Cal OES

GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

CALIFORNIA STATE HAZARD MITIGATION PLAN

Volume 2

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Appendix K. Hazard Events History

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Appendix K. **Hazard Events History**

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K. HAZARD EVENTS HISTORY

This appendix contains excerpts of previous events and losses presented in the 2018 State Hazard Mitigation Plan (SHMP). This has not been updated for the current SHMP because this content represents a historical record of the previous SHMP. For sources cited in this appendix, see the 2018 SHMP.

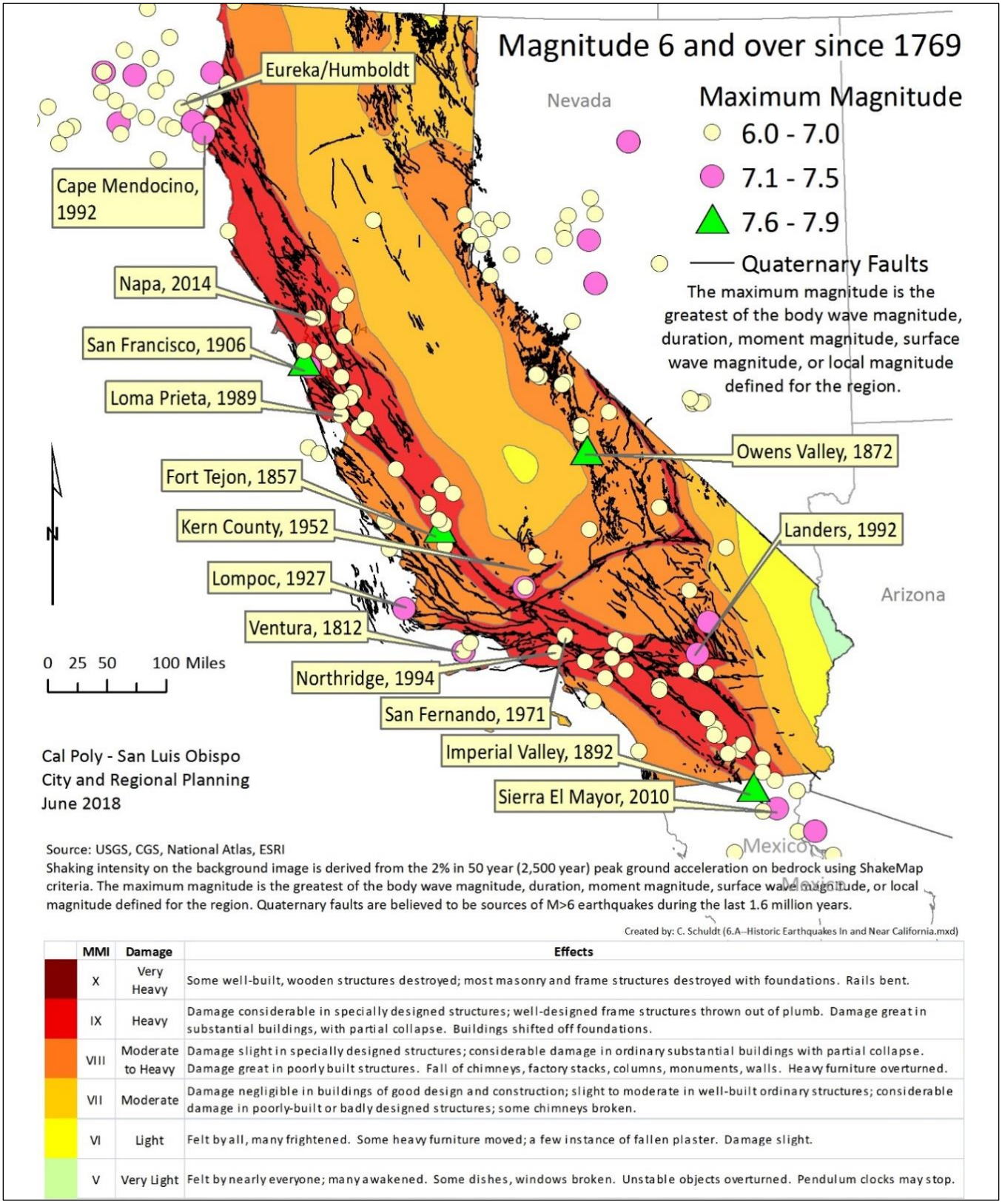
K.1. EARTHQUAKE AND GEOLOGICAL HAZARDS

K.1.1. Earthquake

Figure K-1 shows the pattern and selected dates of earthquakes in and near California during the past 240 years. Earthquakes large enough to cause moderate damage to structures – those around Magnitude 5.5 – occur three to four times a year in California. For example, the Magnitude 6.5 San Simeon Earthquake of December 22, 2003, caused two deaths, 47 injuries, and $263 million in damage. The Magnitude 6.5 Humboldt County Earthquake on January 9, 2010, resulted in zero deaths, 35 injuries, and $43 million dollars in damage. The Magnitude 7.2 El Mayor Cucapah Earthquake (also known as the Sierra El Mayor Earthquake) of April 4, 2010, was in Northern Baja California at the former mouth of the Colorado River. This event shook not only Mexicali and Tijuana but also a large part of Southern California and parts of southwestern Arizona and Nevada. There were two confirmed deaths in Mexicali and 100 persons were injured between Baja California and Imperial County California. The total estimated damage in Southern California from the El Mayor-Cucapah event was $91 million while the total estimated damage between Southern California and Baja California was estimated to be $1 billion with most of the damage affecting the agriculture industry and irrigation district in Baja California.

Strong earthquakes of Magnitude 6 to 6.9 strike California on an average of once every two to three years. An earthquake of this size, such as the 1994 Northridge Earthquake (Magnitude 6.7) or the 1983 Coalinga Earthquake (Magnitude 6.7), is capable of causing major damage, if the epicenter is near a densely populated area. The Northridge Earthquake caused over $40 billion of disaster losses, 57 deaths, and 11,846 injuries, while the 2014 earthquake (Magnitude 6.0) in less densely populated area, caused $87 million of disaster losses, one death, and 200 injuries.

Figure K-1. Historic Earthquakes in and Near California by Magnitude (1769-2017)



MMI	Damage	Effects
X	Very Heavy	Some well-built, wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
IX	Heavy	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
VIII	Moderate to Heavy	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
VII	Moderate	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly-built or badly designed structures; some chimneys broken.
VI	Light	Felt by all, many frightened. Some heavy furniture moved; a few instance of fallen plaster. Damage slight.
V	Very Light	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

Major earthquakes (Magnitude 7 to 7.9) occur in California about once every 10 years. The 1992 Landers Earthquake (Magnitude 7.3) and the 1999 Hector Mine Earthquake (Magnitude 7.1) caused extensive surface fault rupture but relatively little damage because they occurred in lightly populated areas of the Mojave Desert. Earthquakes of smaller magnitude but in densely populated areas, such as the 1989 Loma Prieta Earthquake (Magnitude 6.9), have caused extensive damage over large areas.

Figure K-2 shows the distribution of State-proclaimed and federally declared earthquake disasters from 1950 to 2017. It shows the following numbers of State- and federal-declared earthquake disasters by county (representing 26 of California's 58 counties):

- Los Angeles County – 6
- Imperial County – 5
- Humboldt, Napa, and Solano Counties – 3 in each county
- Orange, Riverside, San Bernardino, Santa Barbara, and Santa Clara Counties – 2 in each county
- Alameda, Butte, Contra Costa, Fresno, Marin, Modoc, Mono, Monterey, Sacramento, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Cruz, Sonoma, and Ventura Counties – one in each county

Figure K-3 shows the numbers of historical occurrences of events described as Modified Mercalli Intensity (MMI) Scale VII or greater from 1800 to 2017. Such events notably have been concentrated along the San Andreas Fault system, particularly in the San Francisco Bay, Monterey Bay, and Humboldt County areas. However, a significant earthquake is expected in Southern California in the near future. Such an event would change this map significantly by including both larger areas and more occurrences of damage in Southern California.

Two of the largest historic earthquakes in California, the 1857 Fort Tejon Earthquake and the famous 1906 San Francisco Earthquake, were similar in magnitude (Magnitude 7.9 and Magnitude 7.8) and resulted from movement along the San Andreas Fault. Earthquakes of this size (Magnitude 7.7 to Magnitude 7.9) can cause more extensive damage over a larger area than the Magnitude 7.1 to Magnitude 7.4 earthquakes that have struck California in recent decades.

Figure K-2. State and Federal Declared Earthquake Disasters, 1950-February 2017

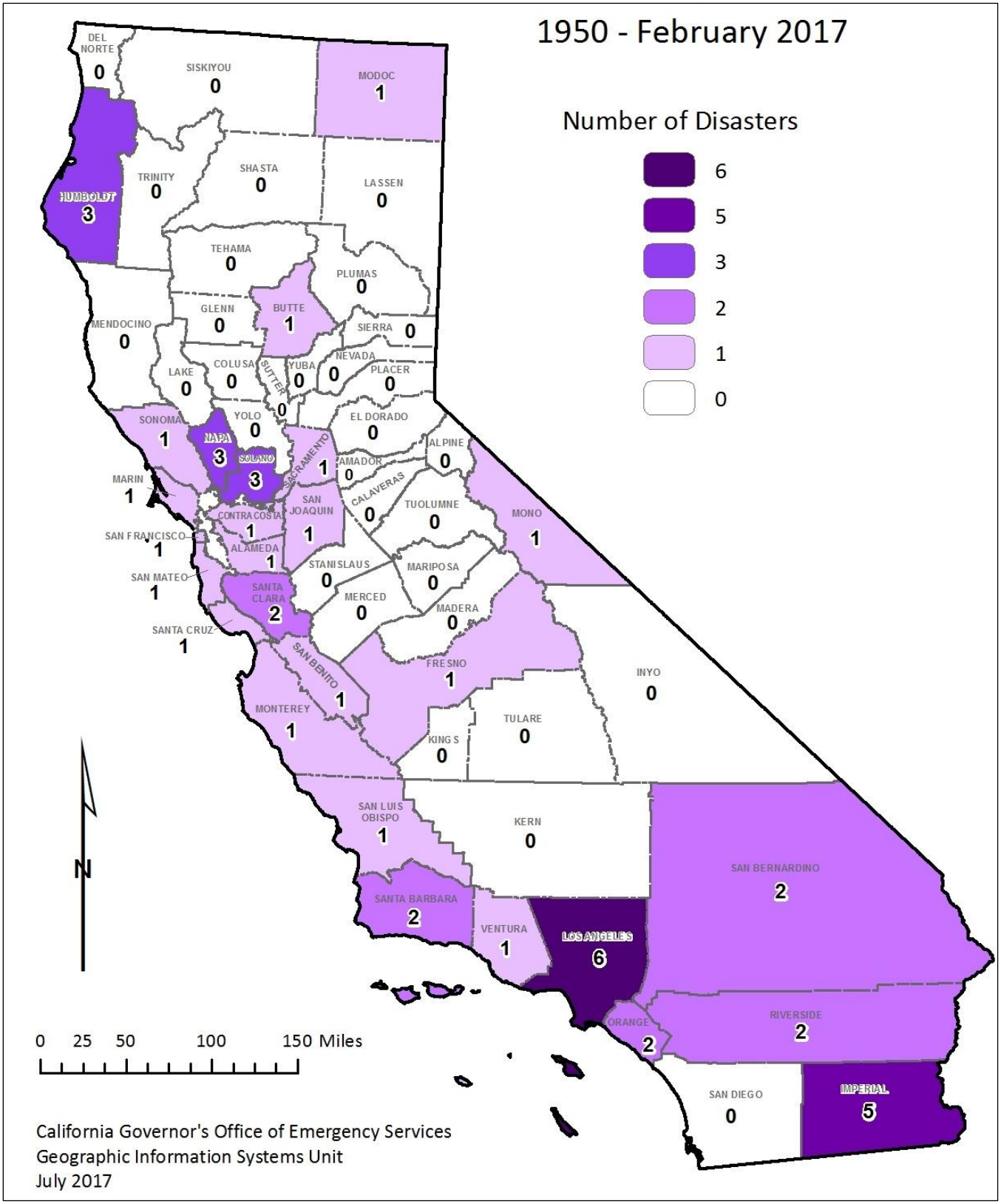
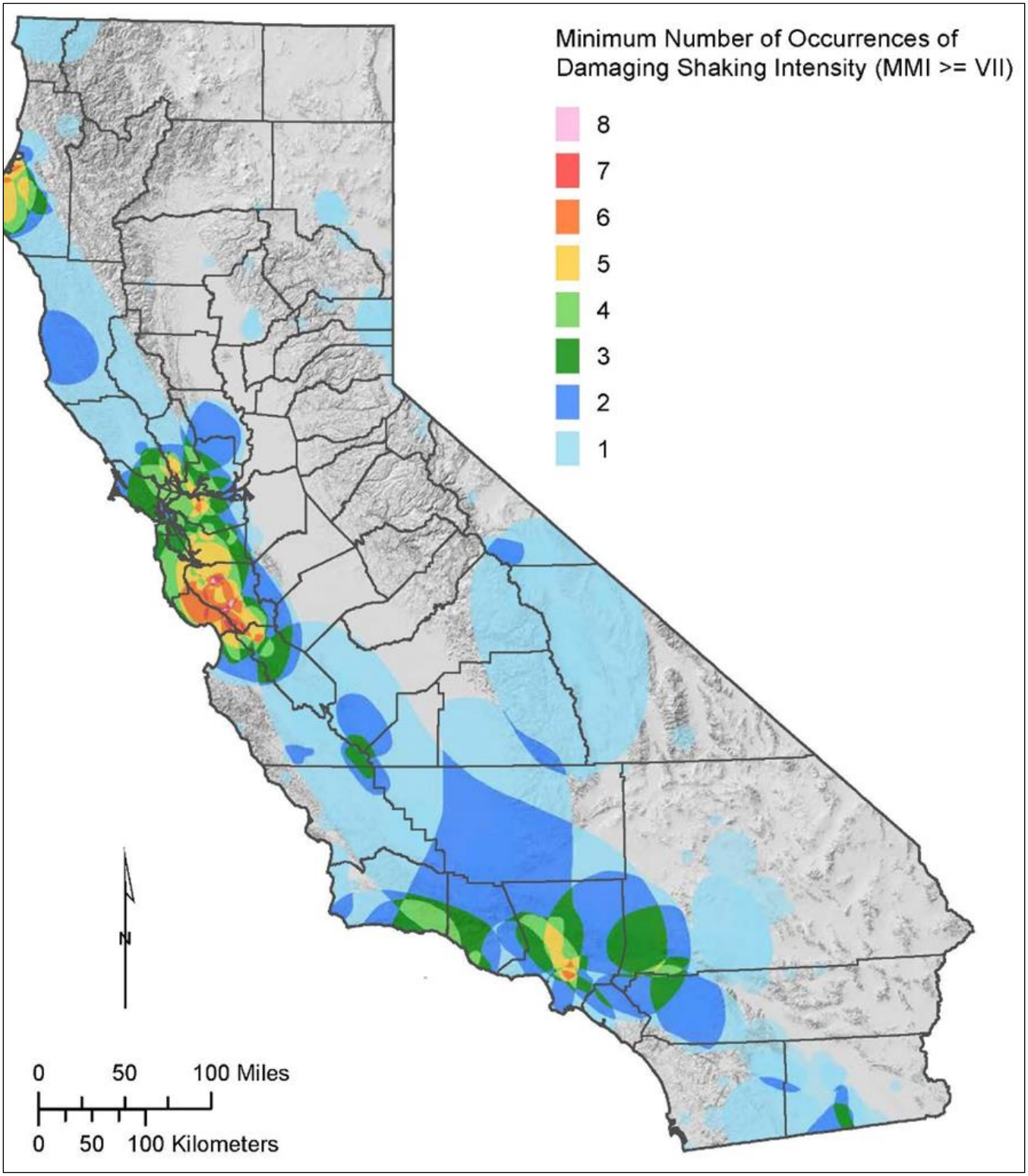


Figure K-3. Areas Damaged by Earthquakes, 1800-2017



Although no earthquake of magnitude 8 or greater has been officially recorded in California, evidence suggests that one occurred in the early 18th century. Historical and geological data strongly indicate that a Magnitude 9 earthquake occurred in January 1700 on the Cascadia Subduction Zone, which extends north from Cape Mendocino in Northern California to British Columbia. An earthquake of this size is similar to the one that struck Alaska in 1964 and is capable of extensive damage over a very broad region.

K.2. LANDSLIDE AND OTHER EARTH MOVEMENT HAZARDS

Landslide hazards are present in many regions of California. Landslide probability is notably high in the coastal regions of California, which are home to much of the State's population, industry, and infrastructure. Particularly hazardous terrain lies where weak rock layers are inclined in the same direction as the mountain slope, a condition found in many areas of California. The Franciscan Formation, which makes up much of the Northern California Coast Ranges, contains weak rock that is both easily eroded and landslide prone. Through the decades, development has been continuing to spread into mountainous terrain where hazard exposure is high. Most reported landslide losses occur in these regions, as illustrated in the cumulative landslide occurrences resulting from the 1995 El Nino winter storms, shown in Figure K-4.

