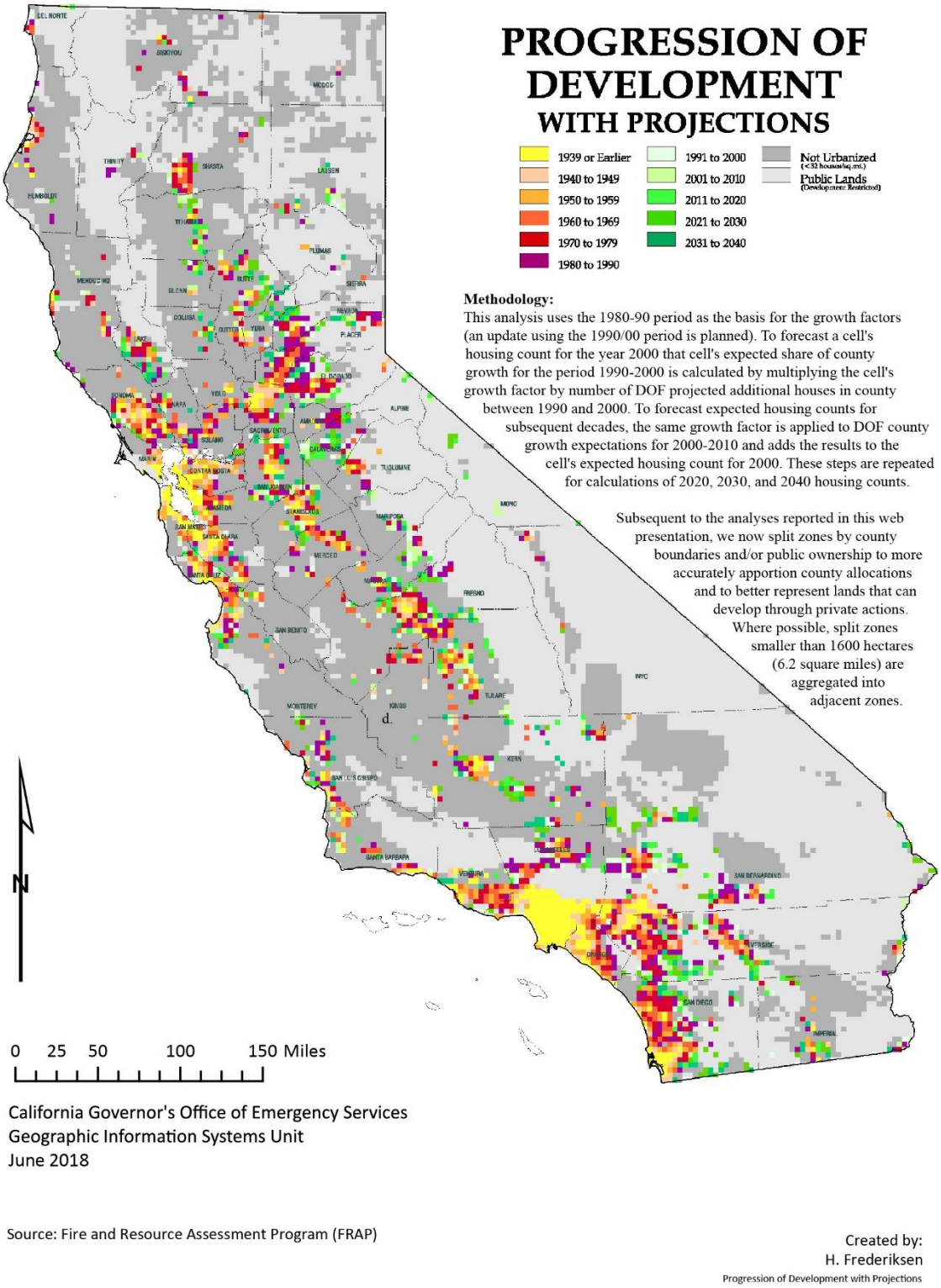
Research following century-old policies of fire exclusion and aggressive suppression has provided better understanding of the importance fire plays in the natural cycle of certain ecotypes, particularly mixed-conifer forests. As a result, prescribed fires have been used more extensively as a land management tool to replicate natural fire cycles. Unfortunately, a century of fire exclusion has led to a significant buildup of fuels in many mixed-conifer forests, which historically experienced frequent, low-intensity surface fires; thus there are significant areas where prescribed fires, in conjunction with mechanical thinning, may be appropriate to restore more natural forest conditions.

The WUI is characterized by the intersection of the natural and the built environments and has been defined as "the area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels" (Society of American Foresters). The WUI can be configured in many ways including a classic "interface" (e.g., a community that abuts a National Forest at a distinct boundary), an "intermix" (e.g., vegetative fuels distributed between buildings throughout a subdivision between buildings), or an "occlusion" (e.g., a community that completely surrounds a designated open space area).

WUI fires represent an increasingly significant concern for the State of California. California has a chronic and destructive WUI fire history with significant losses of life, structures, infrastructure, agriculture, and businesses. Most local governments that have submitted Local Hazard Mitigation Plans (LHMPs) have identified fire and WUI fires as specific hazards. Even relatively small-acreage WUI fires may result in disastrous damage.

Most WUI fires are suppressed before they exceed 10 acres. The remainder usually occur during episodes of hot, windy conditions that exceed initial attack capabilities and, therefore, are more likely to cause heightened losses to the built environment. Many WUI fires occur in areas that have a historical pattern of wildland fires that burn under extreme conditions. The most common extreme fire behavior factor is high, dry, warm foëhn winds, such as Santa Ana or Diablo winds, that occur in a predictable location and seasonable pattern. The pattern of increased damages is directly related to increased urban spread into areas that have historically had wildfire as part of the natural ecosystem.

Map 8.C: California's Projection of Development Based on Historical Factors



California has widespread WUI fire vulnerability, as indicated by Map 8.C. The map is based on CAL FIRE FRAP data that depict an increasing pattern of projected development encroaching into previously wildland area resulting in increased WUI zones.

The Challenge of Wildland-Urban Interface Fire and Repetitive Fire Loss

California has had a long history of disastrous WUI fires beginning with the 1923 Berkeley Fire that destroyed 584 buildings while burning only 123 acres. Many geographic areas have experienced repetitive WUI fires. For example, the area burned in the 1923 Berkeley Fire burned again in the 1991 Tunnel Fire, which is the second most destructive fire in state history. Similarly, the 2007 Witch Creek Fire (1,650 structures burned) in San Diego County reburned portions of the 2003 Cedar Fire area (2,820 structures burned).

Because of repeated losses in California, many WUI fires result in changes to state policies and regulations. Some significant WUI fires and their resultant changes include:

- The 1961 Bel Air Fire, which resulted in examination of wooden roofs in WUI areas
- The 1970 Fire Siege, which resulted in development of the Incident Command System (ICS) and enhanced state and federal wildland fire service mutual aid methods for WUI fires
- The 1980 Southern California Fire Siege, which resulted in the creation of the CAL FIRE Vegetation Management Program
- The 1985 Fire Siege, which resulted in major expansion of local government fire service mutual aid on WUI fires
- The 1988 49er Fire, which was identified as the "WUI fire problem of the future" due to urban expansion from the Sacramento metropolitan area into the Sierra foothills
- The 1991 Tunnel Fire, which resulted in creation of the Standardized Emergency Management System (SEMS) in California and legislation requiring Fire Hazard Severity Zone mapping in LRAs (Assembly Bill [AB] 337-Bates)
- The 1993 Laguna Fire, which resulted in creation of the California Fire Safe Council (CFSC) concept and changes to flammable roofing codes
- The 2003 Fire Siege, which resulted in changes to defensible space clearances from 30 feet to 100 feet and formation of the Governor's Blue Ribbon Commission on WUI fires
- The 2007 Angora Fire, which resulted in a California-Nevada Governors' Blue Ribbon Commission examination of WUI fire issues in Lake Tahoe area
- The 2008 Sylmar Fire in Los Angeles, which led to revision of mobile home fire safety requirements
- The 2009 Station Fire in the Angeles National Forest which led to re-examination of wildland fire management in proximity to urban areas
- The 2017 Northern California Fires and Thomas Fire which led to the July 12, 2018 California Public Utilities Commission resolution extending de-energization to all electric Investor Owned Utilities (IOU) during dangerous conditions to prevent wildfires
- The 2017 Northern California Fires and Thomas Fire have resulted in the introduction of multiple state bills to address fire hazards, which are being considered by state legislature in 2018 (pending at the time of final publication of the 2018 SHMP)

While the number of acres burned fluctuates from year to year, a trend over the last 30 years that has remained constant is the rise in wildfire-related losses. Likewise, fires that originate in the WUI from structures or other improvements can cause damage to wildland resources. The challenge is in how to reduce wildfire losses within a framework of California's diversity of natural and built environments.

Table 8.C shows the most disastrous WUI fires listed in order of structures destroyed. As of August 2018, eighty-five percent of the most damaging WUI fires (as measured by number of structures burned) have occurred in the last three decades.

Table 8.C: Top 20 Most Destructive California Wildland-Urban Interface (WUI) Fires, by Structures Destroyed

	FIRE NAME	IGNITION DATE	COUNTY	NUMBER OF ACRES BURNED	NUMBER OF STRUCTURES DESTROYED	DEATHS
1	*TUBBS*	October 2017	Sonoma	36,807	5,636	22
2	*TUNNEL*	October 1991	Alameda	1,600	2,900	25
3	*CEDAR*	October 2003	San Diego	273,246	2,820	15
4	*VALLEY*	September 2015	Lake, Napa, Sonoma	76,067	1,955	4
5	*WITCH*	October 2007	San Diego	197,990	1,650	2
6	*CARR*	July 2018	Shasta, Trinity	229,651[a]	1,604 [a]	7[a]
7	*NUNS*	October 2017	Sonoma	54,382	1,355	2
8	*THOMAS*	October 2017	Ventura, Santa Barbara	281,893	1,063	2
9	*OLD*	October 2003	San Bernardino	91,281	1,003	6
20	*JONES*	October 1999	Shasta	26,200	954	1
12	*BUTTE (POWERLINES)*	September 2015	Amador, Calaveras	70,868	921	2
12	*ATLAS*	October 2017	Napa, Solano	51,624	781	6
13	*PAINT*	June 1990	Santa Barbara	4,900	641	1
14	*FOUNTAIN*	August 1992	Shasta	63,960	636	0
15	*SAYRE*	November 2008	Los Angeles	11,262	604	0
16	*CITY OF BERKELEY*	September 1923	Alameda	130	584	0
17	*HARRIS*	October 2007	San Diego	90,440	548	8
18	*REDWOOD VALLEY*	October 2017	Mendocino	36,523	544	9
19	*BEL AIR*	November 1961	Los Angeles	6,090	484	0
20	*LAGUNA FIRE*	October 1993	Orange	14,437	441	0

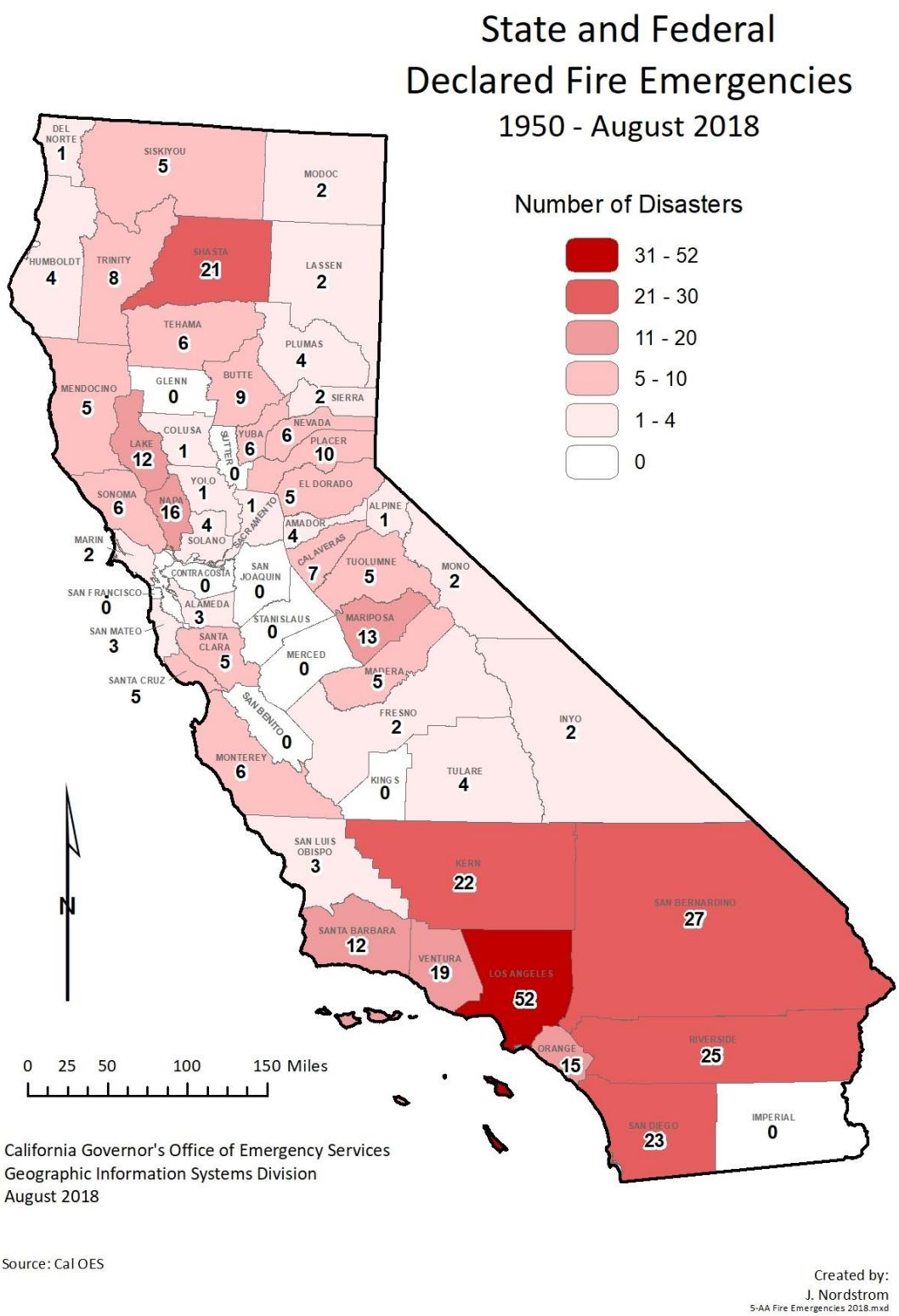
Source: California Department of Forestry and Fire Protection (CAL FIRE), Top 20 Largest California Wildfires, retrieved on September 12, 2018: http://fire.ca.gov/communications/downloads/fact_sheets/Top20_Destruction.pdf

[a] As of September 12, 2018, the Carr Fire is 100 percent contained. See CAL FIRE 2018 Redbook, once published for final fire incident data for the Carr Fire.

It should be noted that while most counties have experienced a state or federally declared fire disaster (see Map 8.D), the majority of those declarations have occurred in Southern California, due to a large population base located in areas that commonly have volatile shrublands, steep slopes, and annually occurring Santa Ana winds. However, there are growing concerns regarding increased wildfire frequency and severity in Northern California shown in climate change models. These concerns were substantiated in 2017 and 2018 with the catastrophically destructive nature of three record breaking fires, the October 2017 Northern California fires in Sonoma, Napa, and Solano Counties; the 2018 Carr Fire in Shasta County; and the 2018 Mendocino Complex in Mendocino, Lake, Glenn, and Colusa Counties.

Declaration of a wildland fire event as a federal disaster is based on monetary thresholds of damages. Some wildland fires, while significant in size and destruction of natural resources, may be located in remote areas with minimal development, these fires thus may not result in high dollar value of losses since destruction of structures or infrastructure may be minimal in these areas.

MAP 8.D: State and Federal Declared Fire Disasters, 1950-February 2018



Map 8.D shows declared wildfire disasters from 1950 to August 2018. The highest numbers were in Southern California, showing the influence of major populated urban areas in Los Angeles and other nearby counties on fire emergency and disaster events.

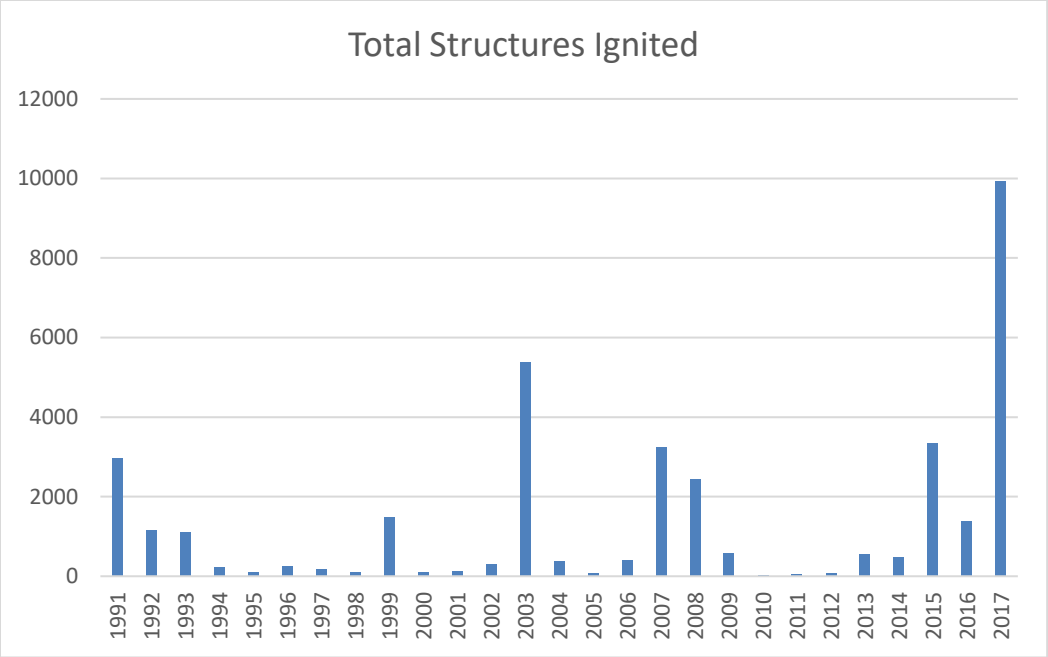
Significant WUI Fire Events

Via aggressive initial attack, CAL FIRE aims to limit 90 percent of all wildfires to fewer than 10 total acres burned. As evidenced by the historical FIRE data presented in Tables 8.B and 8.C, some ignitions exceed initial firefighting capabilities and grow to large fire events (defined by the state as fires exceeding 300 acres). These large fires commonly burn under severe weather conditions. Structures do not burn exclusively in large fire events but are certainly at greater risk during these events, because large fires commonly occur during heightened fire weather and because firefighting capabilities are overtaxed.

Chart 8.B shows the number of structures ignited during large wildfires (i.e., greater than 300 acres) from 1991 to 2017. It should be noted that the large-scale destruction shown in 2017 only includes data from the October Tubbs Fire and others in Northern California (over 5,000 structures lost) and the December Thomas Fire (over 1,000 structures lost). Complete final 2017 wildfire data are pending release of the 2017 Historical Wildfire Activity Statistics (Redbook), not yet published as of August 2018.

While structures burn every year, most damaging fires have occurred when ignitions coincided with severe weather that included critically high temperatures, low relative humidity, and perhaps most importantly, high winds. For example, both the October 2017 northern California fires and the December 2017 Thomas fire occurred during extreme wind events.

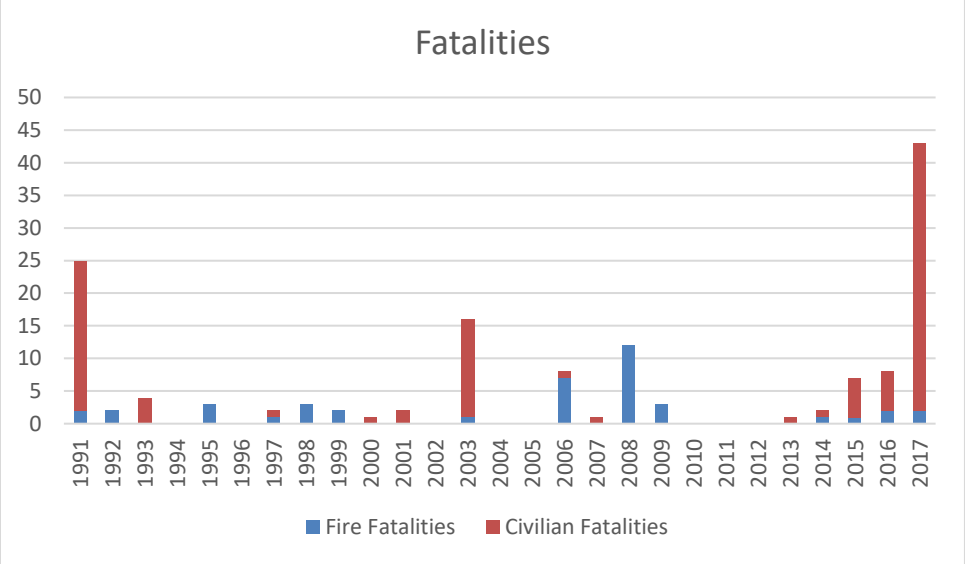
Chart 8.B: Number of Structures Ignited During a Large Wildfire (Greater than 300 Acres), 1991-2017



Source: Data from annual California Department of Forestry and Fire Protection (CAL FIRE) Historical Wildfire Activity Statistics (Redbooks).
Note: 1991 only includes data from the Tunnel Fire in Oakland and from fires originating on sites in which the state had primary fire response obligations. Beginning in 1992, the State began accounting for all fire damages for all jurisdictions.
2017 fire data included is preliminary and only includes preliminary data from the October 2017 Northern California fires and the December 2017 Thomas Fire.