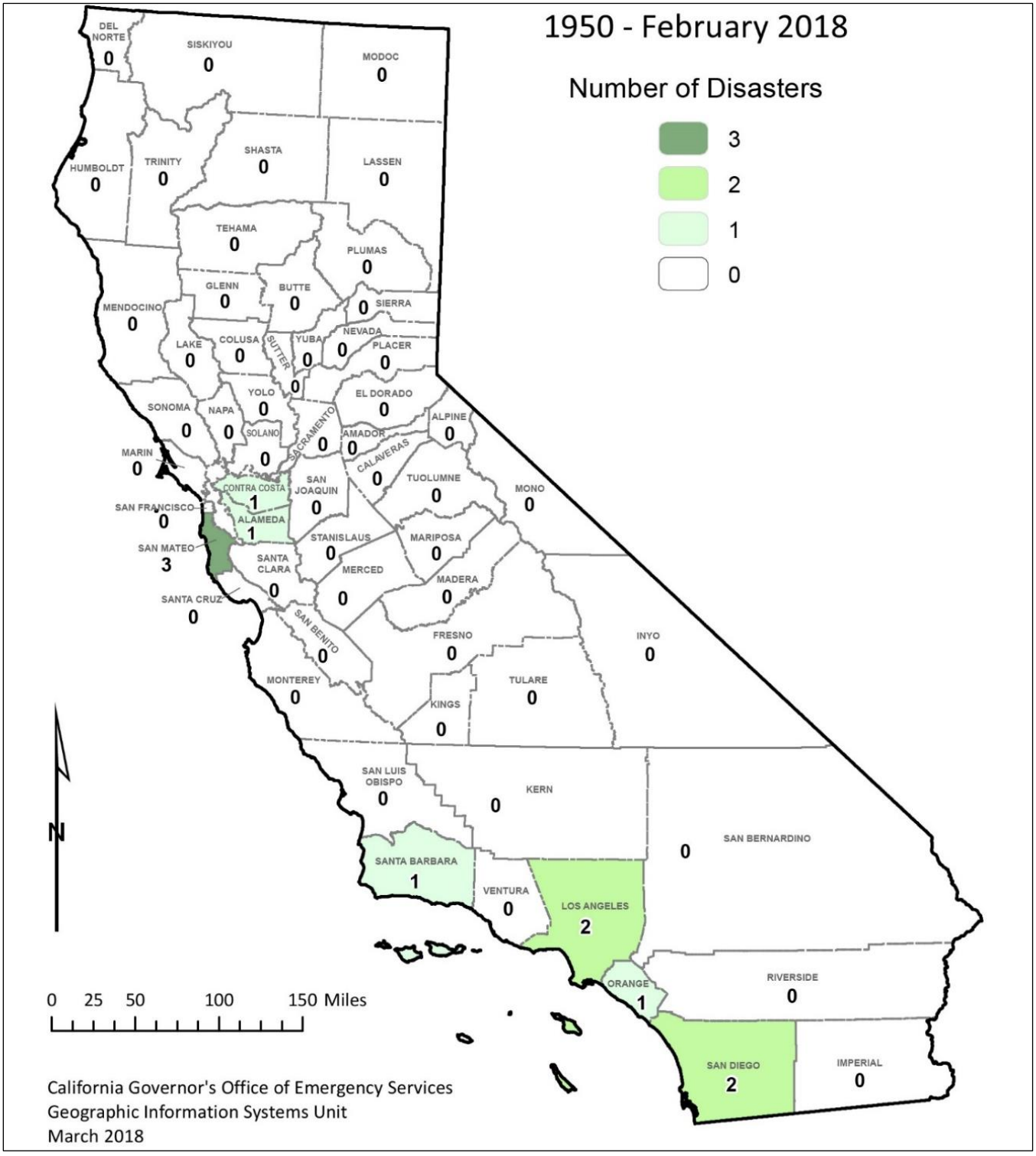
With post-fire debris flows, wildfire can significantly alter the hydrologic response of a watershed to the extent that even moderate rainstorms can produce dangerous flash floods and debris flows. Seasonal rain accumulations on burn areas have little influence on debris flow generation. However, short-duration, intense rainfall, generally greater than 0.5 inch per hour, has the potential to trigger post-fire debris flows. As the rainfall intensity increases above this value, the magnitude and impacts of the debris flows also increase. For example, the January 9, 2018, storm in Santa Barbara County triggered debris flows when rainfall intensities reached 6.48 inches per hour. This storm event initiated several debris flows within the Santa Ynez Mountains that inundated urbanized alluvial fan areas within Montecito and Carpinteria in Santa Barbara County, causing 21 fatalities and 28 injuries, destroying 127 homes and six commercial buildings, and damaging 307 homes and 17 commercial buildings.

Figure K-5 shows State and federally declared landslide disasters by county from 1950 to February 2018. Note that despite frequent local occurrence of landslides, these events are rarely large enough to qualify for a disaster declaration. Additionally, large landslides and debris flows are frequently included under other disaster categories.

Figure K-4. 1994-1995 Winter Storm Landslide Events

Earthquake shaking can rapidly weaken loose water-saturated sediments via liquefaction, which can greatly increase ground deformation and sliding, even on gentle slopes. This happened during the 1971 San Fernando Earthquake, when the soil beneath two earth-fill dams partially liquefied and shifted, causing partial collapse of both facilities. Those events resulted in over a half-billion dollars in damage and the temporary evacuation of 80,000 people below the dam.

Figure K-5. State and Federal Declared Landslide Disasters, 1950-February 2018



K.3. VOLCANO HAZARDS

The most recent eruption in California occurred at Lassen Peak in Lassen Volcanic National Park about 100 years ago, from 1914 to 1917. Geophysical and geochemical monitoring conducted by the U.S. Geological Survey (USGS) CalVO reveals the presence of magma (molten rock) beneath seven of the eight California volcanoes ranked as Moderate, High, or Very High Threat. Low levels of volcanic seismicity, emissions of noxious volcanic gas, and/or ground deformation characterize the present status of Medicine Lake, Mount Shasta, Lassen Volcanic Center, Clear Lake Volcanic Field, Long Valley Volcanic Region, Coso Volcanic Field, and Salton Buttes.

Figure K-6. 1915 Eruption of Lassen Peak as Seen from Red Bluff

Lassen Volcanic Center (LVC) lies in Lassen Volcanic National Park about 55 miles east of the town of Redding. The park draws over 350,000 visitors each year with the spectacular volcanic landscapes created by the hundreds of eruptions occurring over its 825,000-year lifespan.

The last 25,000 years at LVC have been relatively quiet with three notable exceptions: the Chaos Crags eruption (1,100 years ago), the eruption of Cinder Cone (345 years ago), and the Lassen Peak eruption (1914 to 1917). The most recent eruption was confined to sporadic steam blasts until May 1915, when partially molten rock oozing from the Lassen Peak vent began building a precarious lava dome. The dome collapsed on May 19 of that year, sending a hot pyroclastic flow racing down the north flank of the volcano.

Three days later, a vertical column of fine ash exploded from the vent reaching altitudes of 30,000 feet. A snapshot of the ash column taken from the town of Red Bluff some 40 miles west of the volcano is shown above (R.E. Stinson, courtesy of the National Park Service). Fine ash particles from the top of the column drifted downwind 200 miles to the east, as far as Winnemucca, Nevada. On both days, melting snow fueled lahars, flooding drainages 20 to 30 miles away.

K.4. FLOOD HAZARDS

K.4.1. Riverine, Stream, and Alluvial Flood Hazards

From 1992 to February 2018, California has had 34 State-proclaimed flood emergencies and 15 federally declared flood disasters. As shown in Table K-1, since 1992, every county in California has been declared a federal disaster area at least once for a flooding event. The information in Table K-1 extends back to 1992 because that is the year that the California Governor's Office of Emergency Services (Cal OES) began tracking disaster recovery history information. The 1992 flood was the first federally declared flood disaster since Stafford Act implementation began in 1988.

Figure K-7 shows the distribution of floods leading to disaster declarations from 1950 to February 2018. Some of the counties with 24 or more declared disasters during this period include Kern, Los Angeles, Riverside, San Bernardino, Orange, and San Diego in the southern portion of California; Contra Costa, Alameda, San Mateo, Marin, Napa, and Santa Cruz in the San Francisco Bay Area; Sacramento, Yolo, Sutter, El Dorado, and Yuba in the Sacramento/Sierra foothill area; and Humboldt, Trinity, Butte, and Mendocino in Northern California.

Table K-1. Federally Declared Flood Disasters in California, 1992 – February 2018*

Disaster Number	Date	Scope (Number of Counties)	Number of Deaths	Damage in $
935-DR-CA	February 1992	6	5	$123.2 million
979-DR-CA	January 1993	25	20	$600 million
1044-DR-CA	January 1995	45	11	$741.4 million
1046-DR-CA	February 1995	57	17	$1.1 billion
1155-DR-CA	January 1997	48	8	$1.8 billion
1203-DR-CA	February 1998	40	17	$550 million
1498-DR-CA	June 2003	2	16	--***
1529-DR-CA	June 2004	1	0	$57 million
1577-DR-CA	February 2005	8	24	$573.1 million
1585-DR-CA	April 2005	7	0	$198.7 million
1628-DR-CA	February 2006	40	5	$327.8 million
1646-DR-CA	June 2006	16	1	$129.5 million
1884-DR-CA	March 2010	6	0	$50.6 million
4305-DR-CA	January 2017	22	**	$20.4 million
4308-DR-CA	February 2017	43	**	$260.5 million

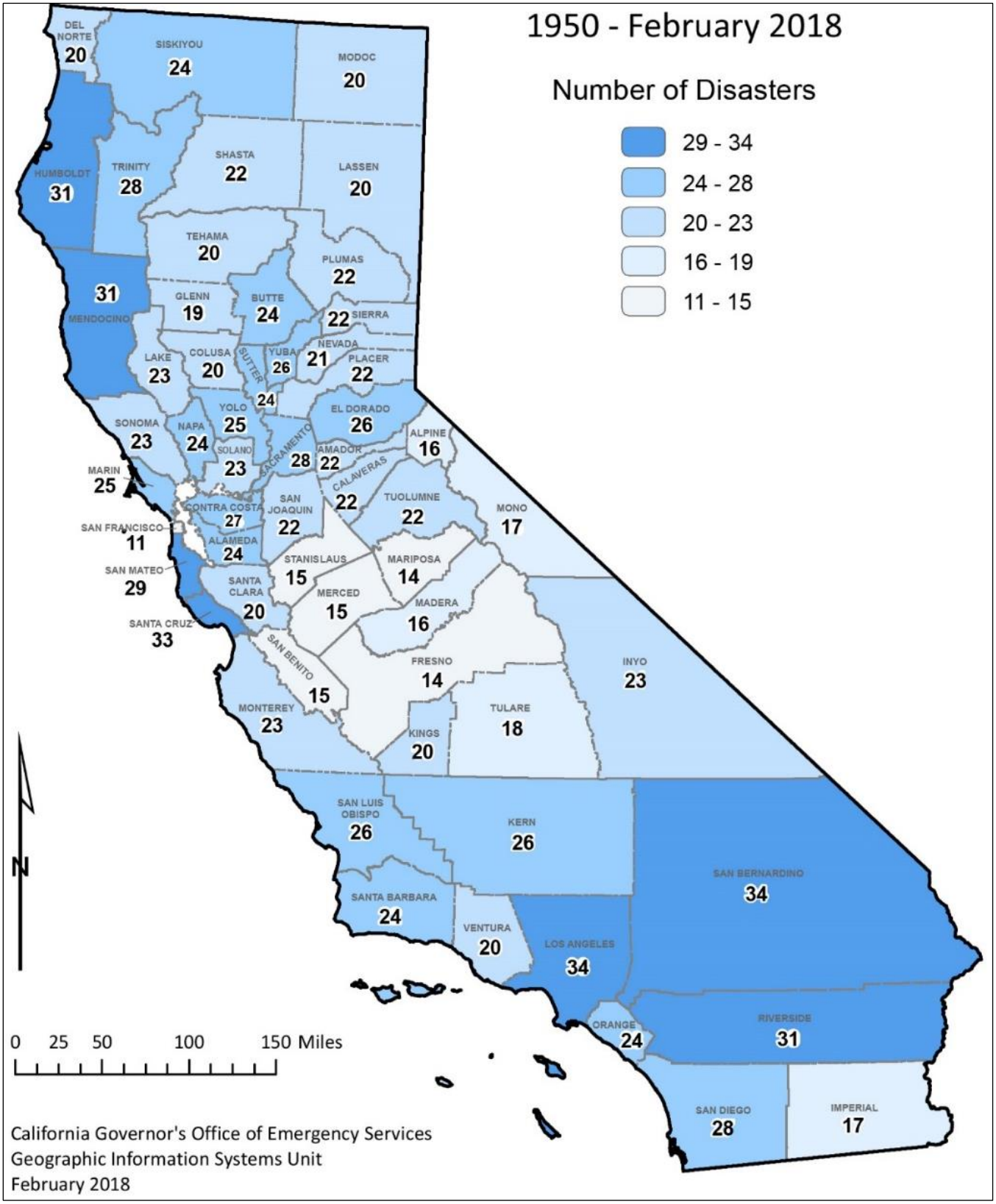
Source: (FEMA 2023a)

* Disasters listed are only those designated by the Federal Emergency Management Agency (FEMA) as Flood Disasters (Storm Disasters are not included in this table).

** Figures pending

*** DR-1428, 2003 Southern California Fires, caused the elimination of vegetation securing soils to the hillsides. In December 2003, mild flooding caused mudflows and landslides killing 16 people. The costs of the flood damages were not segregated from the fire damages.

Figure K-7. State and Federal Declared Flood Disasters, 1950-February 2017



The most significant flooding in State history, and potentially the biggest disaster in California State history, occurred prior to the Federal Emergency Management Agency (FEMA) era and is known as the Great Flood of 1862. In the winter of 1861-62, atmospheric rivers brought rainfall over the course of six weeks. Contemporary reports include 72 inches of precipitation in Tuolumne County, flooding of "a region 250 to 300 miles long and 20 to 60 miles wide" for months in the Central Valley, such severe flooding in Sacramento that the Legislature relocated to San Francisco and estimates of destruction of 1/4 to 1/3 of the State's taxable property (Brewer, 1930). The New York Times further reported that the speed of flooding "was so rapid that most people had not more than an hour's warning of the danger" and they report at least 1,000 deaths (NYT, 1862). Disasters of this scale are observed in the geologic record in the years 212, 440, 603, 1029, 1418, and 1605 – the latter being the largest – and a future similar scenario is known as ARkStorm (Porter et al., 2010). The ARkStorm scenario is viewed to be as likely as the major-earthquake scenario known as The Big One and is estimated to be three times more costly than that scenario, with dollar losses approaching $1 billion (Porter et al., 2010). A recent study suggests the ARkStorm scenario is likely to occur more frequently than the historic record suggests due to climate change (Huang and Swain, 2022).

- Brewer, W.H. Up and down California in 1860-1864: the journal of William H. Brewer. Yale University Press. 1930.
- The Great Flood in California. January 21, 1862. Accessed at https://timesmachine.nytimes.com/timesmachine/1862/01/21/79955563.html?pageNumber=6.
- Porter, K. et al. Overview of the ARkStorm Scenario. USGS Open File Report 2010-1312. 2010.

K.4.2. Sea-Level Rise, Coastal Flooding, and Erosion Hazards

No hazard event history recorded in the 2018 SHMP for the sea-level rise, coastal flooding, and erosion hazards profile.

K.4.3. Tsunami and Seiche Hazards

Numerous studies have documented historical tsunamis recorded along California's coast. In 1700, an earthquake estimated at Magnitude 9.0 ruptured along the Cascadia Subduction Zone, which stretches from along the coasts of British Columbia, Washington, and Oregon to offshore of California north of Cape Mendocino. Though there were no local written accounts, scientists originally recognized the event from

geological evidence and oral histories from the Native American people in the area. This information was eventually cross-referenced with Japanese documents that described an "orphan" tsunami that was not accompanied by a large earthquake in Japan. The exact date and time of this earthquake are known because of a combination of tsunami deposit evidence, carbon-14 and tree-ring dating, tsunami modeling, and historical Japanese records.

The Cascadia Subduction Zone is the most significant local tsunami source for the California coast north of Cape Mendocino. Geological evidence indicates that large Cascadia earthquakes and associated tsunamis have occurred at least 19 times over the past 10,000 years, with event recurrence varying from 200 years to more than a thousand years over that 10,000-year period.

The December 2005 California Seismic Safety Commission (SSC) report (The Tsunami Threat to California—Findings and Recommendations on Tsunami Hazards Risks) indicates that over 80 tsunamis have been observed or recorded along the coast of California in the past 150 years. The report includes findings that tsunamis generated either locally or from events elsewhere in the Pacific Basin pose a significant threat to life and property in California, and that tsunamis present a substantial risk to the economy of the State and nation primarily through the impact on ports.

The National Centers for Environmental Information (NCEI) provides a database cataloging all tsunami occurrences. The database can be used to evaluate past tsunami events at a particular site. As shown in Table K-2, there have been eight tsunamis known to have caused damage to ports and harbors or coastal inundation in California since 1946.

Table K-2. Summary of Tsunami Damage Along the California Coast Since 1946

Date	Event	Magnitude	Cost of Damage*	Deaths
March 11, 2011	Offshore Japan Earthquake	9.0	$100 million	1
February 27, 2010	Offshore Chile Earthquake	8.8	$3 million	0
November 15, 2006	Kuril Islands Region Earthquake	8.3	$20 million	0
March 28, 1964	Offshore Alaska Earthquake	9.2	$20 million	13
May 22, 1960	Chile Earthquake	9.5	$1 million	2
March 9, 1957	Aleutian Islands Earthquake	8.6	<$1 million	0
November 4, 1952	Kamchatka Earthquake	9.0	<$1 million	0
April 1, 1946	Aleutian Islands Earthquake	8.8	<$1 million	2

*"Cost of Damage" represents reported damage at the time of the tsunami; not all damage may be accounted for in early events.