The 2018 Carr Fire (1,604 structures lost), the 2017 Tubbs Fire (5,636 structures lost), and the 2015 Valley Fire (1,955 structures lost) all involved extreme weather conditions. Unfortunately, these conditions also seem to correlate with firefighter and civilian casualties, as shown in Chart 8.C. Data are from annual CAL FIRE Historical Wildfire Activity Statistics (Redbooks). Specific data from the CAL FIRE Redbooks can be found at http://www.fire.ca.gov/fire_protection/fire_protection_fire_info_redbooks.

Chart 8.C: Firefighter and civilian fatalities occurring during a large wildfire (>300 acres) from 1991 to 2017



Source: 1991-2016 data per annual California Department of Forestry and Fire Protection (CAL FIRE) Historical Wildfire Activity Statistics (Redbooks).
**2017 fire data are preliminary; final data are pending release of 2017 Redbook, not yet published as of August 2018.*
Note: 1991 only includes data from the Tunnel Fire in Oakland and from fires originating on sites in which the state had primary fire response obligations. Beginning in 1992, the State began accounting for all fire damages for all jurisdictions.

Because the potential for destructive wildfires exists throughout the state, CAL FIRE's Fire and Resource Assessment Program (FRAP) is legally mandated to periodically identify the potential fire hazard across California. Three designations of Fire Hazard Severity Zones (FHSZs)—moderate, high, and very high—have been assigned to all areas where the State of California has primary fire protection responsibility, called State Responsibility Areas (SRAs). FHSZ designation is based upon a quantitative assessment of potential fire behavior and burn probability of a given area. FHSZs in SRAs are shown in Map 8.E.

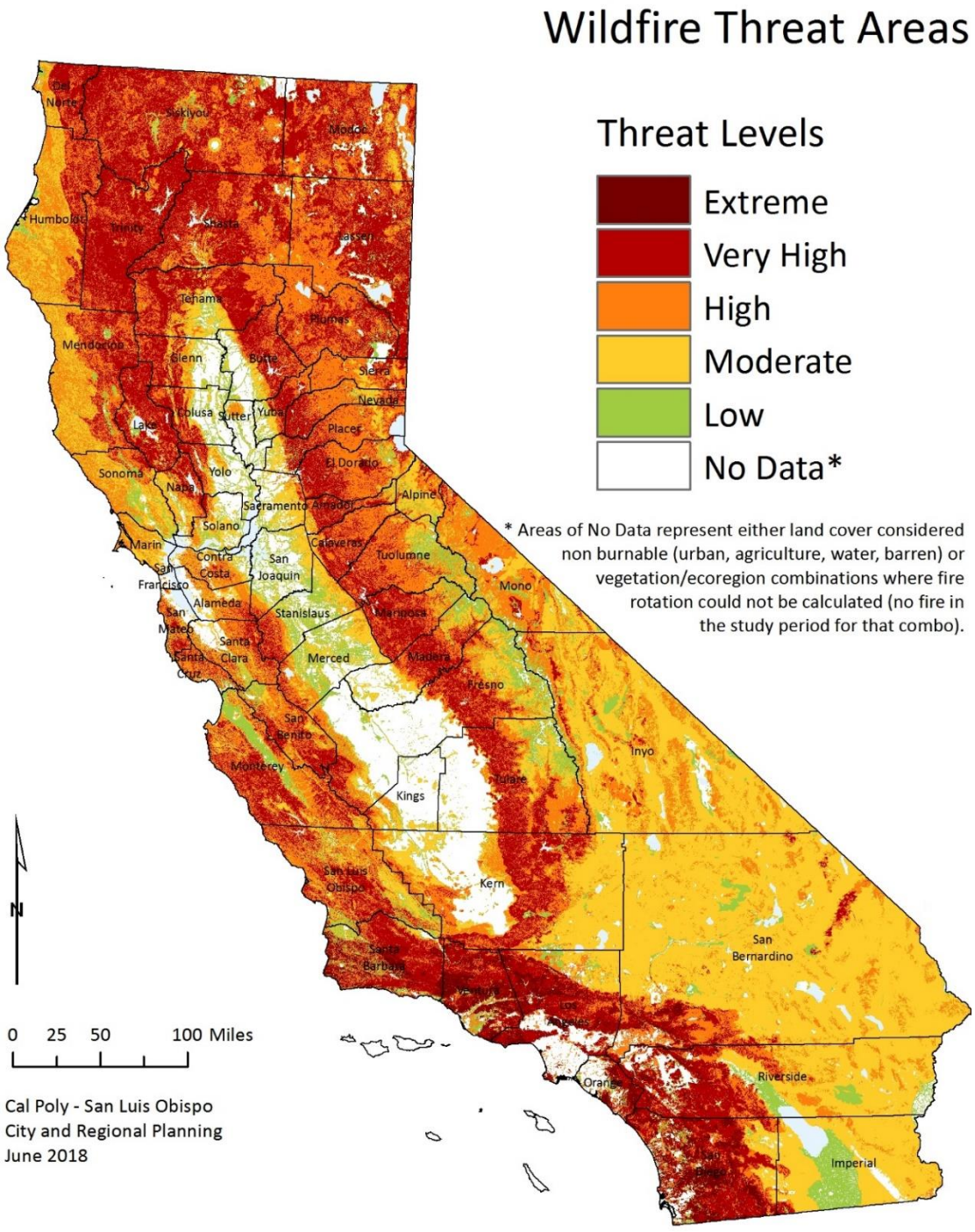
While the entirety of California has been assessed for wildfire threat (see Map 8.F), the assessment might not capture threats on Federal Responsibility Area (FRA) lands, where the FHSZ designation is not used. Further, Local Responsibility Area (LRA) lands are only included if 1) the parcel is designated as a Very High Fire Hazard Severity Zone (VHFHSZ), and (2) the local jurisdiction has elected to accept the state's recommended designation. Many LRA jurisdictions choose to not accept a recommended VHFHSZ designation due to reasons such as perceived negative impacts on property values, potential loss of residential fire insurance, and others. If an LRA jurisdiction chooses to adopt the state's recommendation for a VHFHSZ designation, then residents there are mandated to comply with various state mitigation regulations, including maintaining vegetative defensible space and adhering to the WUI Fire Code for any new construction in which over 50 percent of the structure will be affected. (Note: Explanation of Federal Responsibility Areas [FRAs], State Responsibility Areas [SRAs], and Local Responsibility Areas [LRAs] is included in *Section 8.1.5.3*.)

FHSZ designations identify the potential fire hazard (not risk) in a given area in the absence of mitigation activities. "Hazard" is defined here as the physical condition that can lead to damage to a particular asset or resource. Thus, fire hazard involves the physical conditions related to fire and its ability to cause damage, specifically how often a fire burns a given locale and what the fire is like when it burns (its fire behavior). Thus, fire hazard only refers to the potential characteristics of the fire itself. Risk, however, is defined as the likelihood of loss by wildfire. Thus, a home designated as being in a VHFHSZ might actually be at low risk of loss, due to proper construction materials and maintenance of vegetative fuels. Similarly, a home might be located in a moderate FHSZ (the lowest designation) but be at high risk of burning if the home is constructed with combustible materials and has dense, flammable vegetation that abuts the structure.

MAP 8.E: Fire Hazard Severity Zones in State Responsibility Areas

Map 8.E shows Fire Hazard Severity Zones only in SRAs. SRAs are essentially private lands in WUI areas within unincorporated county areas. They do not include Local Responsibility Areas (LRAs) within cities or federally owned lands such as national forests. Additional maps can be found on CAL FIRE's FRAP website: http://frap.fire.ca.gov/.

Map 8.F: State of California Fire Threat

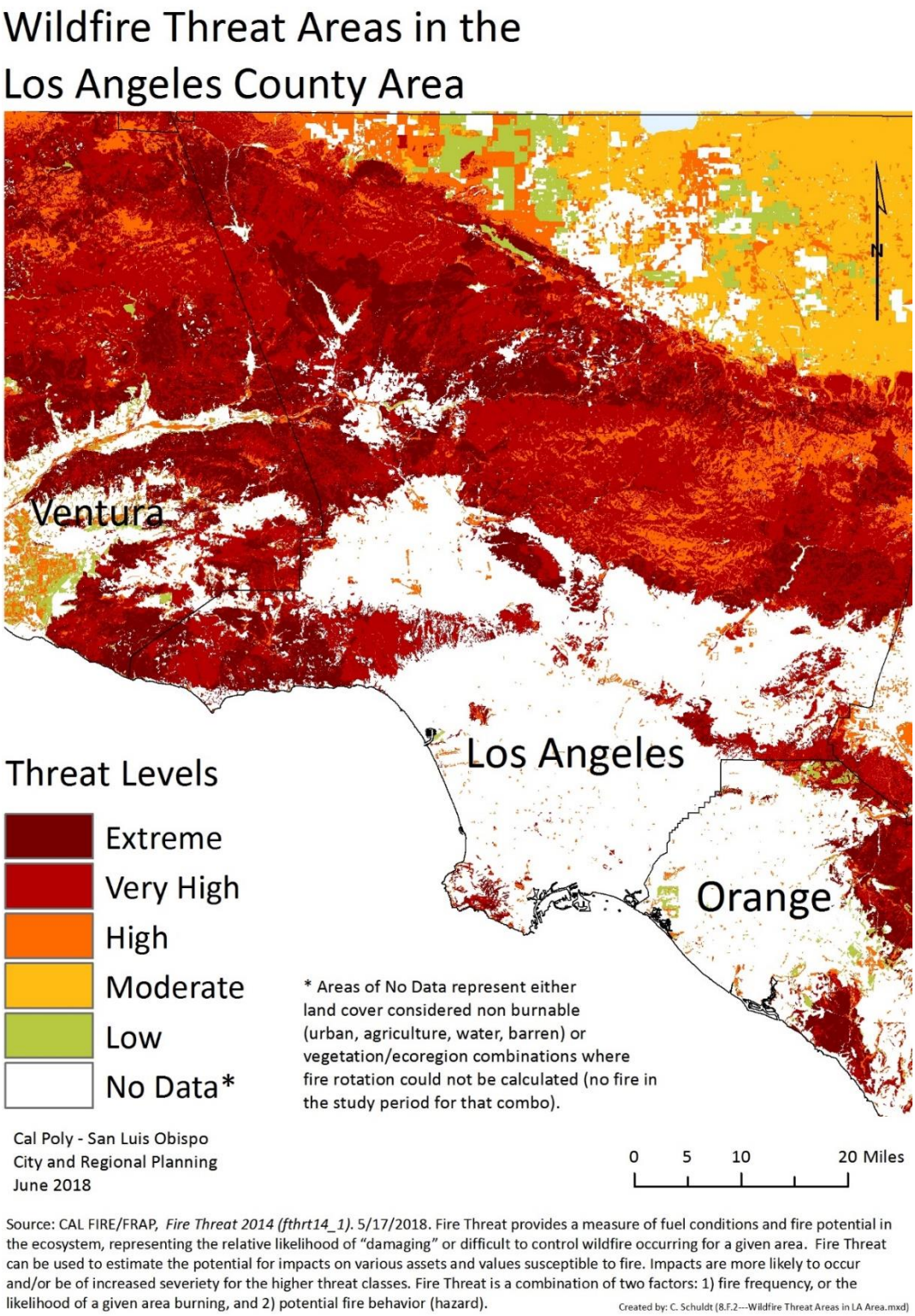


Source: CAL FIRE/FRAP, *Fire Threat 2014 (fthrt14_1).* Fire Threat provides a measure of fuel conditions and fire potential in the ecosystem, representing the relative likelihood of "damaging" or difficult to control wildfire occurring for a given area. Fire Threat can be used to estimate the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severiety for the higher threat classes. Fire Threat is a combination of two factors: 1) fire frequency, or the likelihood of a given area burning, and 2) potential fire behavior (hazard).

Created by: C. Schuldt (8.F--Wildfire Threat Areas.mxd)

Map 8.F, prepared using 2014 fire threat data published by CAL FIRE, shows wildfire threat widely distributed across hilly and mountainous terrain throughout California. Threat is a measure of the potential fire severity. Those urban areas shown as facing a moderate to very high threat in this model are areas exposed to WUI fires and windblown embers that could result in urban conflagration.

Map 8.G: Wildfire Threat in the Los Angeles County Area



Map 8.G is an enlargement of part of Map 8.F and shows the Los Angeles County area. As noted in the map, CAL FIRE does not develop threat data on various areas within the state (represented in white in the map) where land cover is considered non-burnable (urban, agriculture, water, or barren) or where vegetation/ecoregion combinations where fire rotation could not be calculated.

Climate Change and Wildfire Hazard

Climate change has the potential to alter wildfire hazards in frequency, size, and severity beyond the historic range by increasing the length of the fire season, creating drier fuels, decreasing forest health,[195] and altering ignition patterns. The impact of climate change, as a driver for increased wildfire severity, is expected to be greatest in the mixed-conifer forests of the Sierra Nevada and Northern California; less impact is expected for fires in chaparral shrublands, which are expected to be more driven by increases in human-caused ignitions.[196]

Both the 2009 California Climate Adaptation Strategy[197] and the *Safeguarding California Plan: 2018 Update* to the Climate Adaptation Strategy describe the ways in which climate change alters some of the primary factors that govern wildfire behavior: weather, fuels, and topography. While climate change does not affect topography, weather (wind, temperature, etc.) and fuels (vegetation type, amount, and moisture) are influenced by climate change. While shifts in seasonal precipitation and temperature are the primary driver of changes in wildfire frequency and severity, several other factors influence wildfire hazards. These complex interacting influences may be summarized as follows:

To assess local risk and develop hazards mitigation measures, communities must include local experts for understanding forest health and conditions in their region in the strategy development process.

- *Temperature:* Climate change is projected to result in increased average temperature, as well as increased numbers of extreme heat and heat wave events. These changes alter moisture levels in vegetation (fuel) and, ultimately, fuel type. The overall outcome of these shifts is an increase in the expected number of large, high-intensity fires expected.
- *Precipitation Changes and Drought*: Climate change may reduce the annual total amount of rain, but just as critical to its influence on wildfire are expected changes in annual distribution of precipitation and in the duration and frequency of drought events. Periods without precipitation influence fuel moisture and the associated fire potential and behavior.
- *Fuel Health and Structure*: Long-term changes in precipitation and temperature patterns can alter both the health of an undeveloped area and its vegetative structure. Less healthy trees and vegetation may be more vulnerable to fire, thus altering the fire behavior. In addition, climate change may alter the composition of species defining a particular landscape. This alteration in species composition may include increased populations of exotic and invasive species. These changes will influence wildfire frequency, severity, and behavior.
- *Pests:* Changes to the annual patterns of temperature and precipitation can alter the timing, population, and type of pests in a landscape. Shorter, warmer winters or prolonged drought result in stressed trees. These trees are suitable habitat for many pests and result in larger pest populations. For example, many species of bark beetle are associated with high levels of tree mortality in California forests.[198] Dead trees increase the wildfire potential of a forest and cause heightened fire behavior, especially before dead needles fall and begin decomposition.
- *Fire Ignition and Behavior:* In addition to change in seasonal temperature and precipitation patterns, climate change is associated with increased wind and storm frequency and severity. These changes can increase ignitions via lightning[199] and be further exacerbated by high winds that can serve to bolster large wildfires.[200]

The above descriptions are only general summaries of the interacting influences of climate change. To assess local risks and develop mitigation measures, communities must include local experts in order to understand forest health and conditions in their region.

[195] California Natural Resources Agency & California Emergency Management Agency. California Adaptation Planning Guide. 2012. Sacramento: author.
[196] Keeley & Syphard 2017
[197] California Natural Resources Agency. 2009 California Climate Adaptation Strategy. 2009. Sacramento: author, 200 p.
[198] http://www.tuolumnecounty.ca.gov/DocumentCenter/View/5742
[199] Price and Rind, 1994; Lutz et al., 2009.
[200] Miller and Schlegel, 2006.

As mentioned previously, wildland fire can have secondary negative impacts in the form of air pollution, soil erosion resulting in siltation in streams and lakes, or mudslides. One result of the increased wildfire intensity and frequency caused by climate change is increased particulate matter resulting from combustion. Particulate matter, one of six U.S. Environmental Protection Agency (EPA) criteria air pollutants, is a mixture that can include organic chemicals, dust, soot, and metals. These particles increase air pollution and cause short- and long-term adverse health effects. Smaller particulate matter is capable of reaching deep into the lungs and causing a host of diseases, including lung cancer, heart disease, respiratory disease, acute respiratory infections, and mortality. For more information about air pollution hazard and particulate matter, see *Section 9.1.2*.

Neighborhoods Destroyed During the October 2017 Wildfires

Source: California Governor's Office of Emergency Services (Cal OES)

Urban Fire Conflagration Potential

Although the SHMP focuses primarily on wildfires, it also recognizes the potential threat of urban conflagrations, or large disastrous fires in which structures themselves are the primary fuel that carries the fire. These urban fires are a significant hazard that can occur due to wildfires, earthquakes, gas leaks, chemical explosions, arson, or other ignition sources.

While ignition sources for urban conflagrations within developed areas have been reduced via improvements in community design, construction materials, and building fire protection systems, continued development in fire-prone areas subsequently increases the potential for an urban conflagration via WUI fires, especially in high-density developments that are adjacent to wildland areas that are prone to seasonably strong, dry winds (e.g., Diablo winds in the Bay Area or Santa Ana winds in Southern California). For example, the 2017 Tubbs Fire moved from the wildlands into urbanized Santa Rosa in Sonoma County and, after crossing the six-lane U.S. Highway 101, destroyed approximately 1,500 homes in the Coffey Park neighborhood alone. This portion of the Tubbs Fire movement was fueled primarily by house-to-house spread. Similarly, the 1991 Tunnel Fire near Oakland began as a vegetation fire and then transitioned into an urban conflagration that eventually burned 2,900 structures and was also largely propagated by house-to-house spread. Thus, in both cases, the fires began in wildland areas, fueled by dry vegetation and high winds, and then transformed into fires in residential areas, fueled largely by the structures themselves.

Urban conflagration fires remain a risk to human safety. One reason for this ongoing risk is the current trend toward increased urban density and infill in areas adjacent to the wildland-urban interface (WUI). In an effort to keep housing more affordable and close to urban jobs, areas previously left as open space due to steep slopes and high wildland fire risk are being reconsidered as infill areas for high-density housing. These types of high-density infill, particularly in areas prone to seasonable hot, dry winds, are most prone to urban conflagrations.

Destruction from the October 2017 Wildfires

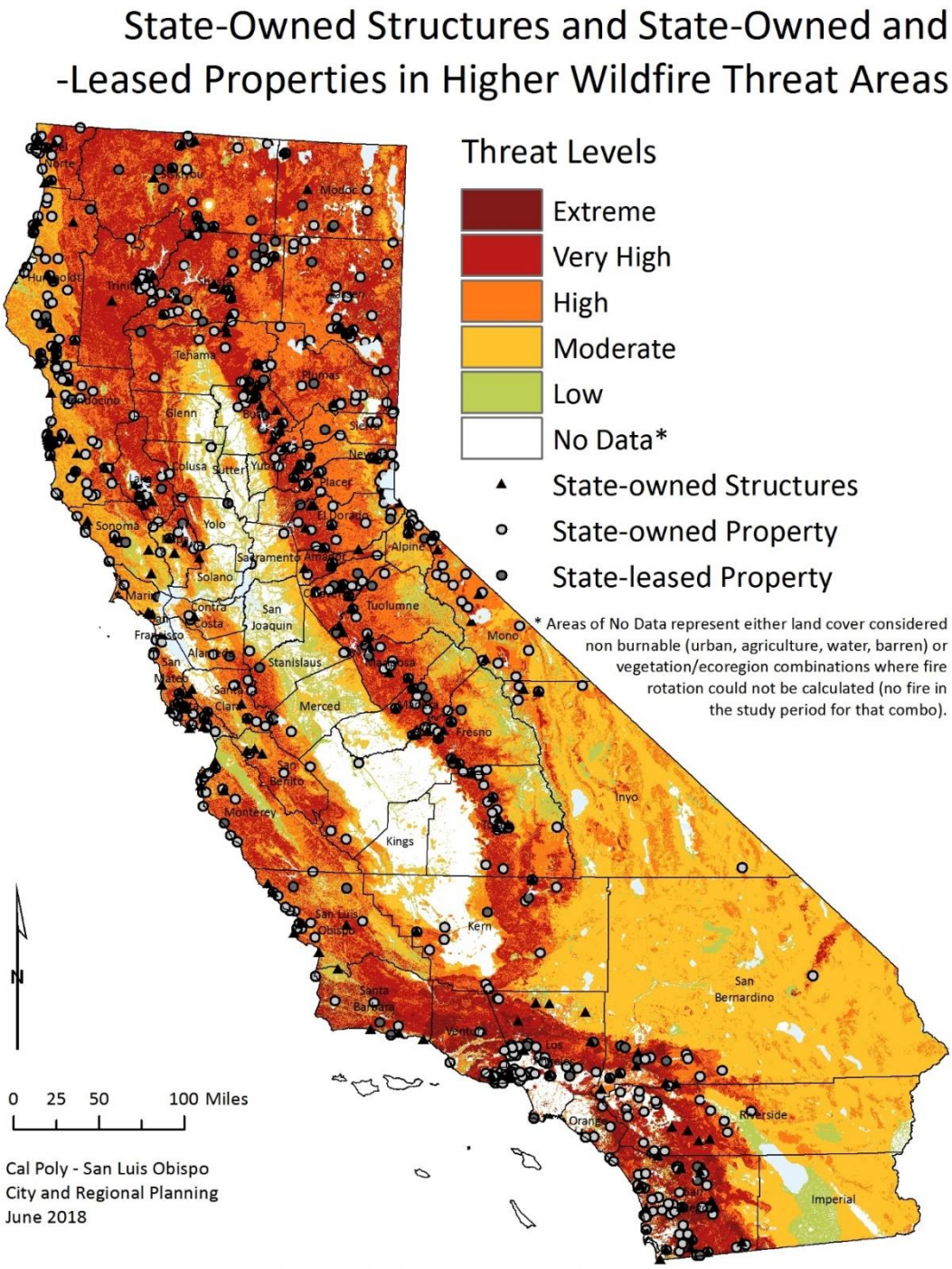
Source: California Governor's Office of Emergency Services (Cal OES)

8.1.3 ASSESSMENT OF STATE WILDFIRE VULNERABILITY AND POTENTIAL LOSSES

8.1.3.1 POTENTIAL DOLLAR LOSSES FOR STATE-OWNED AND -LEASED FACILITIES

Estimating potential dollar losses for state-owned and -leased facilities involves a careful review of locations of these facilities in relation to varying kinds of wildfire hazards. Many of these facilities are within urban areas where wildfire threat is relatively low. However, some facilities are within urban fringe areas, including WUIs, and a few are within VHFHSZs. Completion of the current CAL FIRE remapping will provide specific new insights into the state's overall risk exposure due to wildfire threats to critical facilities.