In 1964, a tsunami caused by a Magnitude 9.2 earthquake offshore from Alaska resulted in 13 deaths in California and destroyed portions of downtown Crescent City. More recently, a 2006 tsunami (originating in the Kuril Islands region north of Japan) caused approximately $20 million in damage to Crescent City harbor. A 2010 tsunami (originating offshore from Chile) caused millions of dollars in damage to ports and harbors in the State.

A tsunami in 2011 (caused by a Magnitude 9.0 earthquake offshore of Japan) killed one person at the mouth of the Klamath River and caused up to $100 million of damage to 27 ports, harbors, and marinas throughout the State (Wilson et al., 2012). The most damage occurred in Crescent City, Santa Cruz and Moss Landing harbors and a federal disaster was declared in Del Norte, Santa Cruz, and Monterey Counties. Both Crescent City and Santa Cruz harbors sustained damage to all docks, and oil spills and water/sediment contamination that resulted from sunk or damaged boats. Because recovery efforts in these two harbors took several years to complete, both harbors incurred business/economic losses that have been difficult to recapture.

K.4.4. Levee Failure and Safety Hazards

In parts of California, both the chances and the consequences of flooding are ranked the highest in the nation. Many of the levees in California are intended to protect against a storm that as a 1 percent chance of occurring in any year. Some areas have an even lower level of protection. For perspective, the levee system protecting the city of New Orleans was intended to protect against a storm that has a 0.4 percent of occurring in any year (a 250-year level of protection) but failed in 2005 due to Hurricane Katrina.

A list of significant levee failures in the Bay-Delta from 1900 to the present is shown in Table K-3. This list documents the spatial and temporal variability of levee failure but does not attribute the failures to a particular loading function or failure mechanism.

Table K-3. San Francisco Bay-San Joaquin-Sacramento Delta Levee Failures, 1900-2017

Delta Island/Tract	Total Acres Flooded	Year Flooded
Andrus Island	7,200	1902, 1907, 1909, 1972
Bacon Island	5,546	1938
Bethel Island	3,400	1907, 1908, 1909, 1911, 1972, 1981, 1983
Big Break	2,200	1927
Bishop Tract	2,100	1904
Bouldin Tract	5,600	1904, 1907, 1908, 1909, 1972

Delta Island/Tract	Total Acres Flooded	Year Flooded
Brack Tract	2,500	1904
Bradford Island	2,000	1950, 1983
Brannan Island	7,500	1902, 1904, 1907, 1909, 1972
Byron Tract	6,100	1907
Canal Ranch Tract	500	1958, 1986
Clifton Court Tract	3,100	1901, 1907
Coney Island	900	1907
Dead Horse Island	200	1950, 1955, 1958, 1980, 1986, 1997
Donlon Island	3,000	1937
Edgerly Island	150	1983
Empire Tract	3,500	1950, 1955
Fabian Tract	6,200	1901, 1906
Fay Island	100	1983
Franks Tract	3,300	1907, 1936, 1938
Glanville Tract	--	1986, 1997
Grand Island	--	1955
Grizzly Island	8,000	1983
Holland Tract	4,100	1980
Ida Island	100	1950, 1955
Jersey Island	3,400	1900, 1904, 1907, 1909, 1981, 1983
Little Franks Tract	350	1981, 1982, 1983
Little Mandeville Island	22	1980
Lower Jones Tract	5,700	1907, 1980
Lower Roberts Island	10,300	1906
Lower Sherman Island	3,200	1907, 1925
Mandeville Island	5,000	1938
McCormack Williamson Tract	1,500	1938, 1950, 1955, 1958, 1986, 1997, 2017
McDonald Island	5,800	1982
Medford Island	1,100	1936, 1983
Middle Roberts Island	500	1938
Mildred Island	900	1965, 1969, 1983
New Hope Tract	2,000	1900, 1904, 1907, 1928, 1950, 1986
Palm Tract	2,300	1907
Pescadero	3,000	1938, 1950
Prospect Island	1,100	1980, 1981, 1982, 1983, 1986
Quimby Island	700	1936, 1938, 1950, 1955, 1986
RD 1007	3,000	1925
RD 17	4,500	1901, 1911, 1950
Rhode Island	100	1938
Ryer Island	11,600	1904, 1907

Delta Island/Tract	Total Acres Flooded	Year Flooded
Sargent Barnhart Tract	1,100	1904, 1907
Sherman Island	10,000	1904, 1906, 1909, 1937, 1969
Shima	2,394	1983
Shin Kee Tract	700	1938, 1958, 1965, 1986
Staten Island	8,700	1904, 1907
Stewart Tract	3,900	1938, 1950, 1997
Terminous Tract	5,000	1907, 1958
Twitchell Island	3,400	1906, 1907, 1909
Tyler Island	8,700	1904, 1907, 1986
Union Island	2,400	1906
Upper Jones Tract	5,700	1906, 1980, 2004
Upper Roberts Island	500	1938
Van Sickle	--	1983, 2017
Venice Island	3,000	1904, 1906, 1907, 1909, 1932, 1938, 1950, 1982
Victoria Island	7,000	1901, 1907
Webb Tract	5,200	1950, 1980

Additionally, there have been other levee failures along the Sacramento and San Joaquin rivers during flood events. Some notable floods include 1950, 1955, 1983, 1986, and 1997 events. During these events Yuba City, Marysville, Linda/Olivehurst, Nicolaus, Manteca, and other areas were flooded.

K.4.5. Dam Failure and Safety Hazards

In the past 50 years, there have been only a small number of dam failures in California. The most catastrophic dam failure in California's history is that of the infamous St. Francis Dam in Los Angeles County, which failed in March 1928, shortly after construction of the dam was completed. This failure resulted in the deaths of more than 450 people and the destruction of nearly 1,000 homes and buildings. Numerous roads and bridges were also destroyed or damaged beyond repair. The Division of Safety of Dams (DOSD) was established as a direct result of this catastrophe. Other significant dam incidents in California's history include the Baldwin Hills Dam failure in 1963, the near failure of the Lower San Fernando Dam in 1971, and the failure of the spillway system at Oroville Dam in 2017.

In February 2017, the gated spillway at Oroville Dam, the tallest dam in the United States, suffered a failure within its concrete chute. A 60-foot-deep hole developed in the lower third of the chute as a result of normal spillway operations undertaken to

lower the reservoir in advance of a moderately large storm. The subsequent occurrence of the storm in the days after the initial incident and the inability to fully use the primary spillway led to the filling of the reservoir and the use of its unlined emergency spillway for the first time ever. After two days of usage and erosion of the unlined hillside and head cutting, concerns regarding the stability of the emergency spillway weir developed, and nearly 200,000 people downstream were evacuated.

K.5. FIRE HAZARDS

K.5.1. Wildfire

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. 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 (WUI) areas. 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.

As of September 2018, over 5,700 wildfires had burned or were actively burning in California during the 2018 fire year. 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 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 K-4 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.

Table K-4. 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****	505,956****	2,016***	742,650***	**	**	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.

** 2017 Local Responsibility Area (LRA) data pending publication of 2017 Annual Wildfire Activity Statistics Report (Redbook), not yet published as of May 2018.
*** 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).
**** SRA data preliminary.
Source: (CAL FIRE 2023a)

Figure K-8, based on California Department of Forestry and Fire Protection (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.

An analysis of repeat fires in a given area, as shown in Figure K-9, illustrates that some areas in California are prone to burn with greater regularity than other areas. This is of special concern in the South and Central Coast regions, which show the highest frequencies. These regions have significant amounts of shrubland plant communities where wildfires typically occur as high-intensity, stand-replacement fires.

Figure K-8. California Fire Perimeters 1985-2017 and Selected 2018 Fires

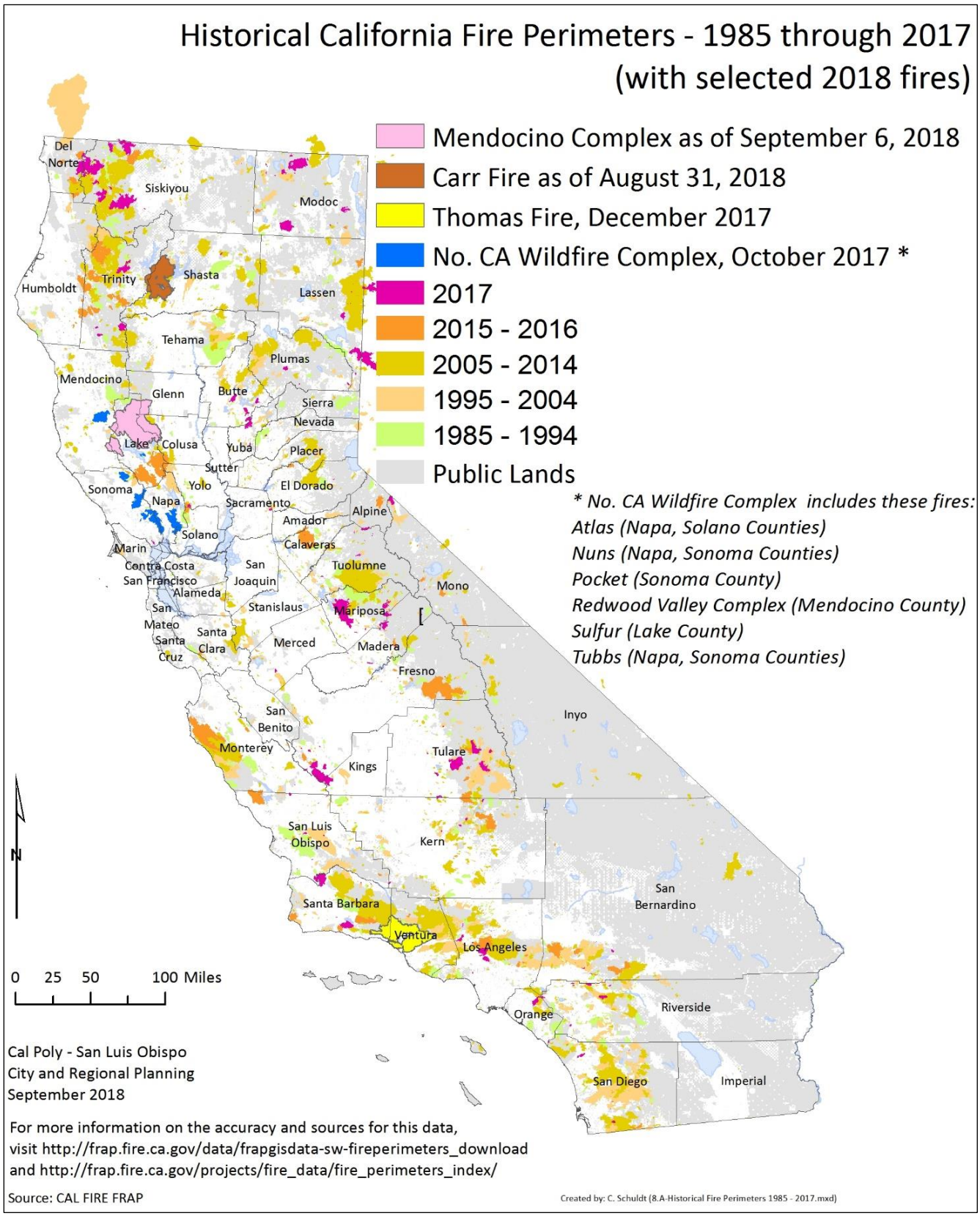
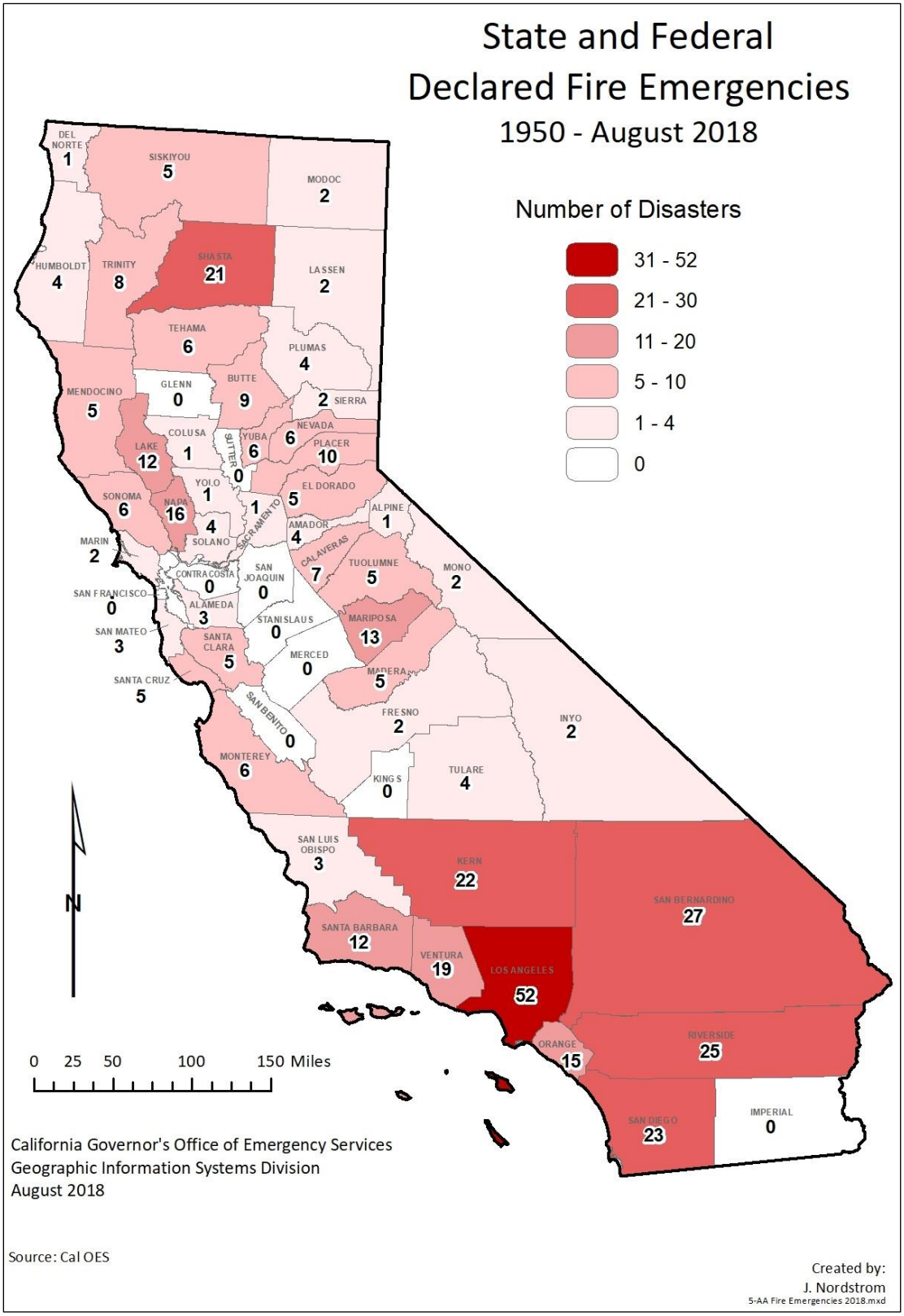


Figure K-9. State and Federal Declared Fire Disasters, 1950-February 2018



K.5.2. Urban 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. Table K-5 lists some of the notable urban structural fires in the State. Information on all fire incidents is reported to the State Fire Marshall and kept at the California Incident Data and Statistic Program. The listed events represent only a selection of urban structural fires.

Table K-5. Notable Urban Structural Fire History in California

Date(s)	Event Name	Location
1906	San Francisco Earthquake	San Francisco
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.		
October 1991	Oakland Hills Firestorm	Oakland
The firestorm occurred 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.		
April 29 to May 1, 1992	Civil Unrest	Los Angeles
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.		
February 2002	Santana Row Fire	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.		

Date(s)	Event Name	Location
September 9, 2010	San Bruno Pipeline Explosion	San Bruno
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 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 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.		
May 2013	Pallet Fire	Fontana
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.		
March 2014	--	Mission Bay area of San Francisco
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.		

Date(s)	Event Name	Location
November 18, 2014	Santa Paula Wastewater Plant Explosion	Ventura Count
A vacuum truck exploded releasing organic peroxide, a highly volatile chemical that burns quickly. Additional hazardous materials were located nearby, creating concerns about potential hazardous smoke and fire. A mandatory evacuation within 1 mile of the facility was order in conjunction with a shelter-in-place order within a 3-mile radius. At least 37 people were treated for exposure.		
December 2014	Temple Fire	Los Angeles
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.		
2016	Fruitland Metal Recycling Plant Fire	Maywood
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.		
December 2, 2016	Ghost Ship Fire	Oakland
A warehouse fire that occurred in Oakland 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 power strips, rather fixed outlets, were used throughout the warehouse to energize appliances. 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.		
October 2017	Tubbs Fire	--
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.		
September 20, 2022	Tesla Megapack Fire	Monterey County
A fire occurred in a lithium-ion battery facility. A shelter-in-place advisory was issued due to the potential release of hydrochloric and hydrofluoric acid. Testing conducted post-incident indicated there was no threat to human health or the surrounding environment.		

K.6. OTHER CLIMATE AND WEATHER-INFLUENCED HAZARDS

K.6.1. Agricultural and Silvicultural Pests and Diseases

K.6.2. Asian Citrus Psyllid

As of 2017, California is actively eradicating the ACP and has identified only one plant infected with HLB.