Map 8.H: State-Owned Buildings and State-Owned and Leased Properties in Higher Wildfire Threat Areas



Source:. Source: CAL FIRE/FRAP, *Fire Threat 2014 (fthrt14_1).* Fire Threat provides a measure of fuel conditions and fire potential in the ecosystem, representing the relative likelihood of "damaging" or difficult to control wildfire occurring for a given area. Fire Threat can be used to estimate the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severiety for the higher threat classes. Fire Threat is a combination of two factors: 1) fire frequency, or the likelihood of a given area burning, and 2) potential fire behavior (hazard). State Property Inventory data from California Dept. of General Services, March 2017.

Created by: C. Schuldt (8.G--State Property and Wildfire Threat.mxd)

Map 8.H indicates the location of state-owned buildings and state-owned and -leased properties in extreme, very high, high, and moderate fire threat areas. Concentrations of state-owned buildings and state-owned and -leased properties subject to these higher fire threats are found primarily in mountainous areas.

Table 8.D shows an estimate of maximum potential exposure of state-owned and -leased facilities to wildfires, given best available data. It identifies a total wildfire risk exposure of $34.6 billion for buildings in very high and extreme Risk areas. These figures overstate potential losses from this hazard for two fundamental reasons: 1) wildfire events are centered within one region or another, and 2) only a small portion of the facilities inventory within a region may be affected by any given wildfire event.

Table 8.D: Potential Loss of State Facilities from Wildfire Hazards

	State Ownership Status	Number of Buildings	Square Feet	$ at Risk (billions)
Zone 2 (High Risk)	Own	8,115	107,041,618	37.46
	Lease	1,561	14,369,254	5.03
	Total	*9,676*	*121,410,872*	*42.49*
Zone 3 (Very High Risk)	Own	13,073	90,591,456	31.71
	Lease	451	1,901,682	0.67
	Total	*13,524*	*92,493,138*	*32.38*
Zone 4 (Extreme Risk)	Own	1,080	6,228,278	2.18
	Lease	33	107,619	0.04
	Total	*1,113*	*6,335,897*	*2.22*
Zones 2-4 TOTAL				***Greater than $77 billion***

Source: Department of General Services, California Governor's Office of Emergency Services (Cal OES)

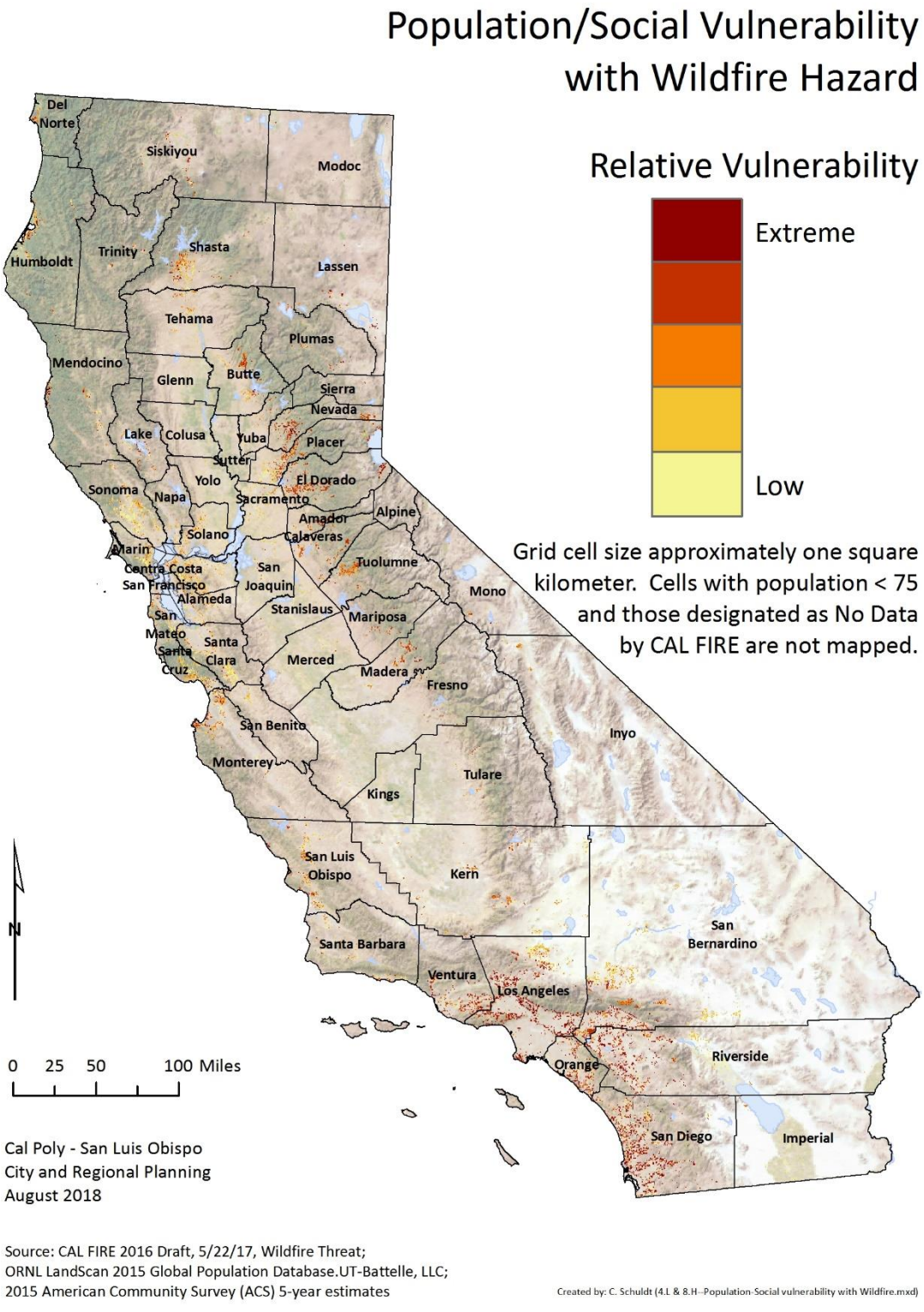
8.1.3.2 WILDFIRE VULNERABLE AREAS AND POPULATIONS

Wildfires are the most frequent source of declared disasters and account for the third highest combined losses. Wildfire vulnerability in California is found chiefly in wildland-urban-interface (WUI) communities, located largely on the periphery of suburban areas in Southern California, coastal mountains, and heavily wooded areas of the Sierra Nevada. Some areas burn frequently, particularly the hills surrounding Los Angeles, San Diego, and Big Sur, as well as more isolated mountains in the Coast Ranges and Sierra Nevada.

Map 8.I uses 2017 wildfire threat Geographic Information Systems (GIS) data compiled by CAL FIRE's Fire and Resource Assessment Program (FRAP) to show areas where vulnerable populations are subject to wildfire hazard. Its original data take into account fuel loads and fire history, among other factors, to create five threat classes: extreme, very high, high, moderate, and little or no threat. Map 8.I shows moderate to high concentrations of population/social vulnerability in areas at high risk of wildfire hazards. Most heavily affected areas are in the hilly and mountainous portions of the San Francisco Bay Area, Southern California, and the Sierra Nevada.

For details about development of the social vulnerability model, see *Chapter 4, Section 4.4.4 Statewide GIS Hazard Analysis*, and *Appendix N* which describes the indexing used for preparing/updating of the model.

Map 8.I: Population/Social Vulnerability with Wildfire Hazard



8.1.3.3 FIRE EFFECTS ON INFRASTRUCTURE

A given fire's impact can ripple well beyond the actual final boundary if critical infrastructure is impaired. For example, if communication infrastructure (e.g., internet, phone, television, radio) is interrupted, then residential emergency notification can be severely hampered. For example, during the 2017 Tubbs Fire, many cell phone towers were reportedly destroyed early in the fire, which may have affected residents who opted in for emergency notifications via their cell phones. Similarly, notification via radio and television can be impaired, which can delay notification and subsequent residential evacuation. Likewise, destruction of radio relay towers can hamper communications and subsequent safety of first responders. After the fire, the burned infrastructure can severely impair communication well outside the fire boundary; for example, it was reported that destruction of communication infrastructure during the Tubbs Fire in Sonoma and Napa Counties affected cell coverage for subscribers to one cell provider for approximately a week in areas as far away as Humboldt County.

Like communication infrastructure, destruction of energy delivery systems (e.g., electricity) can severely hamper communication (and subsequent emergency notification) to residents via internet, phone, radio, television, and others. It can also affect critical medical services and other equipment (e.g., water pumps) if redundancies such as generators are not in place. Further, downed power lines can block roadways, impeding ingress by first responders and egress by evacuees. Because power needs are ubiquitous during and after a fire event, rapid replacement of destroyed electrical delivery infrastructure should be considered paramount in the early stages of fire recovery.

Transportation infrastructure (e.g., roads, bridges, and rail) can severely impair emergency response by both first responders and by residents. For example, U.S. Highway 101 was periodically closed during the 2017 Thomas Fire, which impaired movement of residents, tourists, and commerce that relied on roadways for deliveries.

The 2017 Thomas Fire burns along Highway 101

Source: C. Dicus

Similarly, damaged railways in the 2004 Gaviota Fire near Santa Barbara and the 2016 Blue Cut Fire near the Tejon Pass in San Bernardino severely impaired north/south rail in California, resulting in immense losses to the rail

industry and the customers that relied on their services. Damaged roadways, bridges, and railways can impair transportation for extended periods of time, especially if alternatives are limited.

Water delivery systems and water storage facilities may be dramatically affected by fire. With the exception of the North Coast, most watersheds in California have extensive downstream water supply infrastructures serving the majority of urban and rural residents, larger municipalities, and agricultural users. Increased sediment loading due to soil erosion resulting from severe fires can also decrease storage capacity in dams and reservoirs. As these source watersheds are an essential component of the state's water system, actions to restore and maintain forested watersheds (including prescribed fire and preventing fragmentation and development through conservation easements) can reduce the risk of damaging fires that impair water supplies. To protect water delivery, the State Water Resources Control Board recommended to public water systems that they take necessary precautions to prepare for and mitigate potential effects from a wildfire by maintaining defensible space.

8.1.3.4 WILDFIRE AND EFFECTS ON THE NATURAL ENVIRONMENT

Fire is a natural and critical ecosystem process in most of California's diverse terrestrial ecosystems, dictating in part the types, structure, and spatial extent of native vegetation in the state. Many of California's ecosystems are adapted to a historic "fire regime," which characterizes historic patterns of fire occurrence in a given area. Fire regimes include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability dependent on ecotype and geographical location.[201]

Ecosystem stability is impaired when any of the attributes for a given fire regime diverge from their range of natural variability, a phenomenon that is becoming increasingly common throughout California. In general, when compared to historic fire regimes, many mixed-conifer forests now experience fewer acres burned[202], but the fires that do occur are more intense and severe, while chaparral shrublands experience fire at a greater frequency. Both trends have profound impacts on ecosystem stability throughout California.

A principal cause of intensifying wildfire severity in mixed-conifer forest types in the state is the mounting quantity and continuity of forest fuels that have been brought about by a century of fire exclusion. Fire exclusion in California and throughout the western U.S. has been attributed largely to fire suppression, elimination of Native American ignitions, and introduction of grazing that removed fine fuels necessary for fire spread in and between forested stands. Conifer forests that historically experienced frequent but low-intensity surface fires, which are prevalent in the montane areas of California, are now predisposed to high-intensity, high-severity crown fires because of both fire suppression practices and the removal of many of the older, more fire-resistant trees.

Conversely, native chaparral shrublands, which typically burn in high-intensity stand-replacing events, are threatened due to too-frequent ignitions, which are leading to a type conversion to non-native grasslands.[203] This trend is particularly acute in Southern California, where burgeoning population growth in fire-prone areas has resulted in increased ignitions through accident or arson.[204]

Detrimental Effects of Wildfire on Ecosystem Components

CAL FIRE's Fire and Resource Assessment Program (FRAP) is required by the California legislature to produce periodic assessments of the forests and rangelands of California. The Forest and Range 2003 Assessment, the subsequent California's Forests and Rangelands: 2010 Assessment, along with the 2010 California Fire Plan identified some detrimental effects of fire for various ecosystem components, focusing primarily on impacts that follow high-intensity stand-replacing events outside the range of natural variability in conifer stands.

[201] Sugihara et al., 2006.
[202] See Marlon et al. 2012 for a description of the "fire deficit"
[203] Keeley et al., 2009.
[204] Syphard et al., 2008

In August 2018 CAL FIRE released California's Forests and Rangelands: 2017 Assessment. Due to the timing of the 2017 Assessment release, a detailed description of 2017 Assessment content addressing wildfire effects on ecosystems could not be included in the 2018 SHMP, however, certain detrimental effects of wildfire on ecosystem components identified in the 2003 and 2010 Assessment are described below.

Fire Effects on Timberlands

Timberlands, defined as conifer-dominated habitat types that likely support 20 cubic feet of volume growth per year and are not in reserved status, are a significant economic resource in California and are the primary economic base in some rural areas. Fire can pose significant risk to timber assets through direct loss from combustion, mortality of growing stock, and fire-induced susceptibility to insect, pathogen, and decay mechanisms. The actual loss of timber value associated with a given fire event is a function of tree structure, fire severity, and post-fire salvage opportunity. Roughly three-quarters of California's timberlands face a high fire threat or greater and over half of these lands have very high or extreme fire threat conditions. Only about one-fifth of California's timberlands face a moderate fire threat, where expected losses to timber assets are likely to be low. While some of the standing timber value can be salvaged following a wildfire, many of California's timber assets are exposed to significant risk from wildland fire.

Fire Effects on Woodlands

California's extensive woodland vegetation, especially hardwood woodlands, provides key habitat for many species. The risk of habitat loss associated with fire in woodland areas is highly variable, due to both varying habitat quality and the unique fuel and vegetation response characteristics of specific areas. Habitat characteristics such as tree canopy height and closure, presence or absence of a developed shrub understory, and occurrence of special habitat elements—such as snags and downed logs—are important determinants of habitat quality for many species. Roughly two-thirds of California's hardwood woodlands are exposed to very high or extreme fire threat. While many areas may respond favorably to wildland fire, initial changes in the post-fire environment may cause temporary habitat loss and species dislocation.

Fire Effects on Recreation and Open Space

After a wildfire, significant alteration of watershed lands and the associated stream systems is noticeable for periods varying from a few years to decades. In the short term, the presence of partially burnt vegetation reduces recreational and open space values. Fires can also destroy campgrounds, trails, bridges, and other recreational facilities within the area. Increased amounts of downstream sedimentation may significantly affect streams and lakes, which tend to be the most heavily used spots within larger recreational areas. As the vegetation grows back and damaged recreational infrastructures are replaced, the recreational and open space values would increase. However, it may take decades before vegetation types such as mature forests return to their pre-burn character. Grasslands and shrublands, on the other hand, can return to their pre-burn character within a decade.

Fire Effects on Water and Watersheds

Wildfires can have significant adverse effects on watershed lands, watercourses, and water quality. Large, hot fires cause serious, immediate damage from which a watershed can take decades to recover. By burning off vegetation and exposing mineral soil, fire impairs the ability of a watershed to hold soil in place and to trap sediment before it enters stream systems. Loss of vegetation also means less water being absorbed by plants, causing a short-term increase in the quantity and the delivery rate of water entering streams. This can have significant effects downstream from the site of a fire, such as with the fire-flood cycle commonly experienced in Southern California. This increased runoff and its large sediment load can cause costly damage to downstream assets such as homes, roads, debris basins, and other infrastructure. It can also result in the loss of human life when at-risk residents are not evacuated.

Fire Effects on Soils

Fire presents a significant risk to soil, especially in denuded watersheds, through accelerated erosion potential in the immediate post-fire environment, particularly when subjected to severe rainstorms prior to any vegetation

recovery.[205] The Fire and Resource Assessment Program (FRAP) has developed a statewide risk assessment based on the expected marginal increase in surface erosion from a potential fire.

Erosion is a natural process that occurs across a watershed at varying rates, depending on soils, geology, slope, vegetation, and precipitation. The intensity of a fire and the subsequent removal of vegetative cover increase the potential rate of soil erosion and new sediment sources. Wildfires affect surface erosion in a watershed by altering detachment, transport, and deposition of soil particles. Most wildfires create a patchwork of burned areas that vary in severity. Severely burned areas suffer increased erosion due to loss of the protective forest floor layer and creation of water-repellent soil conditions that can cause flooding, downstream sedimentation, and threats to human life and property.

Fire Effects on Riparian and Aquatic Habitats

Wildfire can produce a wide range of water quality and aquatic habitat outcomes, from beneficial to catastrophic. Increased erosion and sediment deposition can result in channel aggradations (i.e., wider, shallower channels), filling of pools that provide important fish habitat, increased turbidity that makes it harder for fish to find food and can damage gills, and changes in water chemistry.

Wildfire outcomes are determined by weather, fuels, terrain, and, to a lesser extent, suppression efforts. Large wildfires pose the greatest risk to water quality and riparian habitat. If a wildfire encounters fuel levels that have been reduced through prescribed burning and/or mechanical means, there is a good chance the fire would produce conditions more favorable to maintaining good water quality and aquatic habitat. Highly destructive fires are thus minimized.

Fire Effects on Water Quality and Green Infrastructure

Wildfires can potentially affect water quality through increased sedimentation and increased turbidity and through increases in nutrient loadings. Concentration of nutrients (phosphorous and nitrogen) are increased from burned vegetation and delivered to streams through surface runoff. Stream temperatures often increase after fire occurs, typically through the removal of overhead protective vegetation. Elevated stream temperatures are detrimental to most cold-water fish species.

Trade-Offs in Fire Hazards vs. Ecosystem Services Provided by Vegetation

To facilitate sustainable, disaster-resistant communities, there is a critical need to assess the tradeoffs in vegetation's potential to facilitate destructive wildfires versus the biological and economic benefits that it provides. Paradoxically, vegetation is both an asset and a liability to residents living in the WUI areas. The same vegetation that regularly burns with great intensity and destruction simultaneously provides both tangible and intangible benefits to local communities.[206]

Minimizing fire hazard while maximizing the economic, biological, aesthetic, and social values that vegetation provides are seemingly conflicting objectives in the WUI, particularly to those living in high hazard areas with elevated population densities.

Continued immigration to highly fire-prone areas in California will likely continue unabated in the near future. For example, the population of San Diego, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties in Southern California was 19.2 million in 2000 and is expected to grow by at least 15 percent over the next 10 years[207], which will increase both wildfire risk and the likelihood of ignition.[208]

Increased development in fire-prone areas in California has exponentially increased the costs and losses associated with WUI fires in the last two decades. Indeed, in spite of increased fire agency staffing, equipment, and training,

[205] Wells et al., 1979
[206] Dicus and Zimmerman 2007; Dicus et al., 2009
[207] California Department of Finance, 2004
[208] Syphard et al., 2008

85 percent of the 20 most destructive wildfires in California history have occurred over the last 30 years. Since 1987, these top destructive wildfires have collectively resulted in the loss of over 100 lives and over 25,000 structures (see Table 8.C).