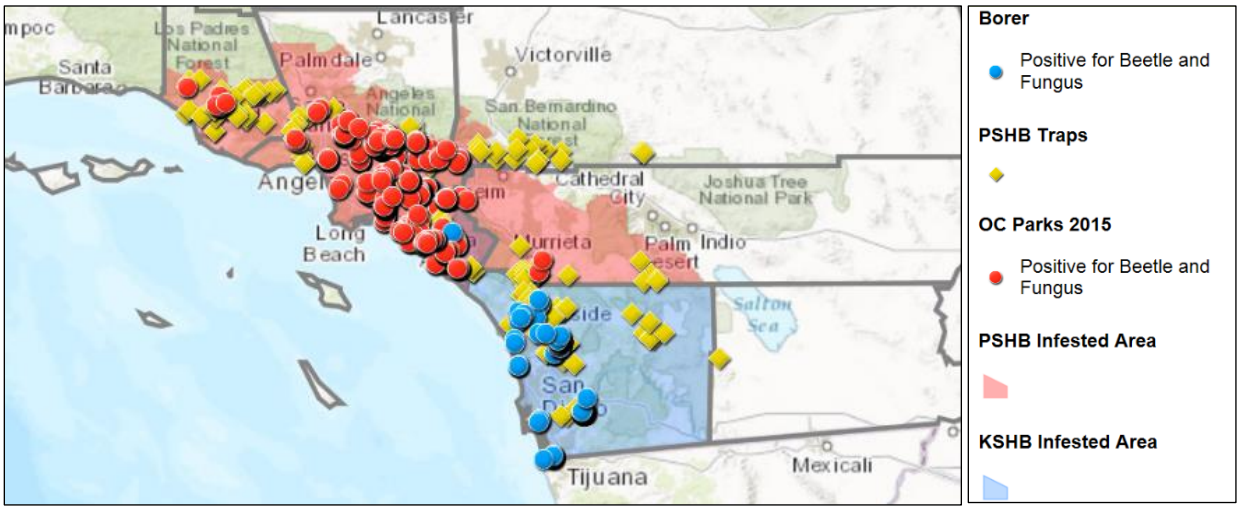
K.6.3. Shot Hole Borer Beetle

Table K-6 summarizes the different categories of host species in California, and Figure K-10 shows spread of the PSHB and KSHB in the southern portion of the State.

Table K-6. California Agricultural and Silvicultural Pests and Diseases, Change from 2012 to 2016

Number of:	2012	2016
Tree species attacked by beetle	286	303
Tree species infected by fungus	117	138
Agricultural crops affected	13	13
California native tree species affected	11	18
Tree families affected	62	64
Reproductive hosts	19	41

Figure K-10. Polyphagous Shot Hole Borer and Kuroshio Shot Hole Borer Spread in Southern California



K.6.4. Bark Beetles

Total tree mortality in California counties from Kern County in the southern portion of the State to Placer County in the north was estimated to be upward of 75 million trees according to 2016 U.S. Forest Service aerial detection survey data. This mortality extends across both private and federal timberlands.

K.6.5. Foot and Mouth Disease

The last outbreak of FMD in California was in 1929.

K.6.6. Bovine Spongiform Encephalopathy

The National Veterinary Services Laboratory in Ames, Iowa, confirmed that a routine surveillance sample obtained from a Holstein cow carcass at a rendering plant in the Central Valley of California was positive for the atypical strain of Bovine Spongiform Encephalopathy (BSE). No part of this carcass entered the human or animal food chain.

K.6.7. Other Animal Pests and Diseases

Diseases such as Exotic Newcastle Disease in poultry and tuberculosis in dairy cattle are credible threats to the State food supply and economy. Other diseases such as anthrax, and Deforming Wing Virus in honeybees, also pose a serious threat to the food supply.

K.6.8. Air Pollution

Air pollution is a continuing problem, with the largest concentration in the most populated air basins: the San Francisco Bay Area, San Joaquin Valley, Sacramento Valley, San Diego, and the South Coast. Pollutants include smog, soot, and toxic air contaminants (TACs). Some air toxic emissions in California are on the decline. Table K-7 shows the average quantities of emissions in tons per day from 2000 to 2015 as well as forecasts to 2035. Forecast emissions for future years take into account emissions data, projected growth rates, and future adopted control measures.

Table K-7. Air Pollutant Emission Trends and Forecasts in California, 2000-2035

Pollutant	2000	2005	2010	2015	2020	2025	2030	2035
Volatile Organic Compounds (VOC)	2,902	2,261	1,943	1,624	1,561	1,554	1,568	1,574
Nitrogen Oxides (NO_X)	3,782	3,214	2,324	1,887	1,553	1,312	1,224	1,200
Sulfur Oxides (SO_X)	289	287	123	78	82	88	94	101
Diesel Particulate Matter (PM)	86	88	54	31	25	23	23	25
$PM_{2.5}$	661	524	447	410	414	419	434	441
PM_{10}	2,436	1,700	1,549	1,491	1,525	1,544	1,572	1,590
Ammonia (NH_3)	730	741	752	719	742	770	776	779

Source: (CARB 2013)

K.7. AQUATIC INVASIVE SPECIES

Non-indigenous species (NIS) are transported to new environments, both intentionally and unintentionally, through human activities. Ships transfer organisms to California waters from throughout the world. Once introduced, invasive species could become a permanent part of an ecosystem and may flourish, creating environmental imbalances, presenting risks to human health, and causing significant economic problems. The introduction of non-indigenous species into California's marine, estuarine, and freshwater environments can cause significant economic, human health, and ecological impacts. A non-indigenous species is considered an invasive species when it becomes established in a new geographic location, causing impacts.

K.8. AVALANCHES

Avalanches have caused property damage and loss of life in California. As shown in Table K-8, between 1996 and 2016, there were 14 deaths and property damage of $140,000 reported due to avalanches. There are no recorded avalanches between 1950 and 1996. Avalanches pose a threat in the Sierra Nevada range on the eastern side of the State and the Cascade Range in the north. Significant avalanches have damaged or destroyed ski resorts at Mt. Shasta and Lake Tahoe, as well as blocked and damaged roadways.

Table K-8. Avalanches, 1950-2016

Period	Counties Affected (Number of Events)	Deaths
1996-2006	Amador (1), Alpine (1), Calaveras (1), El Dorado (2), Mono (3), Nevada (1), Placer (2), San Bernardino (1), San Diego (1), Sierra (1), Tuolumne (1)	2
2007-2016	Inyo (2), Nevada (1), Placer (6), San Bernardino (1), Siskiyou (3), Tulare (1),	12

Source: (NOAA 2023b)

K.9. DROUGHT AND WATER SHORTAGES

Drought has affected virtually every county in California at one time or another, causing over $5.1 billion in damages. Droughts exceeding three years are relatively rare in Northern California, the source of much of the State's water supply. The 1929-1934 drought, which affected the entire State, established the criteria commonly used in designing storage capacity and yield for large Northern California reservoirs. Significant droughts occurring within the past 50 years are briefly described below, followed by an in-depth discussion of the extended statewide drought that began in 2012 and ended in 2017.

K.9.1. The 1975-1977 Drought

California experienced one of its most severe droughts. Although people in many areas of the State are accustomed to very little precipitation during the growing season (April to October), they expect it in the winter. In 1976 and 1977, the winters brought only one-half and one-third of normal precipitation, respectively. Most surface storage reservoirs were substantially drained in 1976, leading to widespread water shortages when 1977 turned out to be even drier. Thirty-one counties were affected, resulting in $2.67 billion in crop damage.

K.9.2. 1987-1992 Drought

California again experienced a serious drought due to low precipitation and runoff levels. The hardest-hit region was the Central Coast, roughly from San Jose to Ventura. In 1988, 45 California counties experienced water shortages that adversely affected about 30 percent of the State's population, much of the dry-farmed agriculture, and over 40 percent of the irrigated agriculture. Fish and wildlife resources suffered, recreational use of lakes and rivers decreased, forestry losses and fires increased, and hydroelectric power production decreased.

In February 1991, DWR and Cal OES surveyed drought conditions in all 58 California counties and found five main problems: extremely dry rangeland, irrigated agriculture

with severe surface water shortages and falling groundwater levels, widespread rural areas where individual and community supplies were going dry, urban area water rationing at 25 to 50 percent of normal usage, and environmental impacts.

Storage in major reservoirs had dropped to 54 percent of average, the lowest since 1977. The shortages led to stringent water rationing and severe cutbacks in agricultural production, including threats to survival of permanent crops such as trees and vines. Fish and wildlife resources were in critical shape as well. Not since the 1928-1934 drought had there been such a prolonged dry period. In response to those conditions, the Governor established the Drought Action Team. This team almost immediately created an emergency drought water bank to develop a supply for four critical needs: municipal and industrial uses, agricultural uses, protection of fish and wildlife, and carryover storage for 1992.

The large-scale transfer program, which involved over 800,000 acre-feet of water, was implemented in less than 100 days with the help and commitment of the entire water community and established important links between State agencies, local water interests, and local governments for future programs.

K.9.3. 2007-2009 Drought

Water years 2007-2009 were collectively the 15th driest three-year period for DWR's eight-station precipitation index, which is a rough indicator of potential water supply availability to the State Water Project (SWP) and Central Valley Project (CVP). Water year 2007 was the driest single year of that drought and fell within the top 20 percent of dry years based on computed statewide runoff. In June 2008, a State emergency proclamation was issued due to water shortage in selected Central Valley counties. In February 2009, for the first time in its history, the State of California proclaimed a statewide drought. The State placed unprecedented restrictions on CVP and SWP diversions from the Delta to protect listed fish species, a regulatory circumstance that exacerbated the impacts of the drought for water users.

The greatest impacts of the 2007-2009 drought were observed in the CVP service area on the west side of the San Joaquin Valley, where hydrologic conditions combined with reduced CVP exports resulted in substantially reduced water supplies (50 percent supplies in 2007, 40 percent in 2008, and 10 percent in 2009) for CVP south of Delta agricultural contractors. Small communities on the west side highly dependent on agricultural employment were especially affected by land fallowing due to lack of irrigation supplies, as well as by factors associated with current economic recession.

The coupling of the drought and economic recession necessitated emergency response actions related to social services, such as food banks and unemployment assistance.

K.9.4. 2012-2017 Drought

The statewide drought of 2012-2017 will be remembered as one of the most severe and costliest droughts of record in California. The drought that spanned water years 2012 through 2017 included the driest four-year statewide precipitation on record (2012-2015) and the smallest Sierra-Cascades snowpack on record (2015, with 5 percent of average). It was marked by extraordinary heat; 2014, 2015, and 2016 were California's first, second, and third warmest years in terms of statewide average temperatures. By the time the drought was declared officially over in April 2017, the State had expended $6.6 billion in drought response and mitigation programs and had been declared a federal disaster area. The following discussion outlines the chronology of events and milestones reached during the drought as well as a summary of Executive Orders issued by the Governor, disaster assistance programs initiated, and grant programs designed to alleviate the impacts of the drought. Table K-9 lists major historical California drought incidents.

Following the dry water years of 2007-2009, water years 2010-2011 marked a return to slightly wetter than average conditions for most of the State. Precipitation in 2011 improved statewide reservoir storage, mitigating the dry conditions that occurred across most of the State in 2012. Although Northern California experienced a series of late November/early December storms in 2013, a record dry January through May resulted in dryness for most of the State, particularly the San Joaquin Valley and Southern California. The impacts of dry years during 2012 and 2013 were notably felt in the agricultural sector, especially rangeland grazing.

With the advent of an exceptionally dry water year in 2014, Northern California began experiencing the significantly below-normal precipitation that had characterized the southern part of the State in the prior years. A blocking high pressure ridge diverted storms away from the State during the key winter precipitation months of December and January, resulting in record warmth and dryness. Some locations in Northern California experienced 50 consecutive days with no measurable precipitation during months that historically exhibited maximum precipitation for the year.

Table K-9. Drought Incidents in California

Year	Number of Events	Jurisdictions Affected (Counties, Unless Otherwise Noted)	Statewide Crop Damage
1972	1	Glenn, San Benito, Santa Clara	$8 million
1976-1977	1	Alpine, Calaveras, Colusa, Fresno, Glenn, Madera, Merced, San Diego, San Joaquin, Solano, Stanislaus, Sutter, Tuolumne, Alameda, Butte, Contra Costa, Kings, Los Angeles, Riverside, San Luis Obispo, Tulare, Yolo, Amador, Monterey, Napa, Nevada, San Benito, San Bernardino, Tehama, San Mateo, Marin	$2.67 billion
1988	1	Madera County location emergency was ratified every two weeks through 1991.	Not Available
1990	2	Santa Barbara (City and County)	0
1991	1	Alameda, Alpine, Colusa, Fresno, City of Orange Cove, Glenn, Kern, Kings, Lake, Madera, Marin, Mendocino, Monterey, Placer, Santa Barbara, City of Santa Barbara, Shasta, Siskiyou, Solano, Sonoma, Sutter, Tehama, Tulare, Tuolumne, and Yuba. Many of these emergencies continued through 1992.	U.S. Department of Agriculture (USDA) - nationwide: $995 million for 1990-1991 crop loss. Additional $775 million in emergency funds for 1990-1992 crop losses.
2001	5	Del Norte, Modoc, Siskiyou, Inyo, Humboldt, Kern, Los Angeles, Ventura, Mono, Lassen, Plumas, San Bernardino, Santa Barbara, Sierra, Shasta, Trinity	Not Available
2002	3	Alpine, Amador, Calaveras, Imperial, Modoc, Nevada, Orange, Placer, Riverside, San Bernardino, Sierra, Stanislaus	$12,100
2007	1	Kings, Riverside	(data pending)
2008	1	Fresno, Kern, Kings, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tulare	(data pending)
2009	1	Fresno	(data pending)
2012	1	All counties	(data pending)
2013	1	All counties	(data pending)
2014	1	All counties	$810 million
2015	1	All counties	$900 million
2016	1	All counties	$921 million

Sources: (Pacific Institute 2015), (UC Davis 2023), (USDA 2023)

The Governor responded to the continuing drought conditions by forming a State interagency Drought Task Force in December 2013 to provide a coordinated assessment of the dry conditions and recommendations on State actions. The

continuing absence of precipitation led to a Governor's proclamation of emergency in January 2014 that ordered State agencies to take specified actions and called on Californians to voluntarily reduce their water usage by 20 percent. In March, the Legislature enacted, and the Governor signed, measures to provide $687.4 million for drought relief, with the largest amount of that funding ($549 million) dedicated to accelerated expenditure of Proposition 84 and Proposition 1E bond funds for grants to local agencies for integrated regional water management projects.

Above normal late spring 2014 precipitation ameliorated some of the worst-case water supply scenarios that had been considered earlier in the year. Hydrologic conditions did not improve sufficiently, however, to avoid record low allocations for some Central Valley Project (CVP) and State Water Project (SWP) contractors: zero to the CVP's agricultural contractors north and south of the Delta, zero to the CVP Friant Division contractors, and 5 percent to SWP contractors. Water year 2014 marked the first time that the Bureau of Reclamation's Friant Division contractors received a zero allocation of their Class 1 water. Reflecting the very dry hydrology, the State Water Resources Control Board (SWRCB) imposed widespread curtailments of diversions in locations including parts of the Sacramento-San Joaquin River watershed and the Eel and Russian River watersheds, another action that had not been taken since 1977.

The water project operating agencies (U.S. Bureau of Reclamation and DWR) coordinated with the regulatory agencies (SWRCB, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service) throughout the hydrologically challenging winter-spring water year 2014 runoff season. Decisions were made to balance impacts and to reserve water in storage to be able to meet critical needs such as cold water for salmon and health and safety needs for urban water users.

As the summer of 2014 wore on, increasing numbers of small water systems, often located on fractured rock groundwater sources in rural areas, were experiencing water shortages, as were rural residents dependent on private wells. Bulk water haulage and distribution of bottled water were used to help some rural communities.

Early seasonal rainfall in November and December 2014, delivered only a third of what would be needed to end the prolonged drought but combined with close coordination among federal and State agencies, allowed DWR to increase expected water deliveries for 2015 to most SWP customers from 10 to 15 percent of requested amounts. SWRCB announced that the statewide urban water conservation rate climbed to 22 percent in December but declined steeply in during January 2015, which was considered the driest January since meteorological records have been

kept. The March snowpack measurements taken by DWR indicated that the water content for the northern Sierra was 16 percent of average for the date. The central and southern Sierra readings were 20 percent and 22 percent of average, respectively. In response to the continuing dry winter, Governor Brown signed emergency legislation to fast track more than $1 billion in funding for drought relief and critical water infrastructure projects.

As the spring and summer of 2015 continued with little measurable precipitation, several new areas of drought response and mitigation were initiated, including construction of a temporary emergency barrier in the Sacramento-San Joaquin Delta to block saltwater from flowing into the central Delta and contaminating water supplies, and emergency actions designed to protect fisheries by releasing additional water into spawning rivers and relocating fish from threatened hatcheries. Additionally, the California Department of Housing and Community Development (HCD) and the California Building Standards Commission (CSBC) adopted new building codes to approve water efficiency requirements for both residential and non-residential construction, as well as schools and hospitals. Despite record-breaking heat in June and July, Californians continued to meet and surpass the Governor's 25 percent water conservation mandate, with a 27.3 percent reduction in water use in June and a 31.3 percent reduction in July.

Early predictions of an "El Nino" in water year 2016 led to a short-lived optimism that there might be a decline in the drought. Rain and snow levels this winter certainly improved from recent years, but not enough to draw the State out of the drought. Rain and snow levels during the winter varied significantly by region, with parts of Northern California receiving-higher-than average precipitation and most of Southern California receiving below-average precipitation.

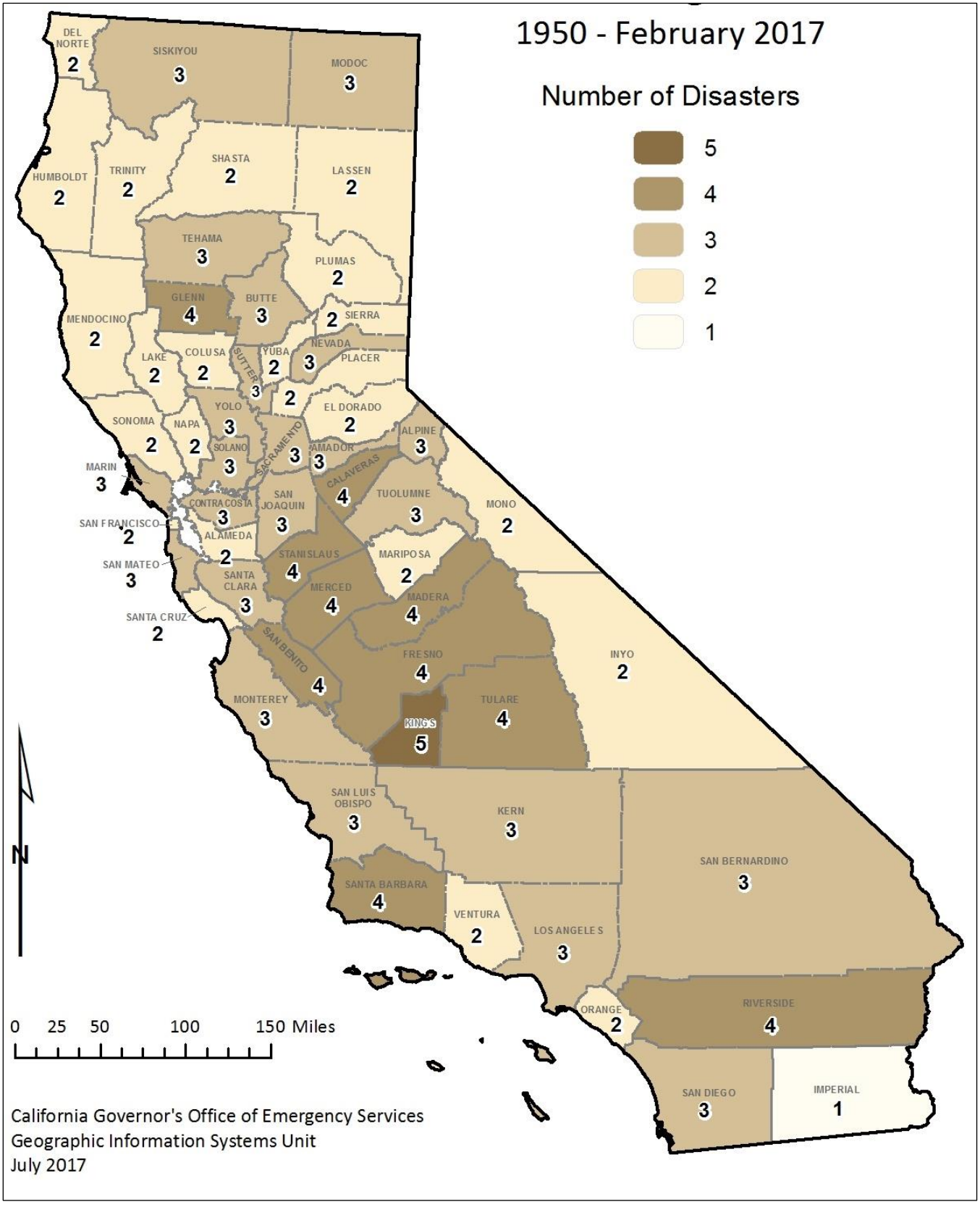
As of mid-April, the automated snow sensors showed snowpack conditions across the State at 70 percent of normal. Regionally, the northern Sierra was at 75 percent of average, the central Sierra was at 76 percent of average, and the southern Sierra was at 60 percent of average. Reservoir levels had increased throughout the State. Californians continued to conserve water, generally meeting the Governor's mandated target of 25 percent, and saving 1.19 million acre-feet of water from June 2015 through February 2016. However, groundwater conditions had not improved, with approximately 2,180 wells statewide being identified as critical or dry, affecting an estimated 10,900 residents, mostly in the Central Valley.

Water year 2017 (October 1, 2016, to September 30, 2017) surpassed the wettest year of record (1982-1983) in the Sacramento River and San Joaquin River watersheds and was close to the wettest year in the Tulare Basin (set in 1968-1969). Mountain snowpack was well above the April 1 seasonal averages throughout the Sierra Nevada, with the southern Sierra at more than 200 percent of average for the year to date.

The plentiful winter rain and unprecedented water conservation prompted the Governor to end the drought state of emergency on April 7, 2017, for all California counties except Fresno, Kings, Tulare, and Tuolumne, where emergency drinking water projects will continue to help address diminished groundwater supplies. Water reporting requirements and prohibitions on wasteful practices, such as watering during or right after rainfall, hosing off sidewalks, and irrigating ornamental turf in public street medians, will remain in effect for all Californians. The goal is to make conservation a way of life in California. The State will also continue its work to coordinate a statewide response on the unprecedented bark beetle outbreak in drought-stressed forests that has killed millions of trees across California. Although the severely dry conditions that afflicted much of the State starting in the winter of 2011-2012 are gone, damage from the drought will linger for years in many areas. The drought reduced farm production in some regions, killed an estimated 100 million trees, harmed wildlife and disrupted drinking water supplies for many rural communities. Another serious consequence that of land subsidence due to groundwater pumping, is discussed later in this section.

Figure K-11 shows the pattern of drought-declared disasters in California over the past 67 years. While heaviest concentrations are centered in the Central Valley area, no part of the State is immune from drought disaster.

Figure K-11. State and Federal Declared Drought Disasters, 1950-February 2017



K.10. ENERGY SHORTAGE AND ENERGY RESILIENCY

The following is a history of energy shortage events that impacted California between 2001 and 2017.

- **January 17, 2001, Northern California** – The California Independent System Operator (CAISO) declared a Stage three Emergency and notified the Governor's Office of Emergency Services (Cal OES) that Pacific Gas and Electric Company (PG&E) was dropping firm load of 500 megawatts (MW) in Northern California leading to rolling blackouts. Cal OES, in turn, issued an Electrical Emergency Message to all Emergency Services Agencies to prepare for rolling blackouts. This scenario was repeated the following day, January 18, 2001, and again on March 19, 2001.
- **July 2006, Statewide** – A July 2006 heat storm event affected the entire State as well as most of the West, producing record energy demand levels in California. The State was able to avoid rotating outages due to a combination of favorable factors that included no major transmission outages, lower than typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major interties. However, the event brought to light the vulnerability of the electric distribution system, as over 3,500 distribution transformers failed, leaving over 2 million customers without power at various times over the 10-day event, many for several hours and a small minority for up to three days.
- **September 8, 2011, Southern California** – An 11-minute system disturbance occurred in the Pacific Southwest, leading to cascading outages and leaving approximately 2.7 million customers without power. The outages affected parts of Arizona, Southern California, and Baja California, Mexico. All of the San Diego area lost power, with nearly 1.5 million customers losing power, some for up to 12 hours. The disturbance occurred near rush hour, on a business day, snarling traffic for hours. Schools and businesses closed, some flights and public transportation were disrupted, water and sewage pumping stations lost power, and beaches were closed due to sewage spills. Millions went without air conditioning on a hot day.
- **October 23, 2015, San Fernando Valley** – Southern California Gas Company (SoCalGas) discovered a leak in one well within its Aliso Canyon storage field in the northern San Fernando Valley. The company stores natural gas underground

at this storage field until it is pumped up and delivered to its customers. This storage field and others in California help meet peak seasonal demand for natural gas in the State during the winter months. Attempts to plug, or kill, the leaking well failed in November and December 2015. During that time actions were taken to reduce the amount of gas leaking from the facility, including withdrawing gas to reduce the gas pressure, and curtailing injections of gas into the storage facility. Recognizing that the storage field could be out of service or available only at reduced capacity for an extended period, the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), Department of Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR), Cal OES, and other State agencies, as well as CAISO and the Los Angeles Department of Water and Power (LADWP), began assessing the potential impacts on natural gas and electricity reliability. Although the levels of methane gas escaping from the leak were too low to raise flammability concerns, the additive odorant called Scentinel T-50 was shown to cause limited short-term eye and skin irritation to residents of Porter Ranch, the closest community to the Aliso Canyon facility. The California Department of Public Health published a fact sheet on its website to educate residents on the public health impacts and to inform residents that Southern California Gas Company would temporarily relocate residents who were experiencing health effects.

- **February 18, 2016, Aliso Canyon** – State officials announced that the leak was permanently plugged after 119 days. Although the well had stopped leaking, DOGGR maintained the moratorium prohibiting Southern California Gas Company from injecting natural gas for storage at the facility until completion of a comprehensive safety review. This safety review required all 114 wells at the Aliso Canyon storage facility to be either thoroughly tested for safe operation or removed from operation and isolated from the underground reservoir. The Natural Gas Storage: Moratorium 2015-2016 (SB 380) codified this directive.
- **July 19, 2017, Aliso Canyon** – State regulators confirmed the safety of the Aliso Canyon natural gas storage facility and cleared Southern California Gas Company to resume limited injections at the field to help prevent energy shortages, once certain conditions were met. That same day, CEC issued a letter to the California Public Utilities Commission (CPUC) urging it to plan for the permanent closure of the facility within 10 years.

K.11. EPIDEMIC/PANDEMIC/VECTOR BORNE DISEASE

K.11.1. Pandemic Influenza

In 2009 a pandemic of H1N1 influenza, popularly referred to as the swine flu, resulted in many hospitalizations and deaths. Pandemic H1N1 influenza is spread in the same way as seasonal influenza, from person to person through coughing or sneezing by infected people.

K.11.2. Mosquito-Borne Viruses

Mosquito-borne viruses belong to a group of viruses commonly referred to as arboviruses (for arthropod-borne). Although 12 mosquito-borne viruses are known to occur in California, only West Nile virus (WNV), western equine encephalomyelitis virus (WEE), and St. Louis encephalitis virus (SLE) are significant causes of human disease. WNV continues to seriously affect the health of humans, horses, and wild birds throughout the State. Since 2003, there have been over 6,000 WNV human cases with 248 deaths, and over 1,200 equine cases. Consequently, the California Arbovirus Surveillance Program emphasizes forecasting and monitoring the temporal and spatial activity of WNV, WEE, and SLE. These viruses are maintained in wild bird-mosquito cycles that do not depend upon infections of humans or domestic animals to persist. Surveillance and control activities focus on this maintenance cycle.

Figure K-12 illustrates WNV activity around the State as of mid-2018. Table K-10 summarizes WNV activity for the period of 2003 to 2016. In 2016, 19 fatal human cases of WNV were recorded, down from the previous year. Current information on incidence of WNV is available on the website maintained by the California Department of Public Health (CDPH) at: www.westnile.ca.gov.

Figure K-12. West Nile Virus Activity in California Counties

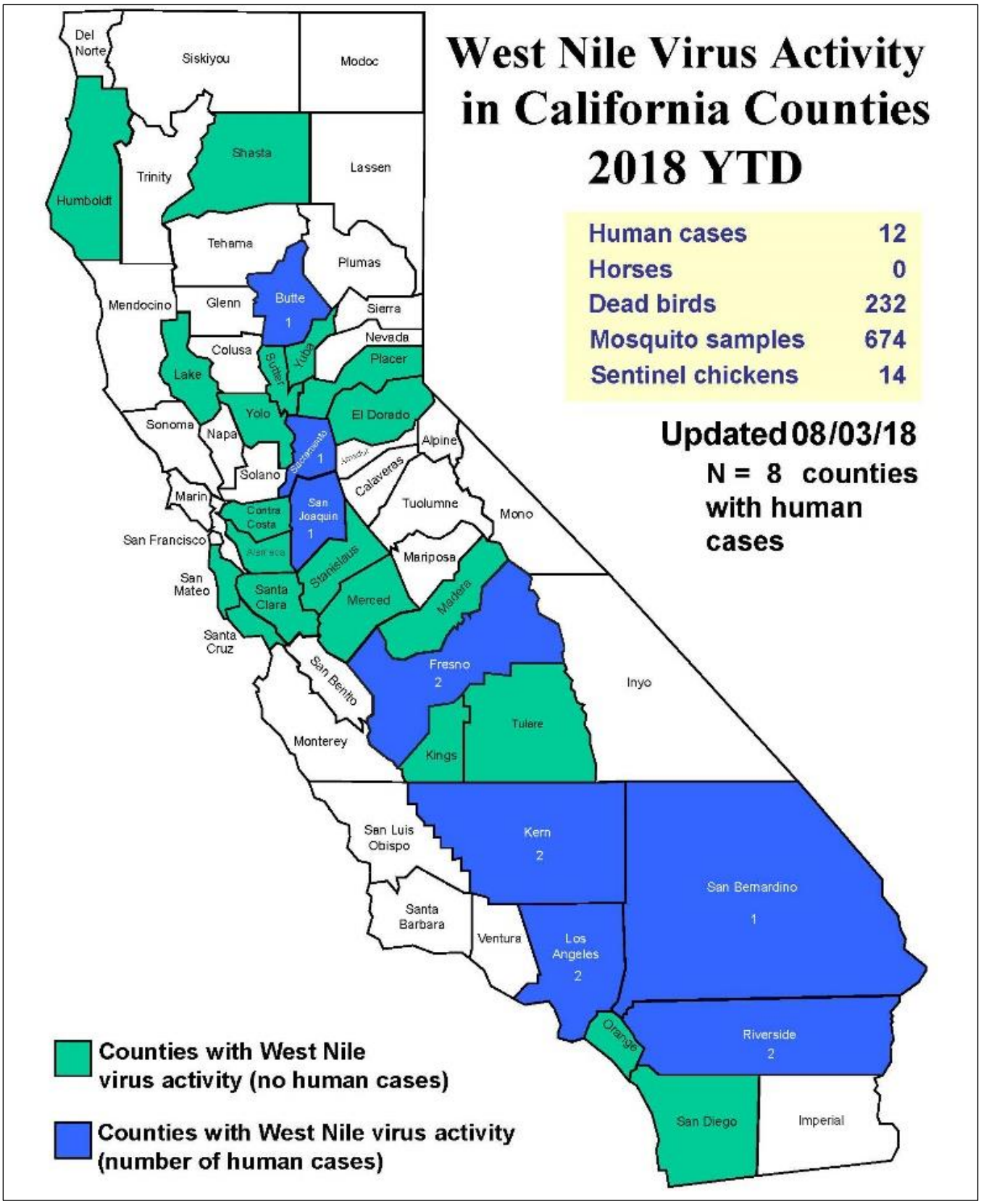


Table K-10. West Nile Virus Activity, 2003-2016

	Number of Cases by Year					
Element	**Human Cases (fatal)**	**Horses**	**Dead Birds**	**Mosquito Samples**	**Sentinel Chickens**	**Squirrels**
2003	3* (0)	1**	96	32	70	-
2004	779 (29)	540	3,232	1,136	809	49
2005	880 (19)	456	3,046	1,242	1,053	48
2006	278 (7)	58	1,446	832	640	32
2007	380 (21)	28	1,396	1,007	510	26
2008	445 (15)	32	2,569	2,003	585	32
2009	112 (4)	18	515	1063	443	10
2010	111 (6)	19	416	1305	281	24
2011	158 (9)	15	688	2087	391	24
2012	479 (20)	22	1,644	2,849	540	23
2013	379 (15)	13	1,251	2,528	485	0***
2014	801 (31)	0***	2,442	3,340	443	0***
2015	782 (53)	0***	1,349	3,329	449	0***
2016	442 (19)	0***	1,352	3,528	343	0***
Total	6,029 (248)	1,202	21,442	26,281	7,042	276

* Plus 20 imported human cases
** Plus three imported horse cases
*** No longer monitored
Source: (CDPH 2023)

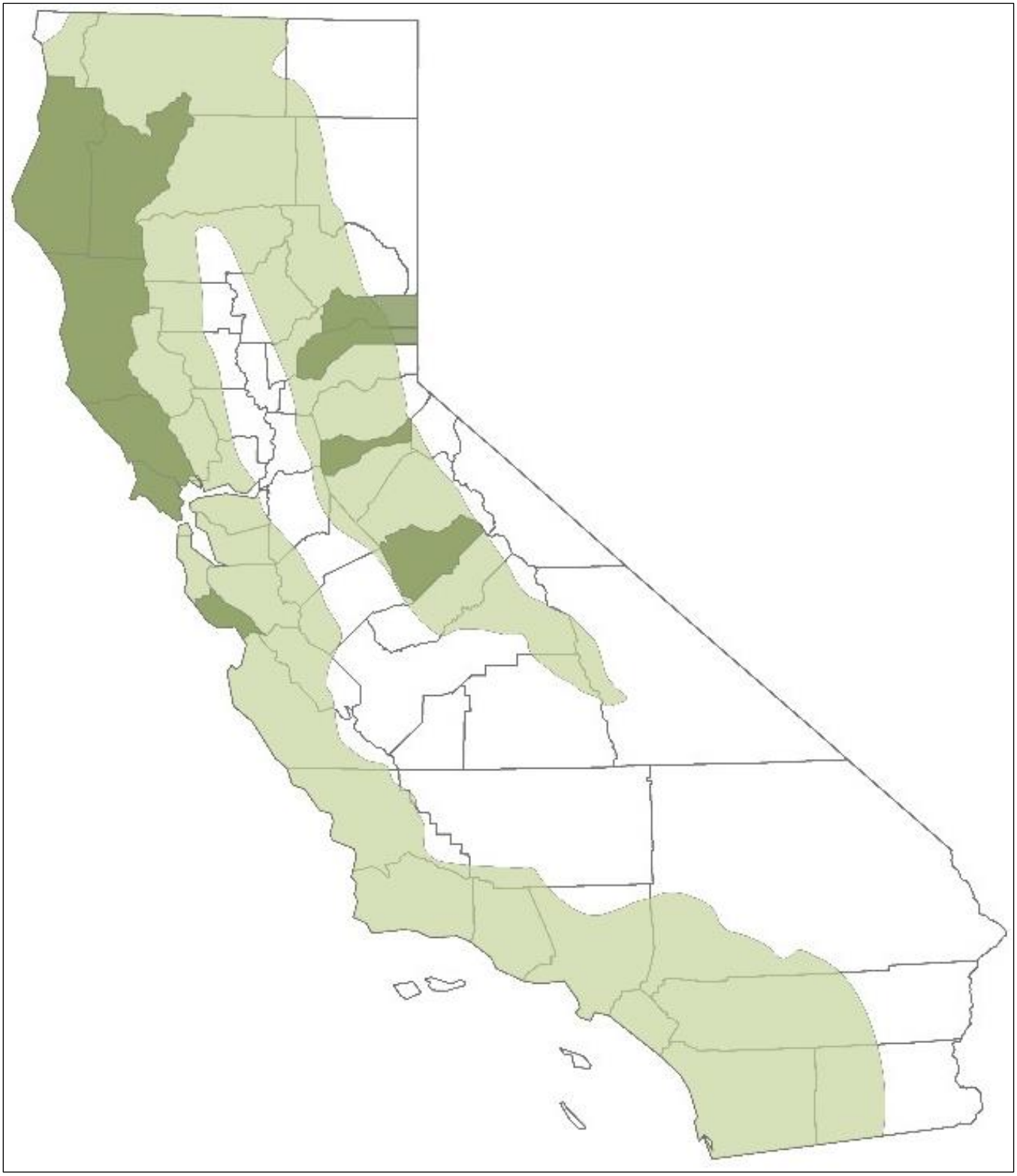
K.11.3. Exotic Aedes Mosquitoes

Two invasive (non-native) mosquito species have been found since 2011 in numerous California cities, and there is a potential for them to continue to spread into other areas of California. The two species are Aedes aegypti (the yellow fever mosquito) and Aedes albopictus (the Asian tiger mosquito). As of 2017, these mosquitoes are found in 12 counties, primarily in Central and Southern California. For information, visit: https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/AedesDistributionMap.pdf.