Landmark wildfire disaster events since 1990 include:

- 2001 Tunnel Fire, which killed 25 and burned 2,900 structures over 1,600 acres
- 2003 Southern California fires, which killed 22 people, consumed over 4,800 homes, and cost $123 million to suppress over 750,000 acres[209]
- 2007 Southern California fire siege, which killed 17 people, consumed 3,069 homes, and cost $155 million to suppress over 750,000 acres[210]
- 2013 Rim Fire, which burned 112 structures and consumed over 250,000 acres
- 2015 Valley Fire, which killed 4 people and consumed 1,955 structures over 76,067 acres
- 2017 Northern California Fires, which killed 44 people and consumed almost 9,000 structures
- 2017 Thomas Fire, which killed 2 people and consumed 1,063 structures over 281,893 acres
- 2018 Mendocino Complex Fire (consisting of the Ranch Fire and River Fire), which, as of August 15, 2018 consumed over 360,000 acres and was still actively burning (Ranch Fire), making it the largest wildfire complex (by acreage burned) in recorded California history[211]

Given the ever-increasing migration of residential neighborhoods closer to California's WUI, similar destructive wildfires are likely for the foreseeable future. Thus, in addition to other mitigation approaches, effective fuel treatments in the WUI, proactive conservation, and long-term commitments to manage for more resilient forests with older fire resistant trees, coupled with actions to create fire adapted neighborhoods (e.g., home retrofits, defensible space), are all critical to maintaining sustainable communities.

However, treatment- and development-induced losses in tree and shrub canopy cover cost society in many direct and indirect ways. Vegetation is more than fuel; depending on its composition and structure, it can provide, various tangible and intangible benefits to society, dependent on its composition and structure. For example, WUI vegetation not only enhances community attractiveness but also reduces home cooling costs and air pollution[212], lessens needed storm water runoff infrastructure[213], sequesters carbon[214], and provides wildlife habitat.

The need to adequately understand how fuel treatments affect both fire hazard and societal benefits is especially critical in light of legislation that calls for a significant increase in mandatory fuel treatments around structures. California Senate Bill 1369, signed into law as a direct result of the 2003 California fires, amended Public Resources Code Section 4291 to increase mandatory vegetation clearance around homes in all designated areas where the state has primary suppression responsibilities. These new standards have the potential to significantly reduce the losses caused by wildfire but will also likely reduce the many tangible benefits to society that vegetation provides.[215] Thus, there is an acute need for California land managers to develop fuel management strategies in the WUI that minimize fire risk while simultaneously reducing loss of native vegetation and the many societal benefits that it provides.

[209] California Department of Forestry and Fire Protection, 2004
[210] California Department of Forestry and Fire Protection, 2009b
[211] Note: as of the time of final publication of the 2018 SHMP in August 2018, the Mendocino Complex fire is still actively burning. On August 15, 2018 CAL FIRE's statewide fire map reports the fire at 314,925 acres burned and 64% contained. For more information about the Mendocino Complex Fire, visit: http://www.fire.ca.gov/current_incidents/incidentdetails/Index/2175
[212] Taha et al., 1997
[213] Sanders 1986
[214] Nowak and Rowntree, 1991
[215] Dicus et al., 2009

8.1.4 ASSESSMENT OF LOCAL WILDFIRE VULNERABILITY AND POTENTIAL LOSSES

This section addresses local wildfire hazard vulnerability and potential losses based on estimates provided in local risk assessments, comparing those with state risk exposure findings presented in the GIS analysis in *Section 4.4.4* of *Chapter 4: Profiling California's Setting*.

8.1.4.1 FIRE EFFECTS ON HOUSING

Wildfire poses significant risk to the people of California and their homes, as evidenced by an increasing trend in structural losses from wildland fires. The risk is predominantly associated with wildland-urban interface (WUI) areas. WUI is a general term that applies to development interspersed within or adjacent to landscapes that support wildland fire.

Threatened Homes in Wildland-Urban Interface Area

Source: California Department of Forestry and Fire Protection (CAL FIRE)

According to California's Forests and Rangelands 2017 Assessment, development patterns around the state have resulted in construction of approximately 3 million housing units within Fire Hazard Severity Zones (FHSZ) that are potentially at risk from wildfire. Of those housing units, close to 2.2 million are within the Wildland Urban Interface (WUI), 83 percent of which are in "dense interface" and 17 percent of which are in "intermix". Dense interface WUI can be described as a fully developed residential area that terminates at the edge of a wildland area, while intermix WUI, as the name indicates, occurs where residential units are intermittently scattered through a wildland area.

In urban counties, such as Los Angeles, areas of dense development are typically located next to unpopulated open space (usually in public ownership), thus, such housing units are primarily in the "dense interface". In rural counties low-density "intermix" dispersed within wildland fuels tend to be more common; in such areas about half of the housing units are in Intermix (e.g., Butte, Eldorado, Santa Cruz, and Sonoma).[216]

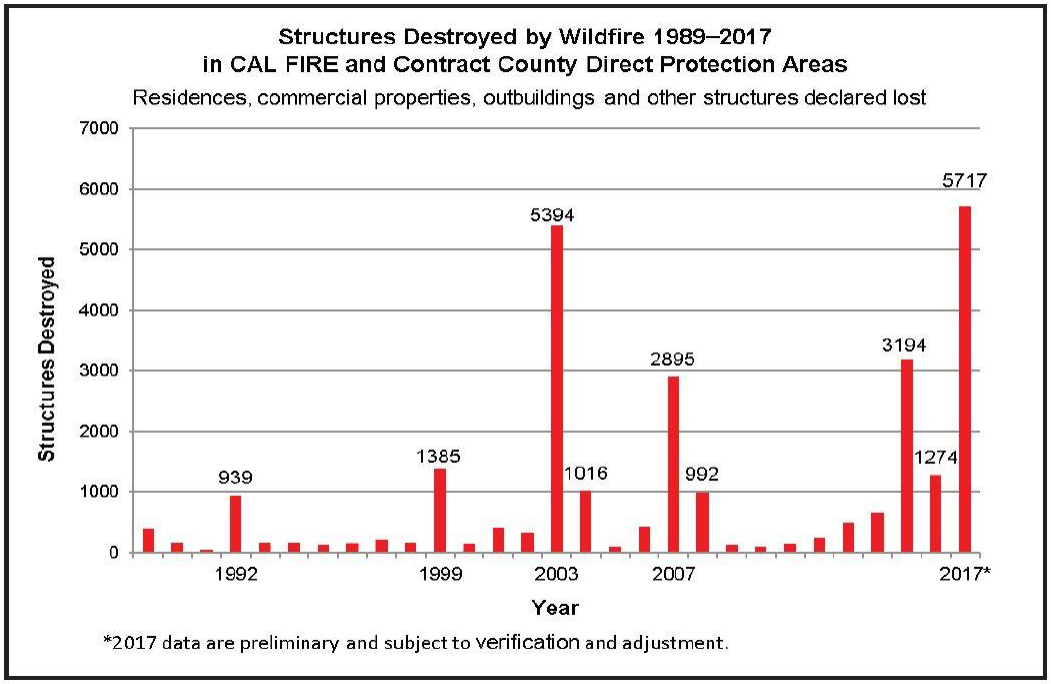
[216] California's Forests and Rangelands 2017 Assessment. CAL FIRE FRAP, http://frap.fire.ca.gov/assessment/2017/assessment2017

Aerial Images Illustrating Dense Interface and Intermix WUI Development

Source: California Department of Forestry and Fire Protection (CAL FIRE), California's Forests and Rangelands 2017 Assessment

The 2017 assessment notes that "a large proportion of the housing units (HU) within FHSZ are in the southern portion of the state. The top five counties for FHSZ HU, all in Southern California, contain about half of all statewide HU in FHSZ, and 62 percent of the HU in the Very High class. However, this is clearly a statewide problem—37 counties have at least 10,000 HU in FHSZ". Across the state, 67 percent of housing units in the interface WUI are within high or very high FHZS.[217] Since 1989 there have been 7 years where loss of more than 1,000 structures occurred in CAL FIRE/contract county direct protection areas, including 2015, 2016, and 2017,[218] as a result of increasing wildfire frequency and severity. This increase is illustrated in Chart 8.D.

Chart 8.D: Structures Destroyed by Wildfire 1989-2017



Source: California Department of Forestry and Fire Protection (CAL FIRE), California's Forests and Rangelands 2017 Assessment

[217] California's Forests and Rangelands 2017 Assessment. CAL FIRE FRAP, http://frap.fire.ca.gov/assessment/2017/assessment2017
[218] California's Forests and Rangelands 2017 Assessment. CAL FIRE FRAP, http://frap.fire.ca.gov/assessment/2017/assessment2017

8.1.4.2 LOCAL HAZARD MITIGATION PLAN HAZARD RATINGS

In the review of Local Hazard Mitigation Plans (LHMPs) approved as of May 2017, the most significant hazards reported continue to be earthquakes, floods, and wildfires—the three primary hazards also identified on a statewide basis by the 2013 SHMP.

Map 8.J summarizes relative ratings of wildfire hazards in the 2018 review of LHMPs. Displayed are predominant wildfire hazard ratings shown as high (red) and moderate to low (orange) rankings, reflecting ratings given by the jurisdictions with LHMPs within each county. Counties shown without color represent either jurisdictions not having LHMPs approved by the Federal Emergency Management Agency (FEMA) or counties where data are missing or problematic. For a detailed evaluation of LHMPs approved as of May 2017, see *Chapter 5: California Local Hazard Mitigation Planning*.

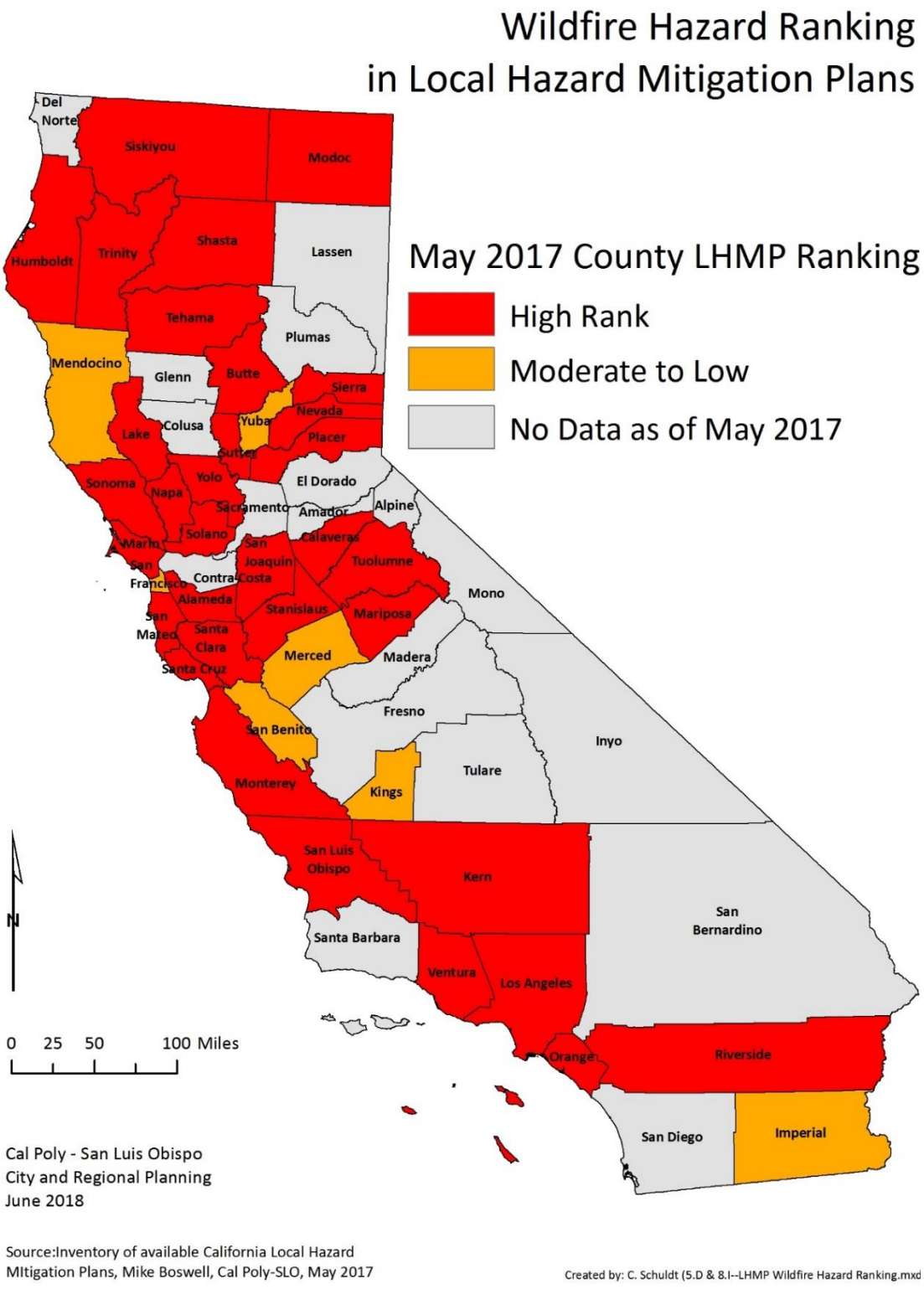
Implications for Local Loss Potential

Local hazard ratings are highly variable, responding to a wide variety of very specific local conditions. Each county has its own set of variables conditioning wildfire loss potential within its cities and unincorporated area. Descriptions of loss potential are very specific within individual LHMPs and are not consistently drawn up between plans, nor is there even coverage of all cities and unincorporated areas. Such variability will diminish as more cities and counties prepare LHMPs and greater standardization enables comparability of local data with statewide data.

Comparison with Statewide Vulnerability

Map 8.J reveals that most LHMPs reviewed in 2017 in Southern California and San Francisco Bay Area counties, some Central Valley counties, and many North Coast and Sierra Mountain counties rated wildfires high in their hazard rankings. This is consistent overall with the patterns of wildfire hazards and population/social vulnerability patterns identified in Map 8.I, Population/Social Vulnerability with Wildfire Hazard.

Map 8.J: Wildfire Hazard Ranking in Local Hazard Mitigation Plans



Map 8.J identifies wildfire hazards as being a predominant concern in the 2017 LHMP review for most Southern California and many San Francisco Bay Area counties with approved LHMPs, as well as many Sierra Mountain counties. For those counties labeled as "no or insufficient data," either the approved LHMP did not include wildfire as a risk or there is no approved LHMP for that county.

8.1.5 CURRENT WILDFIRE HAZARD MITIGATION EFFORTS

Once thought of as a seasonal hazard, wildfires are an almost everyday occurrence in California. However, much of the state's approach to dealing with wildfire is still seasonal in nature. Flammable expanses of brush, diseased timberland, overstocked forests, hot and dry summers, extreme topography, intense fire weather wind events, summer lightning storms, and human acts all contribute to California's wildfire threat. Destructive fire events in 2015, 2016 and 2017, including the Tubbs Fire in Santa Rosa, are reminders of the urgent need to stay vigilant about reducing loss from future catastrophic fire events through mitigation efforts.

Wildfire and human development have always been in conflict. Wildfire is a natural part of the environment and human development has expanded further into the wildlands as non-wildland areas build out. This inherent conflict requires careful management in order to reduce or eliminate losses of life, property, and resources from wildfires.

Some past management practices have failed to address the comprehensive nature of the human/wildfire conflict and have exacerbated conditions that can lead to more damaging fires. One example is focusing on wildfire suppression without pro-active management of hazardous fuels or defensible space. Another is historical development in WUI fire areas without performance-based fire-resistant construction standards or fire-safe development requirements. Daily actions and decisions often fail to consider WUI fire risks and the potential for resulting losses.

Managing the human/wildfire conflict requires a commitment of resources and a focused mitigation plan over the long-term. The approach should be system-wide and may include the following:

- An informed, educated public that takes responsibility for its own decisions relating to wildfire protection
- Land use policies and standards that protect life, property, and natural resources
- Building and fire codes that reduce structural ignitions from windblown embers and flame contact from WUI fires and impede or halt fire spread within the structure once ignited
- Construction and property standards that provide defensible space
- Forest management commitments to manage for more natural forest conditions
- An effective regulatory mechanism for permitting an aggressive hazardous fuels management program
- An effective wildfire suppression program

8.1.5.1 LEGISLATION AND REGULATIONS

2018 Pending Wildfire Hazard Legislation

Following the 2017 Thomas and Northern California fires, California legislators responded by proposing new legislation to address wildfire hazards and support various wildfire mitigation efforts. Some of the mitigation efforts proposed by pending legislation focus on forest management actions, while others address built environment considerations. Some of topics addressed by the pending legislation include the following:

- Require state agencies to promote watershed health and promote post-fire recovery by implementing projects that promote use of woody biomass
- Develop and implement an insurance pool for certified prescribed burn managers
- Change fire safety planning efforts, defensible space requirements, and electrical transmission or distribution line vegetation clearance requirements
- Authorize the state to cover up to 90 percent of costs associated with removal of dead or dying trees in counties experiencing the Governor's declared Tree Mortality Crisis
- Authorize federal, state, and local agencies to engage in collaborative forestry management and enhance CAL FIRE's role in identifying wildfire hazards as local governments plan for new housing and neighborhoods
- Require mitigation plans by electrical corporations and wildfire mitigation measures prepared by local publicly owned utilities to include a description of factors used to determine when it may be necessary to deenergize

electrical lines (note: in July 2018 the California Public Utility Commission passed a resolution extending authority to all electric utilities to shut off electric power during dangerous conditions to prevent wildfires)

As of the fall of 2018, the outcomes of these and other 2018 legislative efforts to address wildfire hazard are still pending.

Senate Bill 109, the Budget Act of 2017, Funding Wildfire Mitigation

Senate Bill 109 has allocated $220 million from the Greenhouse Gas Reduction Fund to CAL FIRE to address fire protection and resource management to mitigate wildfire. The funds appropriated to CAL FIRE are intended to be used for state and local healthy forest and fire prevention programs and projects that improve forest health and reduce greenhouse gas emissions caused by uncontrolled wildfires, including, but not limited to, vegetation management, forest overgrowth reduction, biomass energy generation, and measures to ensure future wildfires are more consistent with historic regenerative fire regime.

These funds are available as local assistance grants, grants to Fire Safe Councils, grants to qualified non-profits, and fund for public education to reduce fire risk in State Responsibility Areas (SRAs).

Even with ample "defensible space" this residence, likely ignited via lofted embers, was destroyed

Source: C. Dicus

Executive Order B-52-18 Addressing Tree Mortality and Wildfire

In the face of the worst wildfires in California's history, Governor Brown issued an executive order on May 10, 2018 to combat dangerous tree mortality, increase the ability of forests to capture carbon, and systematically improve forest management. The issuance of Executive Order B-52-18 coincides with the release of the California Forest Carbon Plan: Managing our Forest Landscapes in a Changing Climate, prepared jointly by the California Department of Forestry and Fire Protection (CAL FIRE), California Environmental Protection Agency (CalEPA), and California Natural Resources Agency (CNRA).

The plan's intent is to provide a detailed implementation plan for the forest carbon goals embodied in the California Air Resources Board (CARB) 2030 Target Scoping Plan Update, which outlines strategies to achieve the 2020 greenhouse gas emissions (GHG) reduction goals.

Key elements of Executive Order B-52-18 include:

- Doubling the land actively managed through vegetation thinning, controlled fires and reforestation from 250,000 acres to 500,000 acres.
- Launching new training and certification programs to help promote forest health through prescribed burning.
- Boosting education and outreach to landowners on the most effective ways to reduce vegetation and other forest-fire fuel sources on private lands.
- Streamlining permitting for landowner-initiated projects that improve forest health and reduce forest-fire fuels on their properties.
- Supporting the innovative use of forest products by the building industry.
- Expanding grants, training, and other incentives to improve watersheds.

Executive Order B-52-18 will improve the health of the state's forests and help mitigate the threat and impacts of deadly and destructive wildfires, which hinder the state's progress toward its climate goals. Forests serve as the state's largest land-based carbon sink, drawing carbon from the atmosphere and storing it in trees and shrubs and in forest soils. But even a single wildfire can immediately cancel all those benefits.[219]

To support implementation of Executive Order B-52-18 and the California Forest Carbon Plan, a Forest Management Task Force was convened in June 2018, and $96 million is allocated to these efforts in the Governor's May budget revision. For more information about the California Forest Carbon Plan, visit: http://fire.ca.gov/fcat/.

Senate Bill 1241 (2012): Legislation for Local Wildfire Hazard Planning

This legislation is a significant addition to hazard mitigation efforts for wildfire areas because it follows the legislative model used in the 2007 flood legislation of hazard mitigation through state oversight of general plans. Similar to flood legislation adding floodplain planning responsibilities to local general plans (AB 162, etc.), Senate Bill (SB) 1241, passed in 2012, mandates wildfire planning responsibilities by local agencies through requirements regarding 1) wildfire updates to general plans, 2) mandatory findings for subdivision approvals in State Responsibility Areas (SRAs) and Very High Fire Hazard Severity Zones (VHFHSZs), and 3) California Environmental Quality Act (CEQA) checklist updates for wildfire safety.

Senate Bill 1241 and the Safety Element

California planning and zoning law requires that cities and counties adopt a comprehensive general plan with various elements including a safety element for protection of the community from unreasonable risks associated with various hazards, including wildfires. All elements of a general plan, whether mandatory or optional, must be consistent with one another.