K.11.4. Lyme Disease

Figure K-13 shows Western black-legged tick and Lyme disease incidence in California. The Western black-legged tick is common in all green areas on the map; dark green areas show where reported Lyme disease cases most often had exposure.

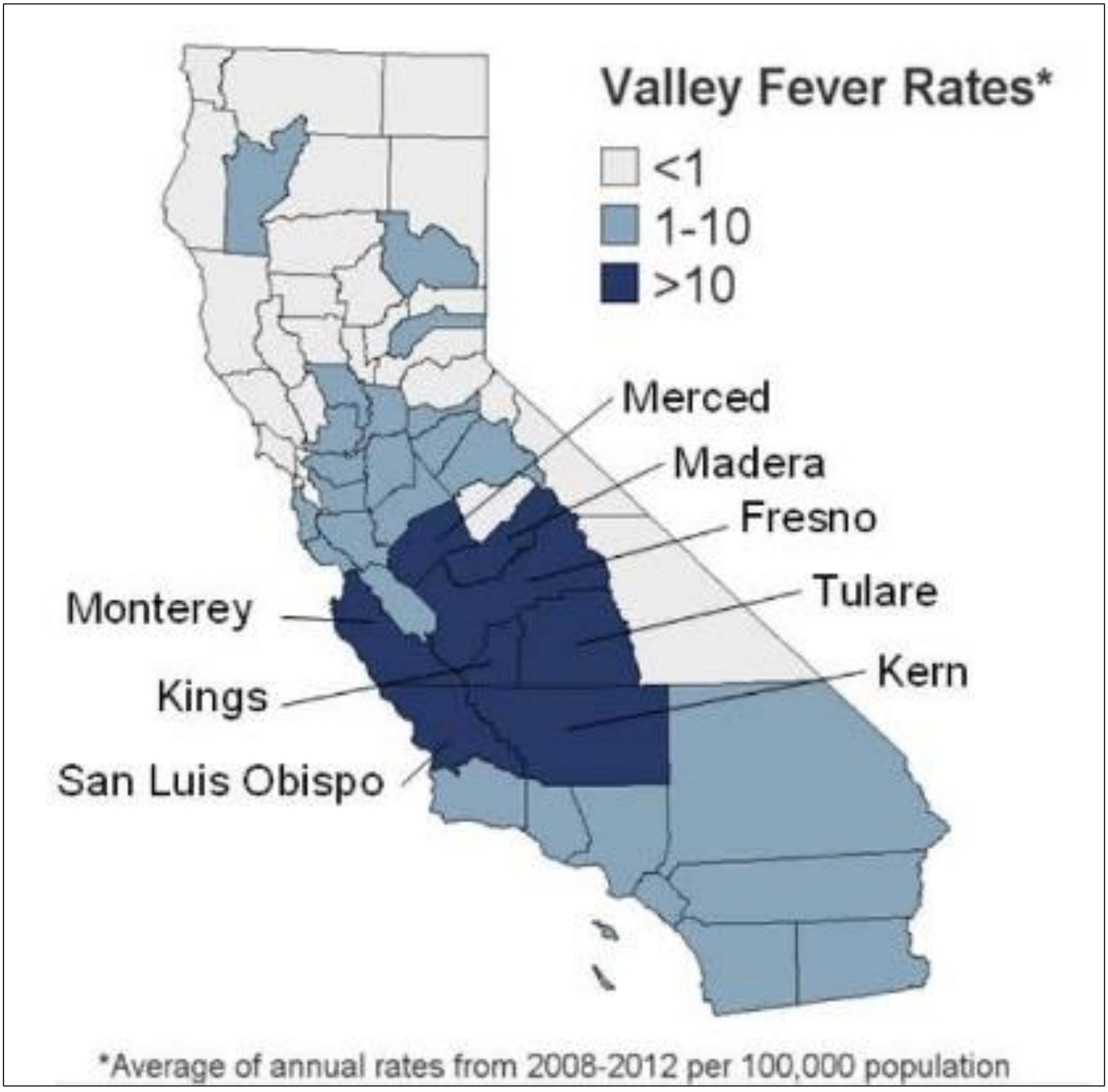
Figure K-13. Western Black-Legged Tick and Lyme Disease Incidence in California



K.11.5. Valley Fever

Most cases of Valley Fever in the U.S. occur in people who live in or have traveled to the southwestern United States, especially Arizona and California. Figure K-14 shows the areas where the fungus that causes Valley Fever is thought to be endemic, or native and common in the environment. The full extent of the current endemic areas is unknown and is a subject for further study.

Figure K-14. Valley Fever Average Annual Rates by California County



K.12. EXTREME HEAT

Heat waves do not cause damage or elicit the immediate response that floods, fires, earthquakes, and other disasters do. However, they have claimed many more lives when compared with other disasters. The worst single heat wave event in Southern California for loss of life occurred in 1955, when an eight-day heat wave is said to have resulted in 946 deaths. The summer 2006 heat wave in California caused the deaths of about 650 people over a 13-day period. County coroners and medical examiners reported at least 140 deaths from extreme heat between July 15 and August 1, 2006 (Knowlton, et al. 2009). Another study concluded actual mortality during the July 2006 heat wave was two to three times greater than the coroner estimates (Ostro, et al. 2009). In comparison, other types of disasters, such as recent earthquakes and fires, have caused in fewer deaths. For example, the 1989 Loma Prieta Earthquake resulted in 63 deaths, while the 1992 Northridge Earthquake was responsible for the loss of 55 lives. The catastrophic 2003 Southern California firestorms resulted in 24 deaths.

K.13. FREEZE

Figure K-15 shows the pattern of declared freeze disasters in California since 1950. Greatest concentrations are in the Central Valley, followed by areas north and south of the San Francisco Bay Area and portions of Southern California. Table K-11 lists freeze disasters that have occurred in the State since 1950.

Figure K-15. State and Federal Declared Freeze Disasters, 1950-February 2017

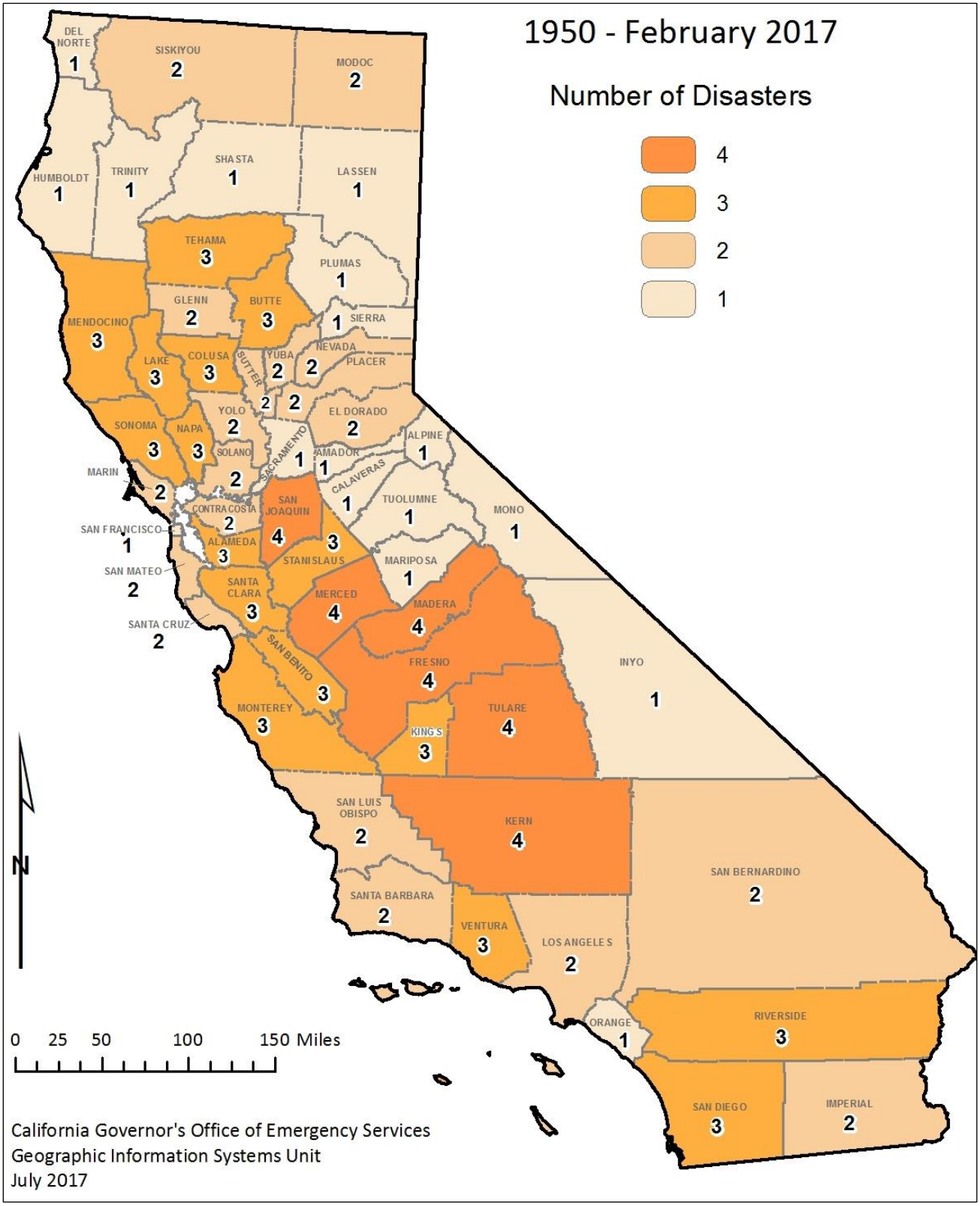


Table K-11. Freeze Disasters, 1950 to Present

Year*	Number of Incidents	Counties Affected	Crop Damage
1969	1	San Diego	$10 million
1972	2	Colusa, El Dorado, Fresno, Kern, Kings, Lake, Madera, Merced, Modoc, Nevada, Placer, San Benito, San Joaquin, Santa Clara, Stanislaus, Siskiyou, Tehama, Tulare	$113.5 million
1973	1	Alameda, Contra Costa	$8-$10 million
1990	1	Alameda, Butte, Colusa, Fresno, Glenn, Imperial, Kern, Los Angeles, Madera, Marin, Merced, Mendocino, Monterey, Napa, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Ventura, Yolo, Yuba	$852.4 million
1998-99	1	Fresno, Kern, Kings, Madera, Merced, Monterey, Tulare, Ventura	N/A
2001	3	Butte, Colusa, Fresno, Glenn, Madera, Mariposa, Merced, Plumas, Sutter, Tehama, Tuolumne, Yuba	N/A
2002	5	Butte, Colusa, Glenn, Lake, Marin, Mendocino, Napa, Orange, Riverside, Sacramento, Shasta, Sonoma, Tehama, Trinity	N/A
2007	1	Alameda, Amador, Calaveras, El Dorado, Fresno, Glenn, Imperial, Kern, Kings, Lake, Los Angeles, Madera, Marin, Mendocino, Merced, Monterey, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Solano, Stanislaus, Tulare, Ventura, Yolo, Yuba	$1.3 billion
2008	11	Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Madera, Marin, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Sacramento, San Joaquin, San Mateo, Santa Clara, Shasta, Siskiyou, Stanislaus, Solano, Sonoma, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba	$137,000
2009	15	Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Madera, Marin, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Sacramento, San Joaquin, San Mateo, Santa Clara, Shasta, Siskiyou, Stanislaus, Solano, Sonoma, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba	N/A
2010	9	Fresno, Kern, Kings, Madera, Mariposa, Merced, Modoc, Siskiyou, Tulare	N/A
2011	10	Del Norte, Fresno, Humboldt, Kern, Kings, Madera, Marin, Mariposa, Mendocino, Merced, Modoc, Napa, Siskiyou, Sonoma, Trinity, Tulare	$300.44 million
2012	12	Fresno, Kern, Kings, Madera, Mariposa, Merced, Modoc, Siskiyou, Tulare	N/A

Year*	Number of Incidents	Counties Affected	Crop Damage
2013	19	Fresno, Imperial, Kern, Kings, Madera, Mariposa, Merced, Modoc, Riverside, San Bernardino, Siskiyou, Tulare	$440.35 million
2014	12	Fresno, Kern, Kings, Madera, Mariposa, Merced, Modoc, Siskiyou, Tulare	N/A
2015	14	Fresno, Imperial, Kern, Kings, Madera, Mariposa, Merced, Modoc, Riverside, San Bernardino, Siskiyou, Tulare	N/A
2016	6	Kern, Modoc, Siskiyou	N/A

Source: (USDA 2023); (NOAA 2023b)

K.14. SEVERE WEATHER AND STORMS

The information in Table K-12 extends back to 1993 because that is the year that Cal OES began tracking disaster recovery history information. The 1993 storm was the first federally declared flood disaster since Stafford Act implementation began in 1988.

Table K-12. Federally Declared Storm Disasters Since 1993 (as of February 2018)

Disaster #*	Date*	# of Counties Affected	# of Deaths**	Damage in $
DR-979	Jan-Mar 1993	20	20	$175,734,172
DR-1046	Feb-Apr 1995	41	17	$110,327,382
DR-1044	Jan-Feb 1995	33	11	$143,991,187
DR-1155	Dec 1996-Apr 1997	47	8	$174,408,427
DR-1203	Feb-Apr 1998	43	17	$367,638,469
DR-1577	Dec 2004-Jan 2005	7	0	$258,456,701
DR-1585	Feb 2005	7	0	$77,765,373
DR-1628	Dec 2005-Jan 2006	13	0	$155,861,541
DR-1646	Mar-Apr 2006	17	0	$35,332,696
DR-1884	Jan-Feb 2010	6	2	$28,328,920
DR-1952	Dec 2010-Jan 2011	12	0	$75,384,562
DR-4301	Jan 2017	34	–	$78,667,600
DR-4302	Jan 2017	Hoopa Valley Tribe	–	$3,296,420
DR-4305	Jan 20147	22	–	$39,993,640
DR-4308	Feb 2017		–	$199,828,031
DR-4312	Feb 2017	Resighini Rancheria	–	$269,935
TOTAL				**$2,112,685,689**

* Source: (FEMA 2023a)
** Information on number of deaths from storm related disasters is not available as of February 2018

As shown in Table K-13, between 1950 and 2017, 354 tornadoes occurred in California, resulting in 87 injuries and more than $103 million in property damage, as well as $267,000 in reported crop damage. No known deaths occurred as a result of

California tornadoes, however, and the State has never proclaimed a state of emergency or had a federal disaster declared as the result of a tornado event.

Table K-13. Tornado Losses, 1950-2017

Magnitude	Number	Injuries*	Property Damage*	Crop Damage*
F0	236	8	$38 million	$212,000
F1	93	26	$18 million	$55,000
F2	23	47	$45 million	N/A
F3	2	6	$2.5 million	N/A

* 2013-2017 updates pending
Source: (Tornado Project 2018), (NOAA 2023)

Of the 354 tornadoes that occurred in California between 1950 and 2017, only two reached F3; 23 were F2, 93 were F1, and the remaining 236 were at F0. Based on the number of events within the recorded period, in the 67 years between 1950 and 2017, the average recurrence interval of an F0 tornado was about 3.7 per year; the interval for an F1 tornado was about 1.5 per year, the interval for an F2 tornado was approximately once every 2 years, and the interval for an F3 tornado was once every 28 years. However, both F3 tornadoes occurred within a five-year period (1973-1978). The biggest risks of tornadoes in California include light to moderate damage to homes, destruction of mobile homes, and injuries caused by light object projectiles.