SB 1241 added language to Government Code Section 65302 that addresses local general plan safety elements by:

1. Revising safety element requirements for SRAs areas and VHFHSZs
2. Requiring local general plan safety elements, upon the next revision of the housing element on or after January 1, 2014, to be reviewed and updated as necessary to address the risk of fire in SRAs and VHFHSZs
3. Requiring each safety element update to take into account the most recent version of the California Governor's Office of Planning and Research (OPR) "Fire Hazard Planning" document
4. Requiring OPR, at the next update of its general plan guidelines, to include the provisions of SB 1241 (2012), or a reference to the provisions of SB 1241 (2012), as well as any other materials related to fire hazards or fire safety deemed appropriate for reference

[219] https://www.gov.ca.gov/2018/05/10/governor-brown-issues-executive-order-to-protect-communities-from-wildfire-climate-impacts/

Local general plan safety element updates are required to include:

1. Comprehensive review of local fire hazards in relation to distribution of existing or planned uses in SRAs and VHFHSZs within that jurisdiction
2. Goals, policies, and objectives for protection of the community from unreasonable risk of wildfire based on the identified fire hazard information
3. Feasible implementation measures to carry out the defined goals, policies, and objectives
4. Attachment of or reference to any previously adopted fire safety plan that fulfills the goals of Government Code Section 65302

For any jurisdiction containing SRAs or VHFHSZs, Government Code Section 65302.5 also requires that the draft safety element update be submitted to the State Board of Forestry and Fire Protection and to every local agency that provides fire protection for the territory in the city or county for review at least 90 days prior to the adoption or amendment of that safety element. Any recommendations provided by State Board of Forestry and Fire Protection or any local fire protection agency must be considered by the city council or county board of supervisors. Any rejection of recommendations must be communicated in writing to the State Board of Forestry and Fire Protection or local fire protection agency.

In May 2015, OPR released an update to its General Plan Technical Advice Series – Fire Hazard Planning that incorporates the requirements of SB 1241 (2012). This document reviews SB 1241 and other federal and state fire hazard planning requirements; ways that fire protection policies can be developed to meet specific, local needs and conditions; and issues relating to fire safety that local jurisdictions should consider while developing their general plan. The document also includes an appendix with funding resources, further fire protection planning resources, and examples of fire hazard planning policies and programs from communities around California. The document is available for download from OPR's website at:
http://opr.ca.gov/docs/Fire_Hazard_Planning_Public_Review_Draft_June_24_2014.pdf.

Senate Bill 1241 and the Subdivision Map Act

The Subdivision Map Act requires the legislative body of a city or county to deny approval of a tentative map, or a parcel map for which a tentative map was not required, unless it makes certain findings.

SB 1241 (2012) added new required findings to Government Code Section 66474.02. The legislative body of a county or city must make the following three findings prior to approval of a tentative map or parcel map for any area located within an SRA or VHFHSZ:

1. That the design and location of each lot in the subdivision and the subdivision as a whole are consistent with any applicable regulations adopted by the State Board of Forestry and Fire Protection per Sections 4290 and 4291 of the Public Resources Code
2. That structural fire suppression services will be available for the subdivision (this finding must be supported by substantial evidence in the record)
3. That ingress and egress for the subdivision meets the regulations regarding road standards for fire equipment access per Sections 4290 and 4291 of the Public Resources Code

Senate Bill 1241 and the California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires a lead agency to prepare and certify the completion of an environmental impact report (EIR) on a project that it proposes to carry out or approve that may have a significant effect on the environment, or to adopt a negative declaration if it finds that the project will not have that effect. CEQA requires OPR to prepare and develop guidelines for the implementation of CEQA by public agencies.

SB 1241 (2012) requires OPR to prepare, develop, and transmit to the Secretary of the California Natural Resources Agency recommended proposed changes or amendments to the initial study checklist for the inclusion of additional, specific questions related to fire hazard impacts for projects located in SRAs and VHFHSZs. Proposed updates to the

CEQA Guidelines were issued by OPR in November 2017 and included updates to the initial study checklist to add new questions addressing the requirements of SB 1241. OPR also updated the Fire Hazard Planning General Plan Technical Advice Series in response to SB 1241, in 2015. To download the Fire Hazard Planning General Plan Technical Advice Series, visit: http://opr.ca.gov/ceqa/technical-advisories.html.

Progress Summary 8.A: Senate Bill 1241 (2012) and CAL FIRE's Land Use Planning Program

Progress as of 2018: The Land Use Planning Program (LUPP) was established within the California Department of Forestry and Fire Protection (CAL FIRE) Office of the State Fire Marshall (OSFM) in June 2013 to implement the provisions of Senate Bill (SB) 1241. The primary function of the Land Use Planning Program is to provide planning and technical assistance to local jurisdictions to ensure that the safety elements of their general plans meet all required components of the law. The Land Use Planning Program also offers additional assistance to local jurisdictions in adoption of local fire ordinances and fire hazard maps, community planning and development, and damage inspection and recovery following devastation from wildfires and floods.

Staff of the Land Use Planning Program (with 11 positions throughout the state, as of 2017) work in close collaboration with the Board of Forestry and Fire Protection. It is the staff's statutory responsibility to review draft safety elements or existing safety elements and recommend changes to the planning agency regarding uses of land and policies in State Responsibility Areas (SRAs) and Very High Fire Hazard Severity Zones (VHFHSZs) that will protect life, property, and natural resources from unreasonable risks associated with wildland fires; and methods and strategies for wildland fire risk reduction and prevention within SRAs and VHFHSZs.

Thirty local general plan safety elements have been reviewed and commented upon by Land Use Planning Program staff since 2015. This number is expected to increase significantly over the next few years, as many jurisdictions are approaching their mandatory general plan housing element updates.

Additional information regarding the Land Use Planning Program can be found at: http://osfm.fire.ca.gov/fireplan/fireplanning.

Defensible Space Law

A state law that became effective in January 2005 extended the required defensible space clearance around homes and structures from 30 feet to 100 feet. In summary, Public Resources Code Section 4291 now states that a person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining a mountainous area, forest-covered lands, brush-covered lands, grass-covered lands, or land that is covered with flammable material shall at all times maintain defensible space of 100 feet from each side and from the front and rear of the structure, but not beyond the property line. Numerous local jurisdictions have adopted more stringent standards.

Proper clearance to 100 feet dramatically increases the chance of a house surviving a wildfire. The vegetation surrounding a building or structure is fuel for a fire. Even the building or structure itself is considered fuel. Research and experience have shown that fuel reduction around a building or structure increases the probability of it surviving a wildfire.

Good defensible space allows firefighters to protect and save buildings or structures safely without facing unacceptable risk to their lives. Fuel reduction through vegetation management coupled with ignition-resistant construction is the key to creating good defensible space. However, even with adequate defensible space, a structure may ignite via lofted embers.

Defensible space programs, otherwise known as fire safe inspections, can be implemented at many different levels. For example:

- CAL FIRE uses firefighters to inspect high hazard areas
- The United States Forest Service (USFS) inspects where it has direct protection responsibility on private lands
- Fire Safe Council inspections are conducted with the support of grant dollars, homeowners association dues, and counties funds such as Title III
- Local fire agencies, both paid and volunteer, inspect with firefighters and volunteers

For these residences adequate "defensible space" successfully reduced risk of ignition

Source: C. Dicus

Fire Safe Development Regulations

The Fire Safe Development Regulations implement Public Resources Code Section 4290 and stipulate minimum requirements for building construction in SRAs. These regulations address ingress and egress (road widths, turnouts, etc.), building and street sign visibility, emergency water standards, and fuel modification.

In June 2012, CAL FIRE and the Board of Forestry and Fire Protection formed a workgroup to revise the Fire Safe Development Regulations. The workgroup made the first significant changes to the regulations since they were initially effective in 1991 and identified future areas of study. Changes to the regulations were effective January 1, 2016.

This workgroup was re-engaged in 2017 to align the update timeline for the Fire Safe Regulations with the triennial California Fire Code cycle. The workgroup has been reviewing the existing regulations based on feedback received from the 2016 updates to reduce inconsistencies and improve clarity. These changes are anticipated to be effective with the 2020 California Fire Code on January 1, 2020.

Progress Summary 8.B: Board of Forestry and Fire Protection Research Efforts

Progress as of 2018: In an effort to ensure existing state regulations are effective, the Board of Forestry and Fire Protection has engaged various research efforts. In 2016, the Board engaged a mitigation planning team at California State Polytechnic University San Luis Obispo to assess impacts of fire on single access subdivisions and develop a performance-based metric to evaluate evacuation from single access subdivisions. The research effort culminated in a report titled "Single-Access Subdivision Assessment Project: Developing a Planning Tool for Evaluating Proposed Developments Accessible by Dead-End Roads" available publicly on the Board's FIRE website.

Wildfire risk in California poses significant threat to communities located on one or more dead end roads. Such subdivisions possess only a single entry point through which emergency access and evacuation must travel, and are some also have access roadways with inadequate widths, steep grades, or obstacles in the roadway that can threaten safe movement. These factors can combine to interfere with efficient evacuation as well as the ability of responders to combat wildfires. Such issues were evident in the October 2017 wildfires in Northern California, the 2017 Thomas Fire in Southern California, and the Montecito debris flow in early 2018.

The Single-Access Subdivision Assessment Project report provides a mathematical access model to address potentially life-threatening situations that may arise when single-access subdivisions are faced with threats and obstacles that can interfere with egress and ingress, slowing wildfire evacuation and firefighting equipment access. The report's mathematical access model, which measures the length of time required to fully evacuate a subdivision or community under specific circumstances such as road grade, curvature, width, length, and obstacles, may be useful to jurisdictions during general plan preparation and subdivision planning as a tool to evaluate access and evacuation requirements in relation to wildfire and possibly other hazard events.

Wildland-Urban Interface Building Code

More than 50 percent of structures lost in WUI fires are in fires that burn more than 300 structures. These fires are what CAL FIRE has termed "conflagration" fires. These fires burn during extreme fire behavior conditions that usually include high winds and hot temperatures, allowing flames to spread rapidly. Extreme winds sometimes blow embers ½ to 1 mile from the main fire into WUI areas. These fires are located near homes and move so fast and so destructively that it is not possible for enough firefighters and equipment to arrive on scene soon enough to control the fire. The solution to this problem is to design and build communities that are resistant to the unwanted effects of WUI fires. Reducing structural ignitions from windblown embers or direct flame contact through use of appropriate design, materials, and assemblies is the goal of the WUI fire and building codes.

For this reason, state and local governments in California have enacted numerous laws related to protecting communities from wildfire. Many of the laws focus on roofing or vegetation, the two major factors that affect structure loss during wildland fires. In many cases, these laws were passed immediately following a major fire.

On September 20, 2005, the California Building Standards Commission approved the Office of the State Fire Marshal's emergency regulations amending the California Code of Regulations (CCR), Title 24, Part 2, known as the 2007 California Building Code, to add Chapter 7A Materials and Construction Methods for Exterior Wildfire Exposure. This chapter has been revised triennially with the California Building Code and identifies the following scope, purposes, and application:

- *701A.1 Scope*. This section applies to building materials, systems, and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A.
- *701A.2 Purpose*. The purpose of this section is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire.

- *701A.3 Application*. New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this section.

The current standards in Chapter 7A of the 2016 California Building Code[220] include minimum criteria for the following elements of construction:

- Roofing
- Vents
- Exterior coverings (including walls, roof eaves/soffits, exterior porch ceilings, floor projections, underfloor protection, and underside of appendages)
- Exterior windows and doors
- Decking
- Accessory structures

8.1.5.2 FIRE HAZARD SEVERITY ZONE MAPPING FOR MITIGATION ACTION

Public Resources Code Sections 4201-4204 and Government Code Sections 51175-89 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZs), define the application of various mitigation strategies to reduce risk associated with wildland fires. FHSZs are mapped within State Responsibility Areas (SRAs). The zones will provide specific designation for application of defensible space and building standards consistent with known mechanisms of wildfire impacts on people, property, and natural resources.

Wildland-urban interface (WUI) building codes that have been adopted by the California Building Standards Commission took effect January 1, 2008 and use Fire Hazard Severity Zone (FHSZ) maps as the basis for applicability of certain code sections.

Progress Summary 8.C: Fire Hazard Severity Zone Mapping and State/Local Responsibility Areas

Progress as of 2018: The California Department of Forestry and Fire Protection (CAL FIRE) has remapped both state and local fire responsibility areas to provide updated map zones, based on new data, science, and technology that will create more accurate zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. Data for State Responsibility Areas (SRAs) are now updated annually using funds from the California Fire Prevention Fee. An online SRA viewer reflecting these annual data updates is available on the Board of Forestry and Fire Protection website: http://www.fire.ca.gov/firepreventionfee/sraviewer. The online viewer is updated annually and replaces the SRA county maps.

Data for Local Responsibility Areas (LRAs) are now updated annually. CAL FIRE has made recommendations for Very High Fire Hazard Severity Zones (VHFHSZ) for over 200 cities. The VHFHSZ recommendations are available at: http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps_citylist.php.

Many local governments have made similar designations under their own authority. FHSZ mapping was adopted in 2007 and 2008 for most LRAs. LRA FHSZ maps must be ratified by the local government agency and the state for full adoption. There are still a few LRA maps pending local ratification prior to being fully adopted.

[220] https://codes.iccsafe.org/public/chapter/content/1774/

Best Practices Highlight 8.A: City of San Diego's Campaign to Mitigate Wildfire Hazard and Protect Sensitive Resources

What does it take to make significant wildfire hazard mitigation progress? For San Diego, California, it took recognition that fire season is a year-round reality. Fires such as the Cedar Fire in 2003 (the largest fire by acreage in California's history) and the Witch Fire in 2007 each resulted in the destruction of many homes and served as the city's call to action to better address wildfire hazards.

The challenge for San Diego comes from its many linear miles of wildland-urban interface (WUI) where the backyards of homes meet dense stands of native-naturalized vegetation. The development and landscaping of many homes occurred without full understanding of fire severity, resulting in increased wildfire vulnerability. Within San Diego's WUI areas, up to 80 percent of homes previously damaged by wildfire might have been saved if certain fire-safe practices had been followed. To better address and mitigate wildfire risk in WUI areas, the City of San Diego has implemented an array of coordinated fire safe practices including building code standards, a brush management program, and a public awareness campaign.

Use of Fire Hazard Severity Zones to Determine Best Mitigation Measures

State law requires that all local jurisdictions identify Very High Fire Hazard Severity Zones (VHFHSZs) within the area where the jurisdiction is responsible for fire protection. The determination of very high fire hazard severity is based on vegetation density, slope severity, fire department response time, and other relevant factors that contribute to fire severity. The City of San Diego worked closely with the California Department of Forestry and Fire Protection (CAL FIRE) to establish VHFHSZs within the city and develop a fire hazard severity map. The purpose of the fire hazard severity map is to classify lands in accordance with whether a very high fire hazard is present. The fire hazard severity information provided by the map enables City officials to better define mitigation measures such as vegetation management and implementation of building standards to best minimize loss of life, resources, and property.

Building Standards

For properties in VHFHSZs, the City of San Diego's Building Code requires specific additional fire safe building standards be met for new construction projects, as well as additions and exterior alterations to existing buildings. For projects within the City's designated VHFHSZs, additional building standards in the Municipal Code may also apply in conjunction with Building Code standards for new construction.

Landscape Regulations

To reduce the risk of fire through site design and the management of flammable vegetation, the City has introduced fire safe landscape requirements in the San Diego Municipal Code (Section 142.0401). Under its comprehensive brush management program, the City now requires defensible space buffer zones to be created between all structures and contiguous areas of native or naturalized vegetation. In order to ensure necessary reduction of fire hazards around WUI structures while protecting sensitive biological resources, the City has published a brush management guide. The guide explains specific brush clearance techniques and appropriate times for brush management activities to minimize impacts to undisturbed native vegetation.

Ready, Set, Go!

Public education is a crucial part of the success of San Diego's wildfire adaptation efforts. As part of this effort, the San Diego Fire-Rescue Department produced "Ready, Set, Go!" a personal wildland fire action guide for San Diego residents. The "Ready, Set, Go!" program works in a complementary and collaborative fashion with the Firewise Communities Program and other wildland fire public education efforts. The program explains brush clearing and defensible space, along with measures like using fire-resistant plants and disallowing or being cautious of flammable/combustible materials near residences, and encourages residents and homeowners to take an active role in wildfire mitigation efforts. The guide can be downloaded at: https://www.sandiego.gov/fire/safety/tips/readysetgo.

Natural Hazard Disclosures and Disclosure Maps

Natural Hazard Disclosures in real estate transactions have been required for wildland fire hazards since 1990 but were not widely used until the late 1990s. Natural Hazard Disclosures are required in Very High Fire Hazard Severity Zones (VHFHSZs) in LRAs and in all SRAs regardless of fire hazard.

CAL FIRE provides Natural Hazard Disclosure maps and data for two types of fire hazard areas referred to in legislation as disclosure items in real estate transactions. For more information, visit: http://frap.fire.ca.gov/projects/hazard/hazard.

8.1.5.3 WILDFIRE PROTECTION RESPONSIBILITY IN CALIFORNIA

There are literally hundreds of agencies that have fire protection responsibility for wildland and WUI fires in California. Local, state, tribal, and federal jurisdictions have legal (and financial) primary responsibility for wildfire fire protection. In some instances, two fire organizations have dual primary responsibility on the same parcel of land —one for wildland fire protection and the other for structural or "improvement" fire protection.

This layering of responsibility and resulting dual policies, rules, practices, and legal ordinances can cause conflict or confusion. To address wildland fire jurisdictional responsibilities, the California state legislature adopted Public Resource Code Section 54102, Government Code Section 51175, and Health and Safety Code Section 13108.5 establishing Federal Responsibility Areas (FRAs), State Responsibility Areas (SRAs), and Local Responsibility Areas (LRAs).

Federal Responsibility Areas (FRAs)

Federal Responsibility Areas (FRAs) are fire-prone wildland areas that are owned or managed by a federal agency such as the U.S. Forest Service, National Park Service, Bureau of Land Management, U.S. Fish and Wildlife Service, or U.S. Department of Defense. Primary financial and rule-making jurisdictional authority rests with the federal land agency. In many instances, FRAs are interspersed with private land ownership or leases. Fire protection for developed private property is usually NOT the responsibility of the federal land management agency; structural protection responsibility is that of a local government agency or fire protection district.

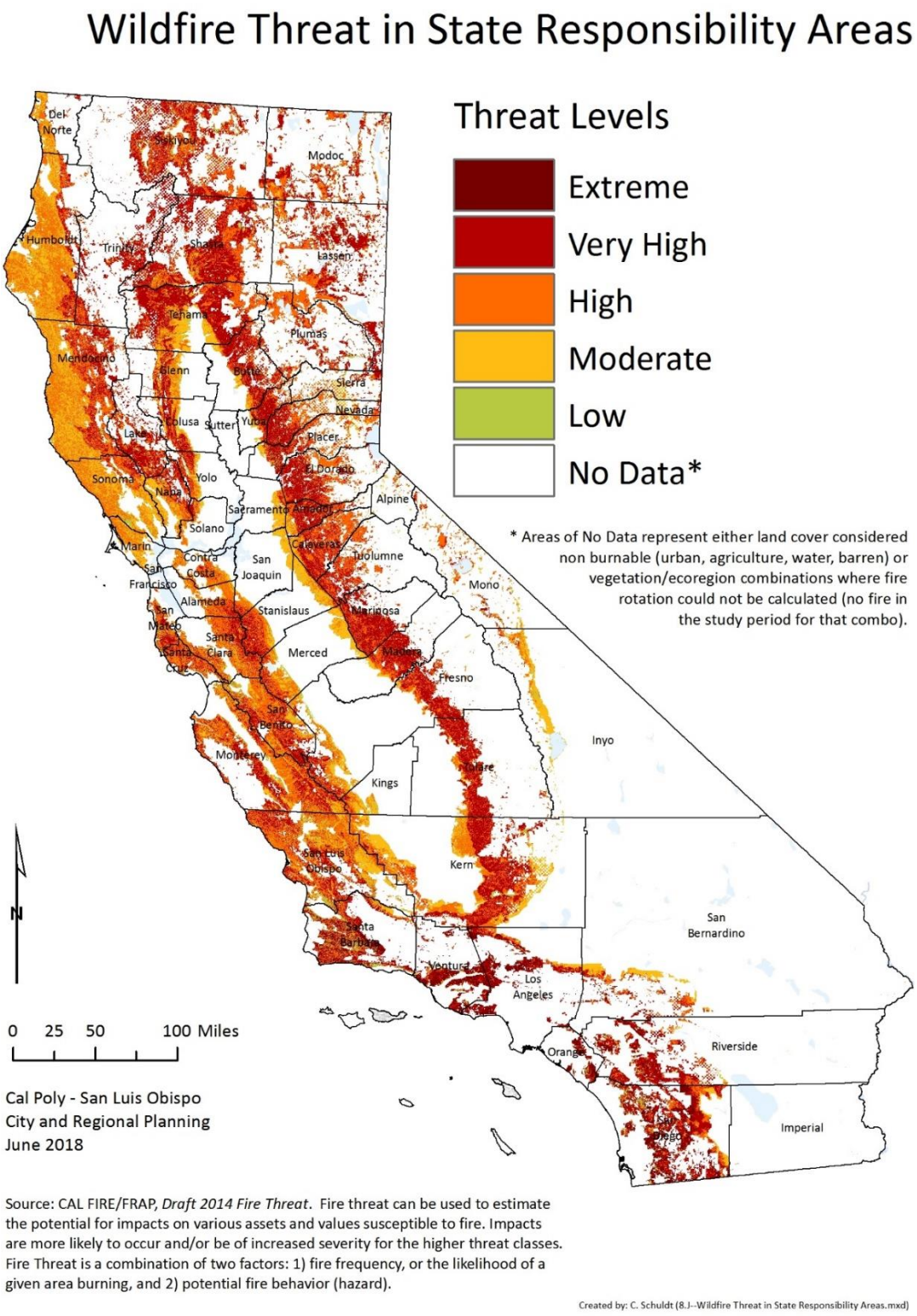
State Responsibility Areas (SRAs)

State Responsibility Areas (SRAs) are those lands in which the State of California has primary fire protection responsibilities. These are areas where CAL FIRE has legal and financial responsibility for wildland fire protection and where CAL FIRE administers fire hazard classifications and building standard regulations.

SRAs are defined as lands that 1) are county unincorporated areas, 2) are not federally owned, 3) have wildland vegetation cover rather than agricultural or ornamental plants, 4) have watershed and/or range/forage value, and 5) have housing densities not exceeding three units per acre.[221] As in FRAs, where SRAs contain built environment or development, the responsibility for fire protection of those improvements (non-wildland) is typically that of a local government agency. Map 8.K shows wildfire threat within SRAs.

[221] CAL FIRE web page, url: http://frap.fire.ca.gov/projects/hazard/hazard#SRAdef

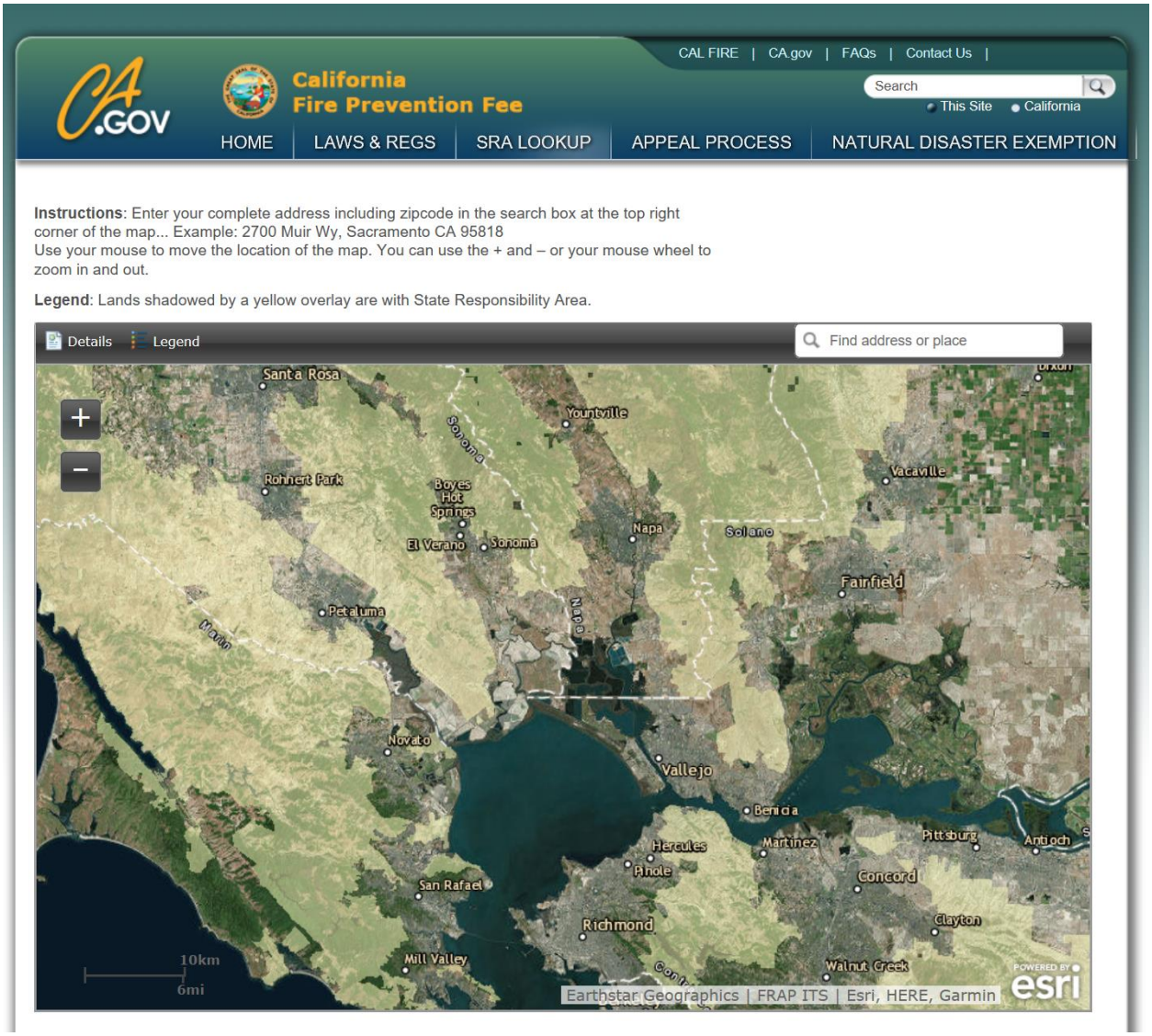
Map 8.K: Wildfire Threat in State Responsibility Areas



Source: CAL FIRE/FRAP, *Draft 2014 Fire Threat*. Fire threat can be used to estimate the potential for impacts on various assets and values susceptible to fire. Impacts are more likely to occur and/or be of increased severity for the higher threat classes. Fire Threat is a combination of two factors: 1) fire frequency, or the likelihood of a given area burning, and 2) potential fire behavior (hazard).

Created by: C. Schuldt (8.J--Wildfire Threat in State Responsibility Areas.mxd)

Map 8.L: State Responsibility Area Viewer Example—SRA in Northern California



Source: http://www.fire.ca.gov/firepreventionfee/sraviewer

CAL FIRE now maintains a State Responsibility Area map viewer that allows users to view the spatial distribution of SRAs at different scales and for different areas of the state. It can also be used to search for a specific address to help determine if the location is within or outside an SRA. SRA boundaries are those adopted by the Board of Forestry and Fire Protection and are updated annually to reflect changes. Map 8.L shows an example map created using CAL FIRE's SRA data viewer.

Local Responsibility Areas (LRAs)

Local Responsibility Areas (LRAs) include land within incorporated cities, cultivated agriculture lands, non-flammable areas in unincorporated areas, and those lands that do not meet the SRA or FRA criteria. LRA fire protection is typically provided by city fire departments, fire protection districts, and counties, and by CAL FIRE under contract to local governments.

LRAs may include areas in which the financial and jurisdictional responsibility for improvement AND wildland fire protection is that of a local government agency.

Rule-Making Authority and Financial Responsibility

The significance of the FRA, SRA, and LRA designations relates to the rule-making authority and financial responsibility for fire protection. Local government agencies (cities and counties) typically control the authority to enact and enforce land use ordinances, building codes, and fire codes for development within their boundaries, although some state regulations apply in LRAs designated as Very High Fire Hazard Severity Zone (VHFHSZs). The significance of these terms for land use and building regulation is discussed later in this section.

CAL FIRE has mapped all LRAs in which the designated Fire Hazard Severity Zone has been determined to be "Very High" (the most hazardous designation); local authorities can then elect to adopt these designations. Once adopted, the designations require equivalent residential vegetation maintenance and building standards as in SRA lands. Some LRA jurisdictions choose not to adopt these designations based upon factors such as perceived impacts on residential property values, fire insurance availability and rates, and others. This land use authority includes those areas where the local agency shares fire protection responsibility with either FRAs or SRAs. Financial responsibility for wildland fire protection is a significant issue because wildland fire protection is very expensive and considerably more expensive in WUI areas.

8.1.5.4 WILDFIRE HAZARD MITIGATION PLANS AND PROGRAMS

Strategic Fire Plan and Wildland Fire Suppression

Initially approved by the California State Board of Forestry and Fire Protection in 2010, the Strategic Fire Plan was revised in 2016. The Strategic Fire Plan forms the basis for assessing California's complex and dynamic natural and human-made environment and identifies a variety of actions to minimize the negative effects of wildland fire.

Vision

The vision of the Strategic Fire Plan is for a natural environment that is more resilient and human-made assets that are more resistant to the occurrence and effects of wildland fire through local, state, federal, and private partnerships.

Goals and Objectives

Through government and community collaboration, the following goals established in the Strategic Fire Plan will enhance the protection of lives, property, and natural resources from wildland fire, as well as improve environmental resilience to wildland fire. Each goal listed here is meant to build upon the previous one (e.g., Goal 3 builds upon the accomplishments in Goals 1 and 2). Although full attainment of a goal is ultimately dependent upon the success of previous goals, any of the goals can be worked on at any given time based on available funding and other opportunities. The goals are as follows:

1. Identify and evaluate wildland fire hazards and recognize life, property and natural resource assets at risk, including watershed, habitat, social, and other values of functioning ecosystems. Facilitate the sharing of all analyses and data collection across all ownerships for consistency in type and kind.
2. Articulate and promote the concept of land use planning as it relates to fire risk and individual landowner objectives and responsibilities.
3. Support and participate in the collaborative development and implementation of wildland fire protection plans and other local, county, and regional plans that address fire protection and landowner objectives.
4. Increase awareness, knowledge, and actions implemented by individuals and communities to reduce human loss and property damage from wildland fires, such as defensible space and other fuels reduction activities, fire prevention and fire safe building standards.
5. Develop a method to integrate fire and fuels management practices with landowner priorities and multiple jurisdictional efforts within local, state, and federal responsibility areas.
6. Determine the level of fire suppression resources necessary to protect the values and assets at risk identified during planning processes.

7. Address post-fire responsibilities for natural resource recovery, including watershed protection, reforestation, and ecosystem restoration.

Other Aspects of the Plan

CAL FIRE has developed an estimate of fire risk in WUI areas that is consistent with National Fire Plan methods but is more refined in terms of both mapping extent and quantification of risk. CAL FIRE uses spatial data to distinguish fire-related characteristics from assets and applies spatial rules for determining relative risk of loss. For more information, see: http://cdfdata.fire.ca.gov/fire_er/fpp_planning_cafireplan.

The 2010 Strategic Fire Plan (revised in 2016) is a different fire plan from those developed in the past. The plan recognizes that fire will occur in California and works to answer the question of "how do we utilize and live with that risk of wildfire?" The approach taken in the revised plan is to focus on a vision and goals and objectives that will help reach that vision. The overall vision is to create a state that is more resistant and resilient to the damaging effects of catastrophic wildfire while recognizing fire's beneficial aspects. The 2010 Strategic Fire Plan (revised in 2016) is a living document.

Wildland Fire Suppression

In addition to the Strategic Fire Plan's broad goals, CAL FIRE has a suppression goal to contain 95 percent of fires at 10 acres or less. Statewide, approximately 97 percent of all vegetation fires are contained within the first few hours after they are reported. The remaining 3 percent either move too quickly or are too intense for available fire suppression resources to handle. Multiple large fires can quickly draw down the pool of fire suppression resources, making it more difficult to bring the fires under control.

Progress Summary 8.D: Strategic Fire Plan

Progress as of 2018: A revised version of the 2010 Strategic Fire Plan, released in April 2016, is the current fire plan and considered the state's road map for reducing risk of wildfire. A new Fire Plan Workgroup made up representatives from the State Board of Forestry and Fire Protection of and the California Department of Forestry and Fire Protection (CAL FIRE) has been formed to update the plan for 2018. The entire current fire plan can be viewed at: http://osfm.fire.ca.gov/fireplan/fireplanning.php and http://www.bof.fire.ca.gov/board_committees/resource_protection_committee/current_projects/resources/strategicfireplan_june2010_06-04_photos.pdf.

California's Forests and Rangeland Assessment

California law requires that CAL FIRE make periodic assessments of forest and range resources and that the Board of Forestry and Fire Protection use the results to develop a policy statement and strategic plan. In addition, the 2008 Federal Farm Bill amended the Cooperative Forestry Assistance Act (CFAA) to require that states prepare state forest resource assessments and resource strategies. The CFAA amendments are reflected in the United States Department of Agriculture (USDA) Forest Service State and Private Forestry "Redesign Program" (http://www.fs.fed.us/spf/redesign/index.shtml). The intent of this program is for the states to identify priority landscape areas and to underscore work needed to address national, regional, and state forest management priorities. In June 2010, the Fire and Resource Assessment Program (FRAP) finished the assessment. For more information about the 2010 assessment, visit: http://frap.fire.ca.gov/assessment/2010/assessment2010.

2017 Update of California's Forests and Rangelands Assessment

CAL FIRE FRAP and the U.S. Forest Service (USFS) Region 5 released California's Forests and Rangelands: 2017 Assessment update in mid-August 2018. The 2017 assessment revisits topics from the 2010 assessment as well as reviving the inclusion of Montreal Process Criteria and Indicators to assess the state's progress toward or away from sustainable forestry. The 2017 Assessment covers a broad range of topics across both private and public lands. Each chapter includes a number of indicators that collectively are used to evaluate the sustainability of forest and rangelands. In the 2017 chapters addressing wildfire, reducing community wildfire risk, and climate change are again

included, as well as new chapters are dedicated to the topics of urban forestry and California's non-metro regional economy.

To download the 2017 assessment, visit: http://frap.fire.ca.gov/assessment/2017/assessment2017.

California's Forests and Rangelands 2010 Assessment

One of the overarching findings of the 2010 Forests and Rangelands Assessment is that California is a complex wildfire-prone and fire adapted landscape. Natural wildfire has supported and is critical to maintaining the structure and function of California's ecosystems. As such, the ability to use wildfire, or to mimic its impact by other management techniques, is a critical management tool and policy issue. Simultaneously, wildfire poses a significant threat to life, public health, infrastructure and other property, and natural resources.

Data suggest a trend of increasing acres burned statewide, with particular increases in conifer vegetation types. This is supported in part by the fact that the three largest fire years since 1950 have all occurred this decade. Wildfire-related impacts are likely to increase in the future based on trends in increased investment in fire protection, increased fire severity, fire costs, and losses, and research indicating the influence of climate change on wildfire activity.

Both the assessment and resource strategies documents are organized around themes and sub-themes delineated in the federal Redesign Program. For each sub-theme, an analytical framework was designed that uses GIS techniques to perform a spatial analysis of the pattern of assets and threats across landscapes. Assets include items of commercial and non-commercial value, both natural and human-made, such as buildings, commercial standing timber, and production of water. Threats are agents that can trigger major negative impacts on assets; examples include wildfire, development, and insect outbreaks. Location information on various assets, and potential threats to those assets, are taken together to identify high value/high threat areas. These delineate landscapes (called "priority" landscapes) where strategies and actions especially need to be focused.

Role in Supporting Hazard Mitigation

Several of these 2010 assessment themes and related strategies provide information that supports hazard mitigation planning and action. Three chapters are of special interest and are mentioned here for those who wish more detailed information:

- *Wildfire Threat to Ecosystem Health and Community Safety* (http://frap.fire.ca.gov/frasc/frasc_topics-wildfire) This chapter reflects the findings cited above and contains three unique spatial analyses that generate priority landscapes:
    - Preventing Wildfire Threats to Maintain Ecosystem Health
    - Restoring Wildfire-Impacted Areas to Maintain Ecosystem Health
    - Preventing Wildfire Threats for Community Safety
- *Forest Pests and Other Threats to Ecosystem Health and Community Safety* (http://frap.fire.ca.gov/frasc/frasc_topics-wildfire) This chapter covers the impacts of forest pests, including both forest insects and diseases, in wildland areas and communities. Collectively, losses from forest pests typically exceed those from wildfire and create serious hazards. The chapter includes four unique spatial analyses that identify priority areas where forest management practices are most likely to prevent and mitigate impacts:
    - Restoring Forest Pest Impacted Areas to Maintain Ecosystem Health
    - Restoring Forest Pest Impacted Communities for Public Safety
    - Preventing Forest Pest Outbreaks to Maintain Ecosystem Health
    - Preventing Forest Pest Outbreaks for Community Safety

- *Planning for and Reducing Wildfire Risks to Communities* (http://frap.fire.ca.gov/frasc/frasc_topics-planning). This chapter looks at the current status of collaborative, community-based wildfire planning and the extent of available planning resources relevant to community wildfire safety and protection. It identifies priority communities where wildfire threat coincides with human infrastructure such as houses, transmission lines, and major roads. These priority communities are then summarized in terms of the presence of a Community Wildfire Protection Plan (CWPP) and Firewise Communities/USA recognition. The availability of community planning resources is also examined.

Assessment Prioritization of Threatened Assets

The process for developing the 2010 assessment was based on looking at the location of forest and range resource assets in the context of potential threats across the state. This information is used to determine priority landscapes that have high asset values that are likely to be threatened. The assessment helps guide efforts to acquire and direct funding that can enable programs and other tools that create desired future landscape conditions

A key function of the 2010 assessment is to support California in allocating financial resources available from the federal government. Increasing threats to natural resources and tighter limits on available funds mean that priorities must be carefully examined.

California Interagency Coordination Efforts

Leading the coordination of wildfire prevention is the California Wildfire Coordination Group (CWCG) Interagency Prevention Committee. The CWCG Prevention Committee was formed as a way to coordinate the pre-fire management efforts of its member agencies: Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), California Governor's Office of Emergency Services (Cal OES), CAL FIRE, California Fire Safe Council (CFSC), National Park Service (NPS), the U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and a Contract County Representative. More information on this Committee can be found at: https://gacc.nifc.gov/oscc/cwcg/.

The CWCG Prevention Committee provides a forum for sharing information so that its member agencies can make decisions and operate pre-fire management programs in a coordinated, integrated fashion. Working together, they discuss and reach consensus on California wildfire prevention and fire loss mitigation strategies.

Examples of pre-fire management programs are:

1. Grants Clearinghouse administered by the California Fire Safe Council that provides a one-stop shop concept for fire prevention community assistance grants. It allows a mechanism for California Fire Alliance members to pool their grant resources and fund grant projects around California and parts of Nevada. The Grants Clearinghouse has provided an efficient organizational structure for mobilizing wildfire mitigation activities and strategies to deal with the WUI issues in California. Projects funded include a variety of fuel reduction projects supporting prescribed fire, mechanical treatments and grazing methods, education and outreach activity, Community Wildfire Protection Plan (CWPP) development, and biomass reutilization.

2. Workshops and Networking:
   - Development and maintenance of Community Wildfire Protection Plans
   - Environmental compliance/Best Management Practices
   - Networking lunches with local community groups active in fire prevention

The collaborative energy of the members has directly benefited the pursuit and mission of building fire-safe communities and healthy wildland ecosystems. The CWCG Prevention Committee provides a single point of contact between the local Fire Safe Councils and its member agencies, while, in turn, the local Fire Safe Councils provide a single point of contact for coordination with individual communities.

Additional work and benefits are:

- Establishing priorities and opportunities for joint actions to collect information, maintain records, and monitor progress
- Maintaining awareness of social, economic, and technological advances; assessing how these changes influence wildfire threats; and informing decision-makers how to decrease wildfire threats and promote healthy wildland ecosystems
- Clarifying and coordinating policies and exploring issues that affect communities threatened by wildfire
- Coordinating a common message in order to improve the quality of information
- Providing education to enhance the public's understanding of wildland fire ecosystems, hazard fuels reduction and mitigation, and wildland fire management

California Fire Safe Councils

Since its formation in 1993, the California Fire Safe Council (CFSC) has united Californians to speak with one voice about fire safety. CFSC is a leader in encouraging grassroots movements that make communities more fire safe, fire wise, and fire adapted. CFSC, a statewide non-profit organization, receives federal grants from agencies like the United States Forest Service (USFS), Bureau of Land Management (BLM), and National Park Service (NPS). These funds provide grant monies to local Fire Safe Councils and other community organizations in California using CFSC's innovative online Grants Clearinghouse. The Clearinghouse enhances existing relationships between communities and state and federal agencies and helps create new relationships by expanding funding opportunities for eligible organizations and agencies.

In its 10 years of grant making, CFSC has funded over 850 grants totaling over $81 million for projects to reduce hazardous fuels, provide wildfire prevention education, and create risk assessments and Community Wildfire Protection Plans (CWPPs). In 2017, CFSC selected 21 projects under its 2017 Grants Clearinghouse that will provide over $2.1 million in federal grant funds to support wildfire risk reduction activities in at-risk communities in 15 counties across California (see Table 8.E). In addition to the federal funds, the projects will use over $2.5 million in matching funds, both in-kind and cash contributions. To assist with the application process, CFSC programs staff provide free workshops across the state on CFSC's two grant programs, share insights into the federal grants process, train participants in best practices for composing successful CFSC grant applications, and assist with wildfire education and outreach as well as organizational issues such as capacity building and sustainability.