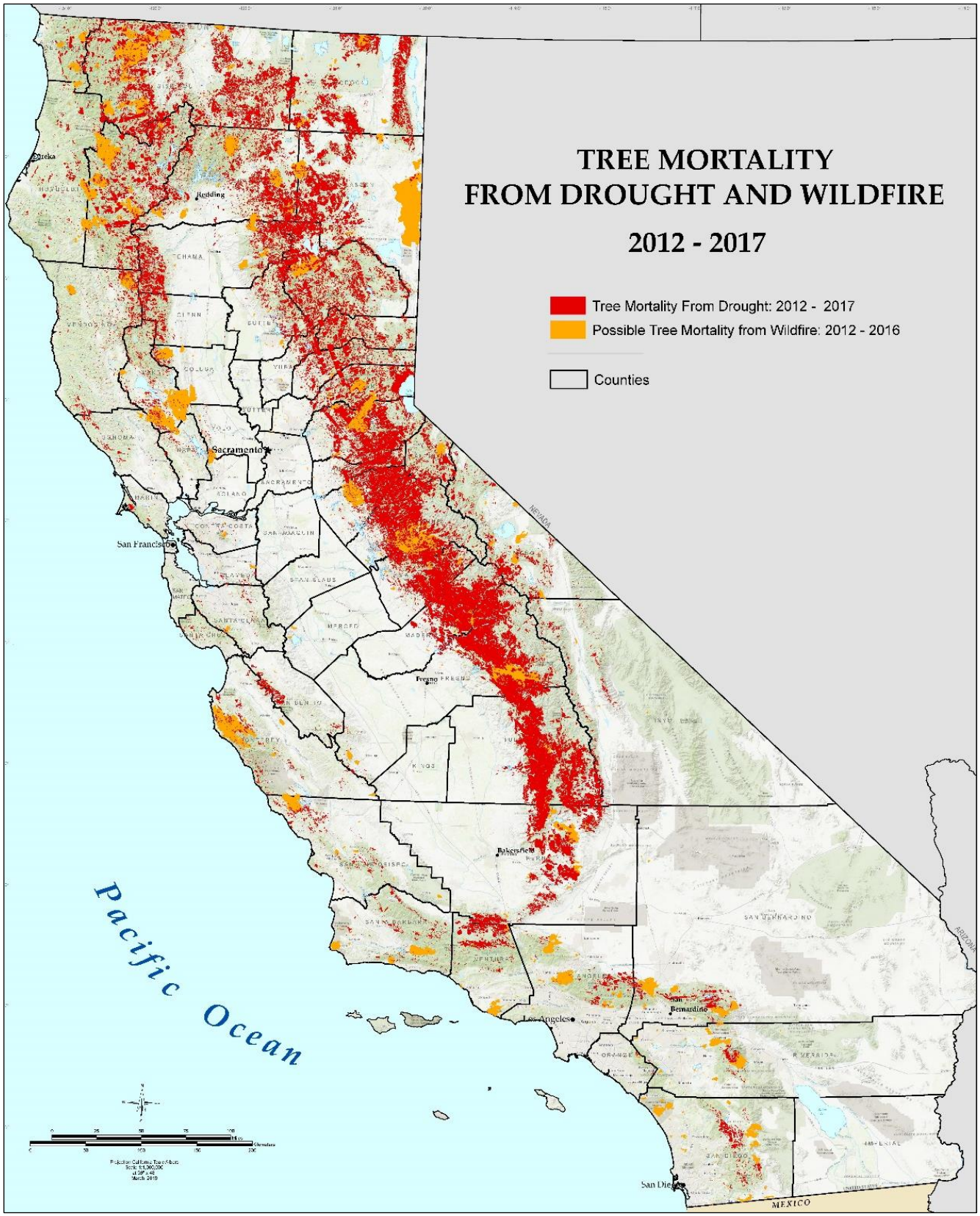
K.15. TREE MORTALITY

In California, drought is a recurring event and a catalyst for thousands of acres of stressed trees, bark beetle outbreaks, and extremely high levels of tree mortality. Due to the drought, tree mortality levels have substantially increased in forests in California over the past several years. Figure K-16 identifies all tree mortality recorded between 2012 and 2017 throughout the State.

An estimated 29 million trees covering three million acres died in 2015 alone. From 2010 through the fall of 2017, approximately 129 million trees died on 8.9 acres.

Tree mortality is occurring statewide but is particularly dramatic on the west side of the southern Sierra Nevada range and in parts of the Transverse range. As of 2017, there are over 1 million acres with high levels of tree mortality across the Stanislaus, Sierra, and Sequoia National Forests. Forest managers are recording 50 percent to greater than 75 percent conifer mortality between 3,000 to 6,000 feet elevation.

Figure K-16. Tree Mortality from Drought and Wildfire, 2012-2017



K.16. HAZARDOUS MATERIAL RELEASE

Accidental hazardous materials releases occur many times during any given day. Most incidents are minor, but some do cause significant impacts such as injuries, evacuation, and the need for cleanup. Table K-14 summarizes major historical events.

K.17. OIL SPILLS

Table K-15 lists historic oil spills that have either occurred in California or have contributed to environmental legislation and regulatory requirements for the oil industry.

Table K-14. Hazardous Materials Releases Incidents in California

Date	Location	Disaster
1964	Alaska	Earthquake (magnitude 9.2) and tsunamis
Standard Oil Company's storage tanks toppled; break in hose connections to tanker loading diesel fuel; fire; rail cars exploded; Texaco bulk oil storage yard ignited.		
1971	San Fernando	Earthquake (magnitude 6.6)
100 natural gas leaks responded to by fire departments; one-third caused fires; also 18 hazardous materials leaks, 12 of which caused fires.		
April 28, 1973	Roseville	N/A
A railroad accident focused national attention on the hazards of munitions involved in fires. A hot brake shoe ignited the oak-wood floor of a Department of Defense boxcar carrying 250-pound bombs filled with Tritonal (TNT/aluminum). The bombs were being transported from the Naval Ammunition Depot in Hawthorne, Nevada, to the ship load-out port facility at the Naval Weapons Station in Concord, California. The train had just entered the yard in Roseville when a fire was observed coming from one of the boxcars. The fire department was summoned but, before they could act, a large explosion demolished a boxcar and spread the fire. Over a period of approximately 32 hours, 18 boxcars exploded in succession. The railroad yard was essentially destroyed. No one was killed but about 100 people were injured. There was about $24 million in property damage to the railroad yard and the surroundings. The litigation that followed lasted for several years and cost the government millions of dollars.		
1983	Coalinga	Earthquake (magnitude 6.7)
Many natural gas line breaks; at least nine hazardous materials releases, including a spill of strong acids and bases at a community college; one caused a fire.		
1987	Whittier Narrows	Earthquake (magnitude 6.1)
1,411 natural gas line breaks, three of which caused fires; 30 hazardous materials releases.		
1989	Loma Prieta	Earthquake (magnitude 6.7)
Hundreds of natural gas leaks; over 300 releases of hazardous materials, including asbestos.		

Date	Location	Disaster
1994	Northridge	Earthquake (magnitude 6.8)
More than 15,000 natural gas leaks; over 200 fires; hazardous materials problems at 134 locations; 60 incidents requiring offsite hazardous materials response; fires and hazardous materials releases at California State University (CSU) Northridge science laboratory complex.		
August 6, 2012	Richmond	N/A
Following a leak and the subsequent ignition of diesel fuel, a series of explosions and fires occurred at Chevron's refinery in Richmond, California. Thousands of East Bay residents were ordered to stay in their homes (shelter in place) with the windows and doors closed. Fortunately, there were no fatalities, but one refinery worker suffered burns to his wrist and was treated at the onsite clinic.		

Table K-15. Summary of California and Other Significant Oil Spills

Spill	Date	Area Affected	Estimated Amount
Lakeville Gusher - Kern County	May 14, 1910– September 1911	Not available	378,000,000 gallons (9,000,000 barrels)
Known as the Lakeville Gusher, this incident involved an oil well that blew out on March 15, 1910. The oil well was being drilled at 2,440 feet below the surface in Kern County between the towns of Taft and Maricopa. The well was drilled into a high-pressure oil-bearing zone. The uncontained oil blew much of the steel casing out of the well and resulted in an estimated 9 million barrels of crude oil pouring from the ground. This was considered the largest documented oil spill in history and has only recently been surpassed by the Deepwater Horizon Oil Spill in the Gulf of Mexico. To mitigate the spread of oil, workers circled the well with sandbags and built an earthen dam 20 feet high and 50 feet thick in the canyon mouths above the well to prevent flash flooding from further dispersing the oil. The well ultimately caved in and sealed itself on September 9, 1911, nearly 18 months after it blew. The site is designated as California Historical Landmark Number 485.			
Santa Barbara	January 28, 1969– February 8, 1969	35 miles mainland coastline;800-square mile slick	3,000,000 gallons (102,620 barrels)
3,600 birds, seals, dolphins, fish, intertidal invertebrates $17 million in lawsuit settlements for property damage			

Spill	Date	Area Affected	Estimated Amount
Exxon Valdez	March 24, 1989	1,300 miles of shoreline	11,000,000 gallons (257,000 barrels)
Although the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska did not directly affect the California environment or economy, it is significant for several reasons. First, it highlights the interconnectivity of oil production and distribution systems. The Exxon Valdez was en route from the Alyeska Pipeline Terminal to Long Beach, California when it ran aground, rupturing 8 of the 11 cargo tanks holding crude oil. Secondly, although in size the spill is no longer listed in the top 50 international oil spills, it is still considered to be one of the largest in terms of environmental damage. Finally, because of the environmental impacts, the Exxon Valdez oil spill resulted in landmark environmental legislation and more rigorous oil industry regulations. 250,000 seabirds, 2,800 sea otters, 300 harbor seals, 250 bald eagles,33 killer whales, billions of salmon and herring eggs $2.1 billion for clean-up by Exxon			
American Trader	February 7, 1990	About 13 miles of coastline plus offshore area	416,598 gallons
On February 7, 1990, off Huntington Beach, California, the oil tanker American Trader ran over its anchor, puncturing its hull and spilling an estimated 416,598 gallons of crude oil. An estimated 3,400 birds and an unknown number of fish were killed, and recreational beach use was seriously disrupted. The biological component of the resulting litigation was settled out of court for $3.45 million for bird- and fish-related injuries, plus an additional $360,000 for water monitoring projects, while the recreational component was eventually settled, following a jury trial, for $11.6 million. For more information, visit: https://www.wildlife.ca.gov/OSPR/NRDA/american-trader.			
Guadalupe Oil Field -San Luis Obispo	1950s–1994	2,700 acres	9,000,000-12,000,000 gallons (212,570 barrels)
The Guadalupe Dunes oil spill typifies another variety of oil spill that can occur in California. The Guadalupe-Nipomo Dunes, located along the southern coast of San Luis Obispo County, is one of the largest dune complexes along the California coast, measuring approximately 15,500 acres. Oil exploration and production began in the area in the late 1940s. By 1953, Unocal Corporation was producing up to 2,000 barrels of oil per day from 34 wells. Oil field operations continued until March 1990 with gradual expansion to 215 wells producing approximately 4,500 barrels per day. Because of the highly viscous nature of the oil being extracted from the field, diluent (a diesel-like crude oil thinner) was introduced in the 1950s to assist in the production and transportation of the heavy crude. A 145-mile network of pipelines was built across the dunes to carry the diluent. Over the years, the pipelines rusted and became buried in the shifting sands, where they sprang leaks in 80 to 90 places, releasing as much as 12 million gallons of diluent into the dunes, beach, groundwater, and the Pacific Ocean. The spill came to the attention of State officials when an oily sheen was noticed by surfers and sea lions and seals began washing up dead on the shore. On March 23, 1994, a lawsuit was filed by the California State Attorney General, the California Department of Fish and			

Spill	Date	Area Affected	Estimated Amount
Wildlife, the California Regional Water Quality Control Board Central Coast Region, the California Department of Toxic Substances Control, and the Coastal Conservancy against Union Oil Company of California. The State plaintiffs alleged in this action that on numerous occasions since Unocal began using diluent at the Guadalupe oil fields, oil had leaked from the pipelines and storage tanks at numerous locations into the groundwater, surface water, and marine water. An agreement was reached between the parties in July 1998, for $43,800,000, of which $9 million was allocated for dune restoration activities. Six State and federal agencies now oversee the cleanup activities. Unocal has dismantled and removed the pipelines, storage tanks, and other infrastructure related to the oil field operations.			
Cosco Busan – San Francisco Bay	November 7, 2007	200 miles of coastline	58,000 gallons (1,375 barrels)
This San Francisco oil spill occurred on November 7, 2007, as a result of a container ship, the M/V Cosco Busan, striking the fender surrounding a footing of the western span of the San Francisco Bay Bridge. The collision caused no substantial damage to the bridge and the ship hull ruptured, causing medium-grade fuel oil to leak from its tank. Unlike oil tankers, container and cargo ships are not required to have double hulls, a regulation that was adopted following the Exxon Valdez oil spill discussed earlier. Numerous local jurisdictions border the bayfront coastline and were affected by the oil spill. Local proclamations were issued by the counties of Alameda, Contra Costa, Marin, San Francisco, San Mateo, Solano, and Sonoma; the cities of Albany, Berkeley, and Oakland; and the East Bay Regional Park District. The Governor's proclamation covered the City and County of San Francisco and the counties of Alameda, Contra Costa, Marin, San Mateo, Solano, and Sonoma. The incident period for the event closed nearly one year following the oil spill on October 31, 2008. Numerous State and federal agencies were involved in the oil spill response, cleanup, and subsequent investigations, including the United States Coast Guard (USCG), California Department of Fish and Wildlife Office of Spill Prevention and Response (OSPR), and California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA). The 226 identified affected shoreline sites were ranked based on spill specifics such as the location of the release, nature of the release, volume of the release, and other established criteria. (For details on the oil spill response organization and activities, please see the Cosco Busan San Francisco Bay Area Oil Spill After Action/Corrective Action Report published by the California Emergency Management Agency, now Cal OES.) Two new response and cleanup initiatives were developed as a result of this oil spill: the Department of Fish and Wildlife developed Shoreline Cleanup and Assessment Techniques (SCAT) teams to oversee beach and shoreline cleanup, and, OSPR has taken a lead role in expanding its convergent volunteer program to include opportunities outside of wildlife rehabilitation.			
Deepwater Horizon – Gulf of Mexico	April 20, 2010–July 15, 2010	2,500-square-mile slick	180,000,000 gallons (4,900,000 barrels)
The Deepwater Horizon oil spill occurred in the Gulf of Mexico on April 20, 2010, as a result of an explosion that killed 11 platform workers and injured 17 others. It is the largest offshore marine oil spill in United States history. After releasing approximately 4.9 million barrels of crude			

Spill	Date	Area Affected	Estimated Amount
oil, the leak was stopped by capping the wellhead. The spill caused extensive damage to marine and wildlife habitats as well as the Gulf's fishing and tourism industries. While a six-month moratorium on offshore drilling was imposed after the explosion, the moratorium was lifted shortly thereafter by the United States District Court. Investigations into the causes of the explosion and spill were conducted by the United States Coast Guard (USCG), Minerals Management Service (MMS), National Academy of Engineering, National Commission on the BP Deepwater Oil Spill and Offshore Drilling, United States House Committee on Energy and Commerce, and others.			
Refugio Oil Spill – Plains All America Pipeline	May 19, 2015	Approximately 7 miles of coastline	123,000 gallons
On May 19, 2015, a 24-inch subterranean pipeline owned and operated by Plains All America Pipeline ruptured on the Gaviota Coast, west of Refugio State Park. Much of the crude oil spilled ran down a storm drain and into a ravine under the freeway and entered the ocean. The size of the spill ranged from 100,000 to 140,000 gallons, covering the Santa Barbara County coastline and extending nearly 9 miles out into the ocean. Various agencies, including local, county, State, and federal partners, were involved in response and recovery efforts, with the participation of approximately 1,300 field and 325 incident command post personnel. Notifications from the county to State and federal partners were aligned with the Santa Barbara Operational Area Oil Spill Contingency Plan and Los Angeles- Long Beach Area Contingency Plan. The incident command post remained operational for the first 13 days of the incident. Interagency field teams conducted a National Resource Damage Assessment to document dead fish, invertebrates, and other wildlife in the oiled areas following the spill. NOAA and its State and federal natural resource co-trustees investigated the extent to which the incident may have caused harm to birds (brown pelicans, common murres, Pacific loons, snowy plovers), marine mammals (including California sea lions), fish (especially surf perch and grunion), and marine invertebrates along with their habitats. The spill also shut down fisheries, closed multiple beaches, and affected recreational uses such as camping, non-commercial fishing, and beach visits. Nearly one year after the spill, Plains All America Pipeline was indicted by the Santa Barbara County grand jury on 46 criminal counts related to the spill, after which the county filed criminal charges. Another three years elapsed before the trial date was set for February 5, 2018, with jury selection beginning in April 2018. The outcome of the trial will not be known for several months. Three bills were signed into law in response to the spill. Under a new law, the California Fire Marshal will be required to review the oil pipelines conditions every year, while federal regulations only mandate a review every five years. Another new law provides for making oil spill response times faster and more effective. The third will force intrastate pipelines to use the best-known technology such as automatic shut-off valves.			

K.18. NATURAL GAS PIPELINE HAZARDS

PHMSA tracks significant incidents and losses as a result of pipeline accidents occurring on gas transmission lines and gas distribution lines. Significant incidents are those reported by pipeline operators with either 1) a fatality or injury requiring in-patient hospitalization, or 2) $50,000 or more in total costs, measured in 1984 dollars.

From 2013 to 2017, a total of 85 incidents were reported on California distribution lines, resulting in a total of six fatalities, seven injuries, and $53 million in property damage. For that same period, a total of 43 incidents were reported on gas transmission lines, resulting in two fatalities, 15 injuries, and $28 million in property damage. These incidents are summarized in Table K-16.

Table K-16. Gas Distribution and Local Transmission Line Incidents, 2013 to 2017

Year	Number of Incidents	Fatalities	Injuries	Total Cost of Damage
Gas Distribution Lines				
2013	14	0	0	$3,490,587
2014	18	2	2	$18,683,512
2015	14	2	2	$1,546,593
2016	16	0	1	$3,061,979
2017	23	2	2	$26,228,185
Total	**85**	**6**	**7**	**$53,010,856**
Gas Transmission Lines				
2013	6	0	0	$2,324,207
2014	13	0	0	$10,344,591
2015	9	2	15	$9,633,537
2016	6	0	0	$2,052,778
2017	9	0	1	$4,208,740
Total	**43**	**2**	**15**	**$28,563,853**

Source: (PHMSA 2022)

K.18.1. San Bruno Gas Transmission Line Explosion

On September 9, 2010, a 30-inch steel natural gas transmission pipeline owned and operated by PG&E ruptured and exploded in a residential neighborhood in San Bruno, California. The rupture produced a crater about 72 feet long by 26 feet wide. The section of pipe that ruptured, which was about 28 feet long and weighed about 3,000 pounds, was found 100 feet south of the crater.

PG&E estimated that 47.6 million standard cubic feet of natural gas was released. The released natural gas ignited, resulting in a fire that destroyed 38 homes and damaged 70. There were eight confirmed deaths and 66 reported injuries. Cal OES has identified preliminary damage estimates at $15.4 million, including $2.5 million for debris removal, $10.2 million for protective measures, $2.1 million for roads and bridges, and $0.6 million for utilities and other facilities.

A report issued by the National Transportation Safety Board (NTSB) in August 2011 determined that the probable cause of the accident was PG&E's 1) inadequate quality assurance and quality control in 1956 during its Line 132 relocation project, which allowed the installation of a substandard and poorly welded pipe section with a visible seam weld flaw that over time grew to a critical size, causing the pipeline to rupture during a pressure increase stemming from poorly planned electrical work at the Milpitas Terminal; and 2) an inadequate pipeline integrity management program, which failed to detect and repair or remove the defective pipe section.

Contributing to the accident were the California Public Utilities Commission (CPUC) and the U.S. Department of Transportation (US DOT) exemptions of existing pipelines from the regulatory requirement for pressure testing, which likely would have detected the installation defects. Also contributing to the accident was CPUC's failure to detect the inadequacies of PG&E's pipeline integrity management program. Contributing to the severity of the accident were the lack of either automatic shutoff valves or remote-control valves on the line and PG&E's flawed emergency response procedures and delay in isolating the rupture to stop the flow of gas.

The NTSB report included a series of recommended actions to be undertaken by federal and State government agencies and PG&E. These recommendations and resulting legislation are discussed in subsequent sections.

K.19. RADIOLOGICAL ACCIDENTS

No hazard event history recorded in the 2018 SHMP for the radiological accidents profile.

K.20. TRAIN ACCIDENTS RESULTING IN EXPLOSIONS AND/OR TOXIC RELEASES

According to Cal OES, there have been 14 train accidents affecting 12 communities since 1950. Several significant train accidents, derailments, fires, and hazardous

material releases have occurred in California in the past 40 years that resulted in multiple deaths, numerous injuries, and property damage and have, thus, stimulated changes in land use and rail safety regulations. Rail incidents involving oil in California increased from three in 2011 to 36 in all of 2013 and 28 in the first half of 2014.

K.20.1. April 1973 – Roseville Train Explosion

A dramatic example in California history was the major explosion and chemical plume release that occurred in April 1973 in the Roseville railroad yard when 6,000 bombs on a train bound for the Concord Naval Weapons Stations detonated after a car caught fire. Although no one was killed, the blast reportedly injured about 100 people and damaged 5,500 buildings, some more than a mile away.

K.20.2. May 12, 1989 – Duffy Street Derailment, San Bernardino

On May 12, 1989, a six-locomotive/69-car Southern Pacific freight train picked up speed while descending down the Cajon Pass in Southern California. The train reached a speed of 110 miles per hour on a curve at Duffy Street in San Bernardino designed for no more than 40 miles per hour. The train derailed and plowed into a residential area on Duffy Street. The conductor, head-end brakeman, and two residents were killed in the crash. Seven homes were destroyed, as was the entire train.

During the cleanup effort, an underground 14-inch high-pressure gasoline transit pipeline suffered undetected damage. On May 25, 13 days after the train derailment, the pipeline burst, showering the neighborhood in gasoline and igniting a large fire that killed two people and destroyed 11 more homes. The total property damage was $14.3 million. Many residents moved after this, and homes are no longer allowed to be built next to the rail lines.

Investigations determined several causes that contributed to the derailment: a miscalculation of the weight of the freight, which was underestimated by 40 percent; lack of dynamic brakes on three of the six locomotives; and train engineer error in activating the emergency brake, which cancelled the dynamic brakes on the functioning three locomotives.

K.20.3. July 14, 1991 – Cantara Loop Spill, Upper Sacramento River

On the night of July 14, 1991, a Southern Pacific train derailed into the upper Sacramento River at a sharp bend of track known as the Cantara Loop, upstream from Dunsmuir, California, in Siskiyou County. Several train cars made contact with the

water, including a tank car that initially appeared to be undamaged; however, a small rupture below the water line allowed its contents to be released into the river. Early the following morning, it became apparent that the tank car had ruptured and spilled approximately 19,000 gallons of metam sodium, a potent herbicide and pesticide used primarily to sterilize soil for agricultural purposes.

When mixed with water, metam sodium breaks down into several highly toxic compounds having varying toxicities and half-lives in the aquatic environment. Though some are highly toxic, all dissipate in a matter of hours or weeks and do not linger long-term. Some of the compounds volatilized into the air, creating a toxic cloud above the river as the chemical plume moved downstream. Efforts to determine the extent of damage to aquatic life from the metam sodium spill were delayed 12 to 48 hours due to the hazard of fume exposure.

Ultimately, over a million fish and tens of thousands of amphibians and crayfish were killed. Millions of aquatic invertebrates, including insects and mollusks, which form the basis of the river's ecosystem, were destroyed. Hundreds of thousands of willow, alder, and cottonwood trees eventually died. Many more were severely injured. The chemical plume left a 41-mile wake of destruction, from the spill site to the entry point of the river into Shasta Lake. Traveling at just under 1 mile per hour on average, the plume entered Shasta Lake on the morning of July 17, 1991. Dilution and evaporation of the metam sodium, combined with continued aeration, reduced the chemical to undetectable levels in the lake by July 29, 1991.

In July 1992, a lawsuit was filed by the State of California and the federal government against Southern Pacific Railroad and other parties considered responsible for the Cantara spill. The lawsuit was on behalf of the natural and biologic resources damaged or destroyed by the spill. The basis of the lawsuit was to recover damages for those injured resources. An out-of-court agreement was reached in 1994, and the entire settlement process was completed by August 1995. The plaintiffs were awarded $38 million in damages, reimbursements, and restoration funds, $14 million of which was to be administered by the Cantara Trustee Council for restoration activities, land acquisition and protection, research, and public education. The Cantara Trustee Council operated for a period of 12 years, from 1995 to 2007. For additional details on the activities and projects funded by the Cantara Trustee Council, see: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=17248&inline=true.

The severity of this spill and the long-term effects on the surrounding ecosystem prompted the California Public Utilities Commission (CPUC) to conduct a statewide risk assessment which identified 19 hazardous rail sites within the State.

K.20.4. January 26, 2005 – Glendale Derailment

On January 26, 2005, a southbound Metrolink commuter train collided with a sport utility vehicle (SUV) that had been abandoned on the tracks near the Glendale-Los Angeles city boundary. The train jackknifed and struck trains on both sides of it, one a stationary freight train and the other a northbound Metrolink train traveling in the opposite direction. The collisions resulted in 11 deaths and 100 to 200 injuries. The driver of the SUV left the vehicle before the crash and was later charged and convicted of 11 deaths and arson.

Subsequent criticism focused on the issue of train configuration. Many commuter trains use a "pusher configuration" to avoid turnaround maneuvers and facilities required to reverse a train's direction. This means the trains are pushed from the back by the locomotive. There were assertions that this type of configuration made the accident worse and claims that if the engine had been in the front, the train might not have jackknifed and caused the second Metrolink train to derail.

To increase rider safety, Metrolink temporarily roped off the first cars in all of their trains and allowed passenger seating in the second car and beyond. Metrolink gradually modified this policy. As of 2007, the line permitted passengers to sit in a portion of the first car when the train is in "push mode," but did not allow seating in the forward-most section of the first car.

K.20.5. September 12, 2008 – Chatsworth Derailment

The September 12, 2008, Chatsworth train accident, resulting in 25 deaths and injuring more than half the train's passengers, spawned significant changes to national rail safety standards. The head-on collision occurred in Chatsworth, a neighborhood of Los Angeles located at the western edge of the San Fernando Valley and involved a Metrolink commuter train and a Union Pacific freight train. All three locomotives, the leading Metrolink passenger car, and seven freight cars derailed. According to the National Transportation Safety Board (NTSB), the Metrolink train engineer most likely caused the collision because he was distracted by sending text messages while on duty. He failed to obey a red stop signal that indicated it was not safe to proceed from the double-track into the single-track section and, thus, collided head-on with

the freight train that was traveling on the same single-track section from the opposite direction.

The NTSB also believed that deployment of a positive train control (PTC), which is a safety backup system that can automatically stop a train and prevent train collisions, could have avoided the disastrous collision and derailment. Although not required at the time of the Chatsworth accident, PTCs have been a high priority for the NTSB following similar collisions since the mid-1980s, and voluntary implementation has been uneven and incremental across the country since that time, primarily due to the high costs associated with installation and maintenance. Following the Chatsworth collision, Metrolink expanded the existing automated train stop system used on 30 miles of Metrolink track in Orange County across its 350-mile system. Metrolink's automated train stop system will automatically apply the brakes to stop a train if the engineer fails to respond to a warning within 8 seconds.

K.20.6. November 25, 2014 – Feather River Canyon Derailment

On November 25, 2014, 11 cars carrying corn derailed adjoining a portion of the Feather River about 50 miles northeast and upstream of Lake Oroville, releasing kernels and husks into the river. Most of the corn landed on the hillside above the river. Although this was not considered a toxic spill, it raised concerns among State and local officials because the rail track routinely carried trains transporting hazardous materials, including 100-car Bakken crude oil trains. At the time, the number of crude oil trains entering the State via mountain passes and river canyons was expected to jump substantially in the next several years as coastal refineries planned to purchase Bakken oil from fields in North Dakota, Canada, Colorado and Texas. As a result of this spill and others occurring in Canada, Virginia, and Pennsylvania, representatives of CPUC and Cal OES provided testimony for U.S. Department of Transportation (US DOT) hearings regarding rail tank safety standards.

K.20.7. January 6, 2015 – Roseville Derailment

On January 6, 2015, a westbound freight train departing the Union Pacific Railroad Davis Yard in Roseville derailed before it was able to leave the yard. Of the seven cars that derailed, three were upright, two were leaning, and two were on their side. The two rail cars that were on their sides included a tank car containing hazardous materials. The tank car sustained substantial damage to its outer shell, but the inner shell was not breached and consequently there was no release of hazardous material. Due to damage to the hazardous material car and initial uncertainty about a possible

release, the Union Pacific Railroad initially set up a half-mile evacuation zone. The Union Pacific Railroad's initial report stated the cause was a broken rail on the lead track of the departure yard. This was substantiated by CPUC staff.

Train derailments involving hazardous materials where track defects are the primary cause are of particular concern. In locations where such statistics highlight this concern, CPUC staff will often monitor and mentor the railroad maintenance personnel, focusing on each employee's competency and ability to perform effective regular inspections. Mentorship and observations in the field allow CPUC inspectors to discuss training needs and other remedies with local railroad managers.

K.21. WELL STIMULATION AND HYDRAULIC FRACTURING HAZARDS

No hazard event history recorded in the 2018 SHMP for the well stimulation and hydraulic fracturing profile.

K.22. TERRORISM

Terrorist events have continued to occur in California. From 2001 to 2011, there were 207 terrorist attacks in the United States. California was the leading state with 40 attacks, followed by 19 in New York State. The leading cities were New York (12), Washington, DC (9), and Los Angeles (8). The most common weapons used in the 207 terrorist attacks in the United States from 2001 to 2011 were incendiary devices and explosives. From 2001 to 2011, the most common targets of terrorists in the United States were businesses (62 attacks), private citizens and property (59 attacks), and government (43 attacks). Table K-17 summarizes terrorist events from 2006 to 2016.

Table K-17. Terrorist Events in California, 2006 to 2016

Date	Location	Description
June 30, 2006	Los Angeles	Attempted firebombing of private home
June 24, 2007	Los Angeles	Attempted firebombing of private home
October 20, 2007	Los Angeles	Flooding of a private home
February 5, 2008	Los Angeles	Arson at a private home
February 17, 2008	Eureka	Arson at a Planned Parenthood facility
April 25, 2008	San Diego	Bombing of a FedEx facility
August 2, 2008	Santa Cruz	Simultaneous firebombing of two separate private homes
March 7, 2009	Los Angeles	Firebombing of a private vehicle
July 3, 2009	Huntington Beach	Racially motivated stabbing of a man

Date	Location	Description
November 16, 2010	Los Angeles	Razor blade booby trap mailed to a private home
April 23, 2011	Stockton	Arson at a mosque
January 8, 2012	Coalinga	Arson at a feedlot
November 1, 2013	Los Angeles	Active shooter targeting Transportation Security Administration (TSA) at Los Angeles Airport
November 4, 2014	Coachella	Drive-by shooting at a mosque
December 7, 2014	Los Angeles	Arson at an apartment complex
September 30, 2015	Thousand Oaks	Arson at a Planned Parenthood facility
November 4, 2015	Merced	Stabbing of students
November 6, 2015	Inglewood	Racially motivated assault of a man
December 2, 2015	San Bernardino	Active shooter murder of 14 people
December 11, 2015	Coachella	Firebombing of a mosque
December 26, 2015	Tracy	Firebombing of a mosque
February 28, 2016	Los Angeles	Racially motivated attack of three people
May 25, 2016	Modesto	Firebombing of a Planned Parenthood facility

Source: (Cal OES 2023d)

In addition to the events listed in Table K-17, there have been numerous crimes by like-minded groups that do not meet terrorism criteria, as well as dozens of terrorism plot disruptions by law enforcement.

K.23. CYBER THREATS

Nationally, cybersecurity incidents such as financial fraud and government database breaches have increased from 5,503 in 2006 to 67,168 in 2014. This increase raises the question of whether there is a cybersecurity threat in California. Between 2012 and 2015, 50 million records of Californians were breached, and the majority of these breaches resulted from security failures, with malware and hacking; physical breaches constituted three quarters of all events. As use of digital information expands, Californians will increasingly become more vulnerable to the slow-moving, potential technological hazard of cyber damage.

K.24. CIVIL DISORDER IN CALIFORNIA

Civil disorders occur in California sporadically, and last from a few days to months. There are various causes, all human-made. All begin as local events; therefore,

mitigation measures need to be planned and carried out locally and be supported by mutual aid agreements from near-by agencies. Extensive loss of life and loss of property have occurred in the last 25 years. As summarized in the Table K-18, there have been several significant civil disorders in the State since 1965 and more recently. These disorders have all taken place in metropolitan areas.

Table K-18. Summary of Significant Civil Disorders in California

Disturbance	Location	Year	Deaths	Injuries	Damage
2016 Election Protests–*Protests against the election of Donald Trump. Thirty protesters were arrested, and three officers were injured.*	Oakland	2016	0	3	n/a
2016 Civil Disorder–*A rally of left-wing protesters and white nationalist groups outside the California State Capitol on June 26, 2016. Ten people were hospitalized for stabbing and laceration wounds.*	Sacramento	2016	0	10	n/a
2014 Oakland Riots–*A series of riots and civil disturbances following the decision of a Grand Jury in St. Louis not to charge Darren Wilson in the shooting death of black teenager Michael Brown in Ferguson, Missouri.*	Oakland	2014			n/a
2013 Oakland Riots–*Riots that occurred when protesters took to the streets on July 13, 2013, following the acquittal of George Zimmerman in the shooting death of Trayvon Martin.*	Oakland	2013	0	2	n/a
2012 Anaheim Police Shootings and Protests–*Two fatal shootings by police officers and subsequent public protests.*	Anaheim	2012	0	6	n/a
2011 Occupy California Protests–*Protests in 50 large and small cities and college campuses, along with 50,000 people participants in Occupy Oakland.*	Various	2011	0	1	$2.4 million
1992 Los Angeles Riots–*Riots that lasted six days and were a response to the acquittal of police officers for the beating of Rodney King.*	South Los Angeles	1993	50	Over 2,000	More than $1.0 billion
1965 Watts Riots–*ace riots that took place in the Watts neighborhood of Los Angeles.*	South Central Los Angeles	1965	34	1,032	$40 million