As State Liaison (2012-2017), CFSC promoted the Firewise program to its extensive list of Fire Safe Councils and community organizations. CFSC provided assistance to these community members and to local fire agencies that were working to achieve the prestigious recognition of Firewise. While acting as the State Liaison from 2012 to 2017, CFSC increased the number of Firewise Communities in California from 50 to 92 nationally recognized communities.

Table 8.E: Wildfire Mitigation Projects Funded by California Fire Safe Council

Year	Total Value of Projects	Number of Grants
2008	$5,281,054	77
2009	$17,791,675	160
2010	$20,874,237	158
2011	$8,950,627	81
2012	$5,437,783	52
2013	$4,937,941	53
2014	$4,028,427	38
2015	$3,358,081	25
2016	$2,149,999	20
2017	$2,100,000	21
Total	**$74,909,824**	**685**

Source: California Fire Safe Council; http://www.cafiresafecouncil.org/wp-content/uploads/2017/08/2017-Grant-Report.pdf

Local Fire Safe Councils (FSCs) are community-based organizations organized to educate groups on Fire Safe programs, projects, and planning, in addition to providing resources to assist communities to take the education into action. The FSCs have been instrumental in securing funding and resources and work closely with the local fire agencies to develop and implement project priorities. For example, the FSCs provide education about defensible space and provide free chipping service to help residents create defensible space by eliminating fuel loads. Much of the value in the FSCs lies in their ties to their communities; they educate their neighbors and assist with planning Fire Safe projects that fit the needs of their local area. Local FSCs have made great strides where agencies and governing bodies have struggled. Many communities have their own Defensible Space Programs (Public Resources Code Section 4291), neighbors helping neighbors with fire prevention education and improving their home's chances to survive a wildland fire by supporting the 100-foot defensible space requirement of state law. There are approximately 200 local and 20 countywide Fire Safe Councils.

Information regarding the California Fire Safe Council and the Grants Clearinghouse can be found at: http://www.Fire Safecouncil.org/.

Community Wildfire Protection Plan

A Community Wildfire Protection Plan (CWPP), as defined by the Healthy Forests Restoration Act (HFRA), enables a community to plan how it will reduce the risk of wildfire. This landmark legislation includes the first meaningful statutory incentives for the United States Forest Service (USFS) and the Bureau of Land Management (BLM) to give consideration to the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects.

In order for a community to take full advantage of this new opportunity, it must first prepare a Community Wildfire Protection Plan (CWPP). Local wildfire protection plans can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection—or all of the above. The process of developing a CWPP can help a community clarify and refine its priorities for the protection of life, property, and critical infrastructure in the wildland urban interface. It also can lead community members through valuable discussions regarding management options and implications for the surrounding watershed.

The development of a CWPP is a collaborative effort involving government entities and affected non-governmental interests, including community grassroots organizations, such as local, county, and regional Fire Safe Councils and local community residents. Communities throughout the state have been encouraged to develop a CWPP and integrate their CWPP planning process into other planning processes such as:

- County or city general plan preparation
- Local Hazard Mitigation Plan (LHMP) preparation
- Flood Mitigation Plans (prepared by communities participating in the National Flood Insurance Program [NFIP])
- Other local hazard, evacuation, and emergency planning efforts

For communities without a CWPP, a good starting place in the plan development process is working from an existing plan such as a general plan safety element or CAL FIRE Unit Plan and building in the CWPP minimum requirements, which consist of the following:

1. **Collaboration.** A CWPP must be collaboratively developed with local, state, and federal agencies that manage land in the vicinity of the community along with other non-governmental stakeholders (i.e., large industrial landowners and utility companies).

2. **Priorities for Fuel Reduction.** A CWPP must identify and rank areas for hazardous fuel reduction treatments on both federal and non-federal land. It needs to recommend the types and methods of treatment that, if completed, would reduce the risk to the community.

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

4. **Final Certification and Agreement Page.** The CWPP must be agreed to and signed off by three entities: the local government, the local fire department, and the State Forester. Communities with a completed CWPP are required to attach this signature page to their plans.

Communities may be listed in or covered by a countywide CWPP and/or develop their own plans. El Dorado County is an example in which there is a countywide plan and approximately 17 communities covered by the countywide plan have been creating individual CWPPs supported by the El Dorado County Fire Safe Council.

Fuel Reduction Programs

Fuel reduction programs are administered and implemented at many of the same levels as defensible space programs.

CAL FIRE offers a Vegetation Management Program (VMP), a cost-sharing program that focuses on the use of prescribed fire and mechanical means for addressing wildland fire fuel hazards and other resource management issues on State Responsibility Area (SRA) lands. A significant provision of the VMP is the public-private partnership authorized by legislation, wherein state-funded CAL FIRE resources can be used on private land at state expense to reduce hazardous fire-prone vegetation. Prior to this legislation, use of public resources was not allowed on private land.

The California Forest Improvement Program (CFIP) provides cost-share assistance to private forest landowners, Resource Conservation Districts, and non-profit watershed groups. Cost-shared activities include management planning, site preparation, tree purchase and planting, timber stand improvement, fish and wildlife habitat improvement, and land conservation practices.

On July 25, 2017, Governor Edmund G Brown signed Assembly Bill (AB) 398, which suspended the State Responsibility Area Fire Prevention Fee (SRAFPF) until 2031. This change in funding replaced the SRAFPF funding with money allocated from the Greenhouse Gas Reduction Fund (GGRF). In addition to continuing to reduce the risk of wildland fires to habitable structures and communities, these fire prevention activities will help maximize carbon sequestration in healthy wildland habitat and minimize the uncontrolled release of emissions emitted by wildfires. For further information regarding the Fire Prevention Grants, visit: http://calfire.ca.gov/fire_prevention/firepreventiongrants.

In 2016-2017 funding cycle, the SRAFPF and Tree Mortality Grant Program had $15.75 million available for projects that focus on supporting local efforts to remove dead and dying trees that pose a threat to public health and safety and for projects that reduce the wildfire threat to habitable structures within State Responsibility Areas (SRAs). Eligible grantees may be local entities including, but not limited to, local government, fire districts, community services districts, water districts, and special districts with SRAs within their jurisdictions, or certified local conservation corps, Fire Safe Councils, or other non-profit organizations organized under Section 501(c)(3) of the federal Internal Revenue Code. Native American tribes are eligible for the tree mortality grants but are generally not eligible for the State Responsibility Area Fire Prevention Fund Grants. They can work with local districts or non-profit organizations to include desired project work in a grant proposal, however.

CAL FIRE works with local government agencies or non-profit organizations, (any California corporation organized under Section 501(c) (3)) to implement Community Assistance Grants (CAGs). In 2018, CAL FIRE has the following grant programs:

- CCI Forest Health
- CCI Urban and Community Forestry
- Fire Prevention
- California Forest Improvement Program
- Local Assistance For Tree Mortality
- Volunteer Fire Assistance

For more information about CAL FIRE's grant programs, visit: http://www.fire.ca.gov/grants/grants. CAL FIRE also assists local agencies and councils in the wildland-urban interface grant process. Some private entities, such as utility companies, also offer private landowners fuel reduction grants.

In addition to state-sponsored programs, the Natural Resources Conservation Service provides the Environmental Quality Incentives Program (EQIP). EQIP was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP contracts provide financial assistance to implement conservation practices. Program practices and activities are carried out according to an EQIP plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or measures needed to address the resource concerns.

Fire Safe Councils assist with the award and administration of the grants that are awarded through the Grants Clearinghouse; these grant dollars may come from federal agencies such as BLM or the USFS.

The FEMA Pre-Disaster Mitigation (PDM) grant program provides assistance to communities that have identified wildfire hazard mitigation needs such as creating defensible space, applying methods for ignition-resistant construction and hazardous fuel reduction, and obtaining planning grants.

Fire safe planning efforts such as the California Fire Plan (updated in 2010), CAL FIRE Unit Fire Plans, Local Hazard Mitigation Plans (LHMPs), general plan safety elements, and local Community Wildfire Protection Plans (CWPPs) are the road maps for reducing the risk of wildfire. These plans identify projects that fit within communities' priority areas and are considered to be of most value. These documents are invaluable to the implementation of Fire Safe programs throughout the state.

CAL FIRE Historical Wildfire Activity Statistics (Redbooks)

CAL FIRE prepares annual reports of wildfire activity statewide for each calendar year. The reports, also known as "Redbooks," summarize protection areas and annual wildfire statistics including:

- Number of fires by cause, by region
- Number of acres burned by cause, by region
- Dollar damage by cause, by region
- Statewide totals of number of fires, number of acres burned, wildfire arson, and CAL FIRE structures destroyed

While the reports are intended as a statistical record of wildfire incidents responded to by CAL FIRE, the information provided in these reports is an important precursor to mitigation efforts as it provides hard numbers about causes of fires that can be used to inform local and regional fire mitigation planning. Annual Redbooks from 1943 through 2016 are available on the CAL FIRE website at the following link:
http://www.fire.ca.gov/fire_protection/fire_protection_fire_info_redbooks.

CAL FIRE also reports incidents using a web-based intranet service called California All Incident Reporting System (CAIRS) for use by CAL FIRE staff. Due to data entry differences, data in CAIRS and Redbooks may differ in completeness.

Firewise USA

Firewise USA is a unique opportunity available to America's fire-prone communities. Its goal is to encourage and acknowledge action that minimizes loss of homes to wildfire. It teaches homeowners to prepare for a fire before it occurs. The program adapts especially well to small communities, developments, and residential associations of all types. As State Liaison (2012-2017), CFSC promoted the Firewise program to its extensive list of Fire Safe Councils and community organizations. CFSC provided assistance to these community members and to local fire agencies that were working to achieve the prestigious recognition of Firewise.

While acting as the State Liaison from 2012 to 2017, CFSC increased the number of Firewise Communities in California from 50 to 92 nationally recognized communities. Firewise Communities/USA is a simple, three-step template that is easily adapted to different locales. It works in the following way:

- Wildland fire staff from federal, state, or local agencies provide a community with information about coexisting with wildfire, along with mitigation information tailored to that specific area
- The community assesses its risk and creates its own network of cooperating homeowners, agencies, and organizations
- The community identifies and implements local solutions

National Cohesive Wildland Fire Management Strategy

In 2009, Congress passed the Federal Land Assistance, Management, and Enhancement Act (FLAME Act), which directs the United States Department of Agriculture (USDA) and the Department of the Interior (DOI) to develop a national cohesive wildland fire management strategy to comprehensively address wildland fire management across all lands in the United States.

Under the direction of the intergovernmental Wildland Fire Leadership Council (WFLC), the National Cohesive Wildland Fire Management Strategy effort (Cohesive Strategy) was initiated in 2010 through a three-phased approach to planning, risk analysis, and collaboration by federal, state, local, and tribal governments and non-governmental partners and public stakeholders. The phased approach allowed systematic and thorough engagement by stakeholders throughout the effort. Each phase included milestones that serve as the building blocks for subsequent steps. A report, The National Strategy, The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy (National Strategy), and the companion National Action Plan culminate the third phase of the Cohesive Strategy effort.

The National Strategy recognizes and accepts fire as a natural process necessary for the maintenance of many ecosystems and strives to reduce conflicts between fire-prone landscapes and people. By simultaneously considering the role of fire in the landscape, the ability of humans to plan for and adapt to living with fire, and the need to be prepared to respond to fire when it occurs, the Cohesive Strategy takes a holistic approach to the future of wildland fire management.

The Wildland Fire Leadership Council (WFLC) adopted the following vision for the next century:

> *To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire.*

The primary national goals identified as necessary to achieving the vision are:

- *Restore and maintain landscapes:* Landscapes across all jurisdictions are resilient to fire- related disturbances in accordance with management objectives.
- *Fire adapted communities:* Human populations and infrastructure can withstand a wildfire without loss of life and property.
- *Wildfire response:* All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

Under the National Strategy, federal, state, and local fire agencies will endeavor to collaboratively solve the wildfire problem in California. As a fire does not distinguish political boundaries, this "all hands, all lands" approach is intended to examine and subsequently reduce fire risk on a landscape scale instead of looking toward solutions for a specific jurisdiction, as has largely been done historically.

"Communities at Risk"

To help protect people and their property from potential catastrophic wildfire, the National Fire Plan directs funding to be provided for projects designed to reduce the fire risks to communities. A fundamental step in achieving this goal was the identification of communities that are at high risk of damage from wildfire.

At the request of Congress, states have submitted lists of all communities within their borders that meet the criteria of structures at high risk from wildfire and are adjacent to federal lands. These high risk communities identified within the WUI were published in the Federal Register in 2001. With California's extensive WUI situation, the list of communities extends beyond only those adjacent to federal lands and includes 1,329 communities.[222] California's "Communities at Risk" are unique communities ranging from large cities, such as San Diego and Los Angeles, to small unincorporated areas with few residents.

Post-Fire Assessments of Effects of Wildfire

Post-disaster effects can also have catastrophic impacts on life, property and the environment. For example, the Thomas Fire, which burned 281,893 acres in December 2017 and January 2018, damaged or destroyed over 1300 structures, caused the evacuation of over 100,000 people, and severely damaged the watershed in Ventura and Santa Barbara Counties. The consequences of that watershed damage became immediately evident when significant rainfall on January 9, 2018 triggered debris flows and flash floods destroying 166 structures, damaging 395 more, and taking 21 lives in Santa Barbara County.

Burn Area Emergency Response Team and State Emergency Assessment Team

The United States Forest Service (USFS) has conducted Burn Area Emergency Response (BAER) team assessments for burned areas located on federal lands. The BAER teams provide a rapid assessment of the fire area and downstream values at risk to determine whether the potential post-fire effects pose a threat to life or property. However, BAER teams only examine federal lands. The directives issued in the Governor's Executive Order S-07-08 collectively require Cal OES, the California Resources Agency, and the California Environmental Protection Agency to provide a similar service to citizens living near burned areas on state, local, tribal, or private lands.

The State Emergency Assessment Teams (SEATs) have been used to conduct similar assessments where needed on State Responsibility Areas (SRAs). While BAER teams are comprised of USFS personnel, the funding and personnel availability for SEATs is not provided for by regulation or statute. In many cases, SEATs work closely with BAER teams to avoid duplication of effort and also to ensure that entire watershed effects are evaluated, since debris torrents and mudslides, which are more common after catastrophic wildfire, occur without regard to jurisdictional boundaries. Both SEATs and BAER teams set work priorities based on potential values and threats to life, property, safety, and resources.

[222] http://osfm.fire.ca.gov/fireplan/fireplanning_communities_at_risk

Watershed Emergency Response Team

Post wildfire evaluation work on non-federal lands in California has been conducted by the California Department of Forestry and Fire Protection (CAL FIRE) in numerous ways over the past 60 years, beginning with Emergency Watershed Protection (EWP) assessments identify and mitigate hydrologic and geologic risk following wildfire. In 2007, CAL FIRE Watershed Protection Program staff developed a draft prioritization form for use in identification of fires that could present the highest risk to lives and property. This approach was revisited in 2015, and has become the basis for Watershed Emergency Response Team (WERT) deployment. WERTs are assembled and deployed to better coordinate local assistance to ensure a rapid response in identification of life safety and property hazards resulting from wildfires. The primary goal is to avoid or reduce the risk posed by post-fire hazards downslope or downstream of burn areas. For more information about WERT see *Section 6.2.4*.

Debris Removal and Recovery Capabilities

In response to the worst fire season in California recorded history, the California Governor's Office of Emergency Services (Cal OES), City of Ventura, County of Ventura, County of Santa Barbara, Federal Emergency Management Agency (FEMA), United States Army Corps of Engineers (USACE), and CalRecycle partnered in a historic recovery mission in completing the major debris removal operations on more than 640 parcels across Ventura and Santa Barbara counties associated with the Thomas Fire.

Additionally, all major work for the removal of fire and ash debris has now been completed in Butte, Lake, Mendocino, Napa, Nevada, Sonoma, and Yuba Counties. So far, nearly 1.7 million tons of debris and over 400,000 pounds of household hazardous waste and asbestos across all seven counties has been removed.

Since the October 10, 2017, disaster declaration, nearly 4,500 households have been approved for FEMA individual assistance, for a total of more than $15.7 million. Of this amount, more than $9.6 million has been approved for housing assistance that can help with home repairs or replacement, rental assistance for residents to use to find another place to live temporarily while home repairs are being made, and more than $6.1 million for other needs assistance. Other needs assistance is a grant to pay for other uninsured or underinsured expenses such as disaster-related medical, dental, or funeral costs or personal property losses.

Reimbursements to state and local agencies have also been awarded, under the FEMA Public Assistance program. The Public Assistance program is intended to benefit everyone—neighborhoods, cities, counties and states. Public Assistance dollars help clean up communities affected by disaster-related debris, repair or replace infrastructure damaged by the disaster such as roads and bridges, and reimburse for emergency protective measures such as overtime costs for first responders or evacuation and sheltering activities. So far, more than $271.8 million in Public Assistance grants have been obligated for eligible disaster-related costs, and the coming months will see millions in additional federal and state assistance to cities, counties, utility districts, and other Public Assistance recipients

The U.S. Small Business Administration (SBA) is another partner agency that plays an integral role in disaster recovery. The SBA provided assistance to businesses of all sizes, private non-profits, homeowners, and renters in the form of low-interest disaster loans. The SBA has approved nearly 1,200 loans for homeowners, renters, and businesses for more than $151 million.

Although significant and historic recovery progress has been made over the last six months, preparing for future disasters remains essential as increased flood risks that follow fires will persist for several years.[223,224]

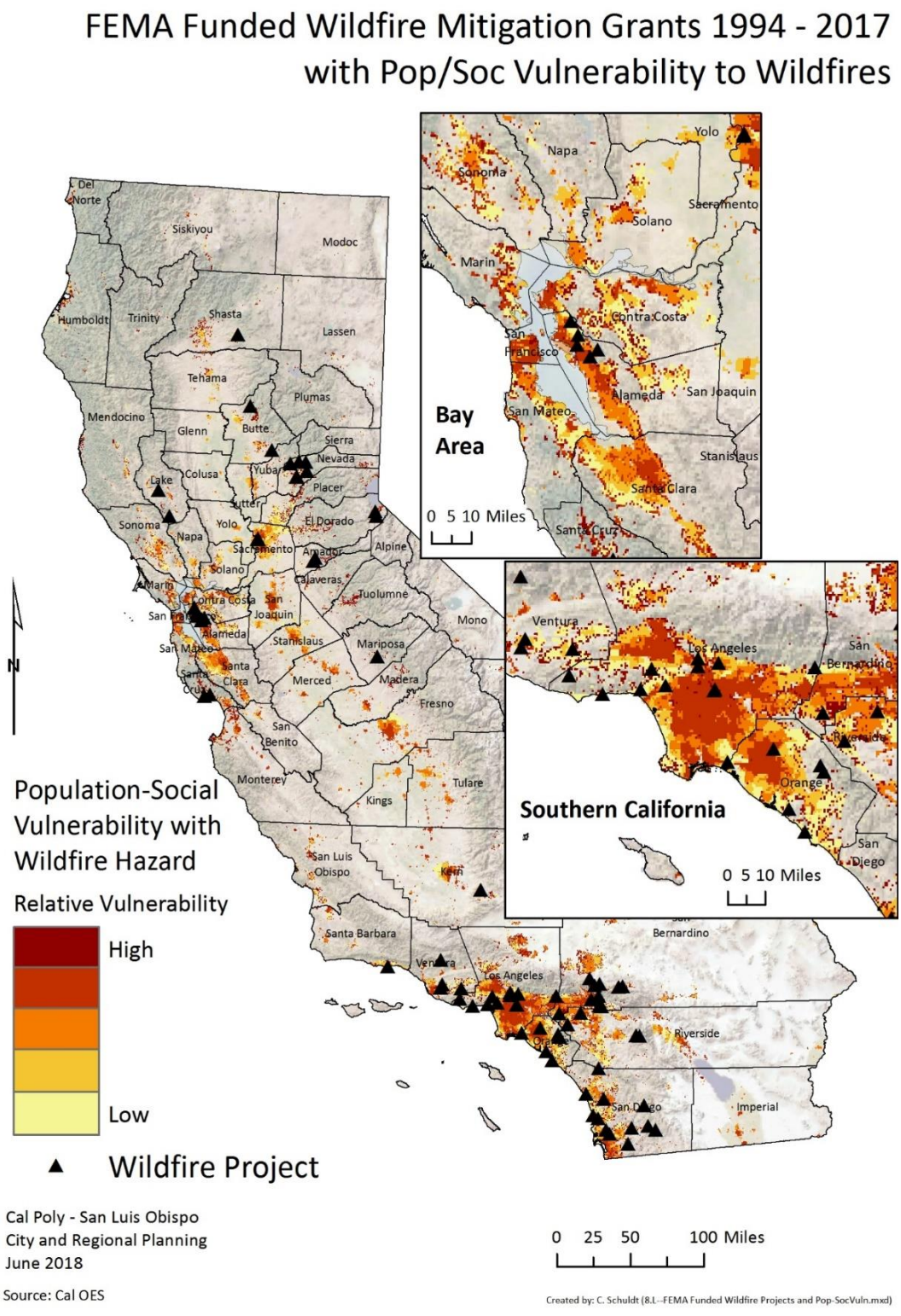
8.1.5.5 FEMA-FUNDED FIRE HAZARD MITIGATION PROJECTS

Map 8.M shows the pattern of wildfire-related Hazard Mitigation Assistance grant funded (Hazard Mitigation Grant Program and Pre-Disaster Mitigation) projects obligated since 1994 in relation wildfire vulnerability.

[223] "Major Debris Removal Operations are Complete in Southern California" May 11, 2018 Bryan May

[224] "Signs of Recovery Show Six Months After Most Destructive Wildfires in California History, Debris Removal Reaches Major Milestone" April 6, 2018 Brad Alexander

MAP 8.M: FEMA-Funded Wildfire Mitigation Projects and Population/Social Vulnerability



8.1.6 ADDITIONAL WILDFIRE HAZARD MITIGATION OPPORTUNITIES

California law requires each city and county to adopt a general plan "for the physical development of the city or county, and any land outside its boundaries which…bears relation to its planning" (Government Code Section 65300). The general plan is the "constitution" for all local development. It expresses the community's goals and embodies public policy relative to the distribution of future land uses, both public and private. The general plan must contain seven mandatory elements—land use, housing, circulation, conservation, open space, noise, and safety – and an additional environmental justice element if the planning area contains a disadvantaged community. Although WUI issues could be addressed in almost any of the mandatory elements, the most logical place for them is the safety element.

The goal of the safety element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from hazards such as fires, floods, earthquakes, and landslides. Within the safety element, local jurisdictions must address fire-safe standards, including evacuation routes, water supplies, road widths, and clearance around structures. Although fire safe planning has been required to be included in general plans since 1974, SB 1241 (2012) added more specific fire planning requirements to Government Code Section 65302.5 and intensifies the application of OPR's Fire Hazard Planning Guidelines in SRAs and VHFHSZs (see *Section 8.1.5.2*).

In 2003, OPR provided specific guidance for incorporating fire issues in the general plan in a publication entitled "Fire Hazard Planning," which is part of the General Plan Technical Advice Series. This document was updated in 2015 and can be downloaded at: http://opr.ca.gov/docs/Final_6.26.15.pdf.

The purpose of the document is to help local jurisdictions develop effective general plan policies related to fire hazard mitigation and to help Fire Safe Councils, concerned citizens, and other interested parties develop fire plans that contain policies that can easily be integrated into local general plans.

The "Fire Hazard Planning" publication encourages a collaborative approach to hazard mitigation planning that links local mitigation efforts with local land use decision-making and that involves state and local government agencies, elected officials, local planners, community members, non-profit organizations, fire districts, and others. This approach maximizes community safety and can help link planning and funding decisions. It has provided a model for other community guidance, such as that provided for communities in flood hazard zones represented by the California Department of Water Resources (DWR) handbook for communities implementing flood hazard legislation.

The "Fire Hazard Planning" document is further strengthened by the passing of Senate Bill (SB) 1241 in 2012. Among other things, SB 1241 requires communities to take the most recent "Fire Hazard Planning" document into account during periodic general plan safety element updates.

8.2 URBAN STRUCTURAL FIRE HAZARDS, VULNERABILITY, AND RISK ASSESSMENT

Identifying and Profiling Structural Fire Hazards

Structural fires are generally defined as fire originating in and burning any part or all of any building, shelter, or other structure, which may include residential, commercial, or industrial buildings. The U.S. Fire Administration (USFA) provides statistics on fires reported through the National Fire Incident Reporting System (NFIRS). The most recent report, published in 2014, documents fire loss in California broken down by property type.

Table 8.F: Reported Fire Loss in California by Property Type in 2014

Property Type	% of Deaths	% Injuries
Residential structures	60.2%	63.7%
Non-residential structures	3.1%	10.8%
Vehicles	19.4%	10.3%
Outside	13.3%	6.6%

Source: U.S. Fire Administration (USFA), 2017, https://www.usfa.fema.gov/data/statistics/states/california.html

As indicated in Table 8.F, residential and other structural fires accounted for more than half of all loss associated with fires in California in 2014. The figures, however, are total figures for all fires regardless of cause. Some casualties may be related to a single structure fire or may be a result of a larger fire or conflagration, including a wildfire. For example, residential casualty figures provided by the USFA for California for 2017 document 132 deaths.[225] Preliminary wildfire figures for California's 2017 wildfires count 41 casualties as a direct result of the October 2017 Northern California wildfires.

Single residential structural fires may be the most common type of structural fire occurring both in California and the United States as a whole and these types of fires are usually contained effectively with local fire suppression resources. While they may result in casualties, damage tends to be limited to the immediate area surrounding the burning structure.

Larger, more destructive fires in urban areas are referred to as urban conflagrations. These fires occurred with some frequency in the early urban history of the United States in major urban areas, including the cities of Boston (1872), Baltimore (1904), Chicago (1871, 1874), Jacksonville (1901), San Francisco (1851, 1906) and most recently Santa Rosa, during the October 2017 wildfires. These conflagrations tend to start as a single fire ignition in a structure and spread rapidly, causing major destruction. Common factors contributing to historical conflagration devastation included the predominance of wood construction which fueled the fires, lack of water and adequate firefighting resources. In several cases, high winds and dry conditions resulting from recent drought were cited as critical determinants of fire spread. Recently in California, however, the ignition of urban conflagration has also resulted from wildland fires during extreme weather conditions, such as occurred in Northern California in October 2017.

An additional source of urban conflagration is fire following earthquake, an example of which was the devastating fire following the Great San Francisco Earthquake in 1906. The urban fire conflagration that followed the 1906 San Francisco Earthquake did more damage than the earthquake itself. Many buildings and infrastructure were destroyed in the 1906 San Francisco Earthquake, partially as the direct result of shaking, but also due to the fires exacerbated by damaged infrastructure. A series of shocks broke the water mains that served residences primarily made of wood, and dozens of fires erupted as the shaking subsided. The losses included over 28,000 buildings, 500 city blocks, 3,000 lives, and the homes of over 200,000 people.[226]

[225] https://www.usfa.fema.gov/data/statistics/
[226] LOC, 2012

Urban Fire Conflagration

In addition those urban fires that ignite due to proximity wildland urban interface wildfires, urban structural fires and conflagration can also be triggered by many other conditions, including buildings not being built to code, buildings under construction, industrial releases and explosions, chemical explosions, earthquakes, gas leaks, arson, and civil unrest. A source of danger to cities throughout human history, urban conflagration has been reduced as a general source of risk to life and property through improvements in community design, construction materials, and fire protection systems.

For example, following the Great Chicago Fire of 1871, improvements in architecture, building design, and construction materials helped to reduce the likelihood of recurrence. Subsequent improvements in construction have been encouraged throughout the U.S. by modern building and fire codes. Although the frequency of urban conflagration fires has been reduced, they remain a risk to human safety. One reason is the current trend toward increased urban density and infill in areas adjacent to the wildland-urban interface (WUI). In an effort to keep housing close to urban jobs, areas previously left as open space due to steep slopes and high wildland fire risk are being reconsidered as infill areas for high-density housing.

The most recent example of a wildfire spreading into an urban area and resulting in urban conflagration is the October 2017 Tubbs Fire, which is described in the *Section 8.1* of this chapter. Fueled by high wind and urban structural fuel, this devastating fire, exemplifies the potential of a wildland urban-interface wildfire to penetrate farther into densely populated urban areas than previously anticipated. That fire developed into an urban conflagration and resulted in the destruction of over 5,000 structures and 22 fatalities.

Another example of urban conflagration linked to wildland fire in recent California history is the Oakland Hills firestorm, officially known as the Tunnel Fire. The firestorm occurred in October 1991, within a larger high fire hazard zone that is part of an approximately 60-mile stretch of hills running from the Carquinez Strait to San Jose in the east San Francisco Bay Area, in portions of the cities of Oakland and Berkeley. In Oakland 2,777 units were destroyed or badly damaged and 69 additional units were destroyed in Berkeley. The fire happened in a largely built-out residential area that has a long-standing fire history linked to hot, dry fall winds and the presence of dense, flammable vegetation. Seasonably strong, dry winds drove flames furiously and rapidly across an approximately 2.5 square mile area of densely developed hillside neighborhoods.[227]

Residential Warehouse Fire

Referred to as the "Ghost Ship" Fire, the warehouse fire that occurred in Oakland on December 2, 2016, resulted in 40 deaths, and left the city in a state of tragedy and loss. The warehouse was used as illegal studio living space with makeshift kitchens, large amounts of flammable materials such as wooden pallets and propane tanks, and appliances such as heaters, generators, and hot plates being used in dangerous conditions. The electrical system was overloaded and was observed to have been "modified," and extension cords and powerstrips, rather fixed outlets, were used throughout the warehouse to energize appliances.[228] According to the Oakland Fire Department's "Origin and Cause Report," the fire originated in northwest area of the building's first floor, but the Fire Department was unable to make a conclusive determination of the cause of the fire.

A host of lessons can be learned from this unfortunate disaster, from the dire need for more affordable housing in the Bay Area, to the importance of proper property management, to the necessity fire safety regulation compliance. When considering mitigating potential structural fires, building code requirements and building inspections should be key components of the mitigation program.

[227] K. C. Topping, J. Schwab, et al. Planning for Post-Disaster Recovery and Reconstruction, American Planning Association, Planning Advisory Service, Report No. 483/484. 1998. p. 261-262.

[228] Oakland Fire Departments' Origin and Cause Report, Incident #2016-085231, December 2, 2016 1315 31st Avenue; http://www.fireengineering.com/content/dam/fe/online-articles/documents/2017/oakland-ca-ghost-ship.pdf, retrieved June 1, 2017.

Construction Fires

The Santana Row Fire occurred in February 2002 in the downtown area of the City of San Jose. According to a technical report issued by the U.S. Fire Administration (USFA) in August 2002, 11 alarms were dispatched to the large structure fire and the numerous exposure fires ignited by flying embers. It required the combined effort of 221 firefighters and 65 pieces of apparatus. Fortunately, no one was killed and there were only minor injuries sustained by firefighters. Santana Row was to be a nine-building development that covered 42 acres and was spread out over several city blocks. Approximately six buildings in the 42-acre development were destroyed, causing more than $100 million in damage. Embers from the fire ignited roofs half a mile away, destroying more than 30 apartments and townhouses and causing an additional $2.5 million in damage. The cause of the fire ignition was unknown.[229]

In March 2014, a fire broke out in the Mission Bay area of San Francisco, destroying a seven-story, multi-million-dollar wood-frame apartment building under construction. Although the cause of the fire was unknown, it was fueled by a large amount of lumber, with no fire alarms or sprinklers yet installed. More than 150 firefighters and six ladder trucks responded to the fire. In addition to extinguishing the fire, efforts focused on keeping the fire from spreading to adjacent buildings, due to the high heat of the fire. One fire was ignited a block away due to embers landing on a roof, but it was quickly contained before it could spread. Low winds that day, combined with strong fire suppression, prevented this fire from becoming a significant urban conflagration.

The Temple Street Fire that occurred in Los Angeles in December 2014 provides another example of fire in unoccupied large buildings under construction. Hundreds of Los Angeles firefighters battled a massive apartment fire in the city's historic downtown, shutting down portions of two major freeways. The fire engulfed a seven-story apartment tower that was under construction on Fremont Avenue. The flames damaged two nearby buildings, including several floors of a 16-story office structure. The apartment building, one of several upscale complexes to be built in downtown Los Angeles over the past 10 years as part of an effort to revitalize the city's urban center, occupied an entire city block. The fire was fueled by the building's wooden framework. The cause of the massive fire remains unknown.

Industrial Fires

Industrial fires, depending on location, have the potential to become urban conflagrations. Also, depending on the contents of the fire, they can cause serious health problems due to both smoke and toxic materials. Examples include the 2016 Fruitland metal recycling plant fire in Maywood, California, which released heavy metals and chemicals into the air, prompting Los Angeles County to issue health advisories; and the May 2013 pallet fire in an industrial area of Fontana, in which towering stacks of wooden pallets covering a quarter acre of land turned into massive bonfires fanned by 25 mile-per-hour winds. Smaller spot-fires appeared in nearby brush but were extinguished by San Bernardino County firefighters before they could spread further.

Explosion Caused Fires

The San Bruno pipeline explosion occurred September 9, 2010, in San Bruno, California, a suburb of San Francisco, when a 30-inch (76-centimeter)-diameter steel natural gas pipeline owned by Pacific Gas & Electric exploded into flames in a residential neighborhood 2 miles (3.2 kilometers) west of San Francisco International Airport. The loud roar and shaking led some residents of the area, first responders, and news media to initially believe that it was an earthquake or that a large jetliner had crashed. It took crews nearly an hour to determine that the explosion was caused by a gas pipeline. As of September 29, 2010, the death toll was eight people. The U.S. Geological Survey (USGS) registered the explosion and resulting shock wave as a magnitude 1.1 earthquake. Eyewitnesses reported that the initial blast had a wall of fire more than 1,000 feet high.

The explosion caused a fire that quickly engulfed nearby houses. Strong winds fanned the flames, hampering firefighting efforts. The blaze was fed by a ruptured gas pipe, and large clouds of smoke soared into the sky. According to the local fire chief, it took 60 to 90 minutes to shut off the gas after the explosion, and thus the gas continued to fuel the fire. The explosion and resulting fire leveled 35 houses and damaged many more. Three of

[229] USFA-TR-153/August 2002

the damaged houses, deemed uninhabitable, were torn down in December 2010, bringing the total to 38. About 200 firefighters battled the eight-alarm fire that resulted from the explosions. The neighborhood continued to burn into the night even after the exploding gas main had been shut off. The explosion compromised a water main and required firefighters to truck in water from outside sources. Firefighters were assisted by residents who dragged fire hoses nearly 4,000 feet (1,200 meters) to working hydrants. Ordinary citizens drove injured people and burn victims to the hospital. Mutual aid responded from all over the Bay Area; responding agencies included the California Department of Forestry and Fire Protection (CAL FIRE), which sent 25 fire engines, four air tankers, two air attack planes, and one helicopter.

Terrorism/Civil Unrest

The most devastating foreign terrorism-caused urban conflagration in the United States occurred as a result of the September 11, 2001 attacks. Two airliners were crashed into the north and south towers, respectively, of the World Trade Center complex in New York City. Within one hour and 42 minutes, both 110-story towers collapsed, with debris and the resulting fires causing partial or complete collapse of all other buildings in the World Trade Center complex, including the 47-story 7 World Trade Center tower, as well as significant damage to 10 other large surrounding structures.

The most dramatic example of civil unrest contributing to urban conflagration occurred in the City of Los Angeles from April 29 to May 1, 1992, in response to an unpopular jury verdict. In the first 36 hours of the disturbance, 863 massive structures burned in a 105-square-mile area. A total of 50 persons died during the riots, and damages were estimated at over $1 billion, not all of which were a result of fires.[230]

Assessment of State Vulnerability and Potential Losses

There is no known comprehensive assessment of state vulnerability or potential losses due to urban structural fire hazards at this time. However, studies have been performed to analyze potential vulnerability due to fire following earthquakes, such as occurred during and after the 1906 San Francisco Earthquake (see *Section 6.1.4.1*). Estimating statewide vulnerability to urban fire would be a complex process, highly dependent on identifying a source or multiple sources of fire ignition, wind patterns, fuel load, topography, vegetation, land use, and firefighting resource capability and availability, including water. At this time, there is no FEMA-developed Hazards United States (HAZUS) module, as exists for earthquake and flood.

Insurance companies selling fire insurance in California each have their own system for assigning risk, setting insurance rates, and identifying geographic areas where they do not offer insurance. These formulas vary between providers and are proprietary. As such, they are not available for state or local government use.

Assessment of Local Vulnerability and Potential Losses

Information related to community vulnerability and loss assessments may be found in Local Hazard Mitigation Plans (LHMPs).

As in the state vulnerability situation discussed above, there are no accessible vulnerability models available for use at the local government level. Local jurisdictions that have been mapped as containing high fire threat zones might be able to perform an initial analysis of vulnerability by overlaying the threat map with local land use, density, population, and building inventory data.

[230] https://www.usfa.fema.gov/downloads/pdf/publications/fa-142.pdf

Current Structural Fire Hazard Mitigation Efforts

California Building Code Requirements and Building Inspections

The 2016 California Building Code and Fire Code requirements regulate the design and construction of new and existing structures for fire safety. The Office of the State Fire Marshal is responsible for promulgating regulations that promote fire and life safety for inclusion into the State Building Codes including the California Building Code, California Fire Code, California Electrical Code, California Mechanical Code, California Plumbing Code, and California Historical Building Code. These documents are also referred to as California Code of Regulations (CCR), Title 24. The process incorporates a great deal of public participation and is guided by the State Building Standards Law.

Throughout the years, the State Fire Marshal has been given the responsibility of developing building standards affecting several industries. Because of the multi-faceted nature of fire protection, the Office of the State Fire Marshal has worked with local governments, fire officials, building officials, and the private sector to develop fire and life safety building standards addressing roof coverings, fire alarm systems, motion picture production facilities, hazardous materials, and organized camps. The Office of the State Fire Marshal also regulates the adoption of building standards in assembly, institutional, educational, and residential buildings as well as high-rises and any building containing state employees.[231]

Title 24, Part 9 is the California Fire Code. It includes the following general chapters:

1. Scope and Administration
2. Definitions
3. General Requirements
4. Emergency Planning and Preparedness
5. Fire Service Features
6. Building Services and Systems
7. Fire and Smoke Protection Features
8. Fire Protection Systems
9. Interior Finish, Decorative Materials, and Furnishings
10. Means of Egress

Additional specific topics and areas of regulation are included in subsequent chapters and can be found through the Office of the State Fire Marshal website at: http://osfm.fire.ca.gov/. One of those topic-specific chapters is Chapter 33, Fire Safety During Construction and Demolition, which includes specific requirements for buildings under construction, including:

- Installation and refueling of temporary heating equipment including oil-fired and LP-gas heaters
- Precautions against fire including prohibition of smoking, and storing of combustible debris, rubbish, and waste
- Storage, use, and handling of combustible materials and explosives
- Development of a pre-fire plan in cooperation with the Fire Chief
- Fire extinguishers, water supply, and standpipe requirements
- Access for firefighting equipment and personnel
- Means of egress including temporary stairways for buildings over 50 feet or four stories

[231] http://osfm.fire.ca.gov/codedevelopment/codedevelopment_title24development

Automatic Fire Suppression Requirements

All automatic fire suppression systems installed in California must meet standards adopted in the California Building and Fire Codes as well as manufacturing and performance standards, and bear the label of an approved testing laboratory.

California Code of Regulations (CCR), Section 904.7, Inspection, Testing and Maintenance Requirements for Engineered and Pre-Engineered Fixed Extinguishing Systems, states: "Inspection, Testing, and Maintenance shall be performed in accordance with the manufacturer's written instruction, which are approved and on file with the Office of the State Fire Marshal."

All businesses in California that test or service automatic fire extinguishing systems, including but not limited to fire sprinkler systems, engineered and pre-engineered fixed extinguishing systems, standpipe systems, and water flow alarm devices, must first be licensed through the Office of the State Fire Marshal or the Contractor's State Licensing Board. Applicants are granted Office of the State Fire Marshal licenses if they meet certain work experience and/or training requirements and pass an on-site field inspection of their facility.

Office of the State Fire Marshal

According to the website, the Office of the State Fire Marshal "provides support through a wide variety of fire safety responsibilities including: regulating buildings in which people live, congregate, or are confined; by controlling substances and products which may, in and of themselves, or by their misuse, cause injuries, death and destruction by fire; by providing statewide direction for fire prevention within wildland areas; by regulating hazardous liquid pipelines; by reviewing regulations and building standards; and by providing training and education in fire protection methods and responsibilities."[232]

The Office of the State Fire Marshal includes several task forces and provides educational materials, listings, and/or licensing for the following fire prevention matters:

- Automatic Extinguishing Systems
- Building Materials
- Fire Extinguishing
- Emergency Evacuation
- Residential Care Facilities
- Fire Hazard Recalls
- Fireworks
- Flame-Retardant Fabrics and Chemicals
- Fire Engineering
- Hydrostatic Testing
- Laboratory Accreditation
- Pipeline Safety
- Vapor Recovery

The website also contains a comprehensive list of all state regulations pertinent to fire prevention and response.

[232] OSFM, 2013, http://osfm.fire.ca.gov/aboutus/aboutus

California Governor's Office of Planning and Research Fire Hazard Planning Technical Advisory

California Governor's Office of Planning and Research (OPR) issued guidelines in 2015 to help local jurisdictions incorporate fire hazard planning into their general plans. In addition to the safety element, other affected general plan elements include land use, open space, conservation, and housing. The guidelines suggest that the following tasks be completed when considering fire risk in urban areas:

- Identify and classify fire hazard severity areas
- Evaluate age, condition, and size of structures (code-related issues)
- Evaluate use and occupancy of structures
- Evaluate construction materials and roofing assemblies
- Evaluate structure density
- Evaluate access and evacuation routes
- Evaluate vegetation management capabilities
- Evaluate historical fire data
- Evaluate projected future fire risk
- Evaluate other pertinent information (maps)
- Evaluate landscaping as potential fire hazard
- Evaluate neighborhood defensible space (island of safety)
- Identify fire protection jurisdictions
- Evaluate use of open space and other facilities as part of overall fire protection/mitigation plan
- Inventory urban forests and evaluate affect with regard to fire hazard

Additional information and details may be found at: http://opr.ca.gov/planning/general-plan/.

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