CHAPTER 4 – PROFILING CALIFORNIA'S SETTING

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About Chapter 4

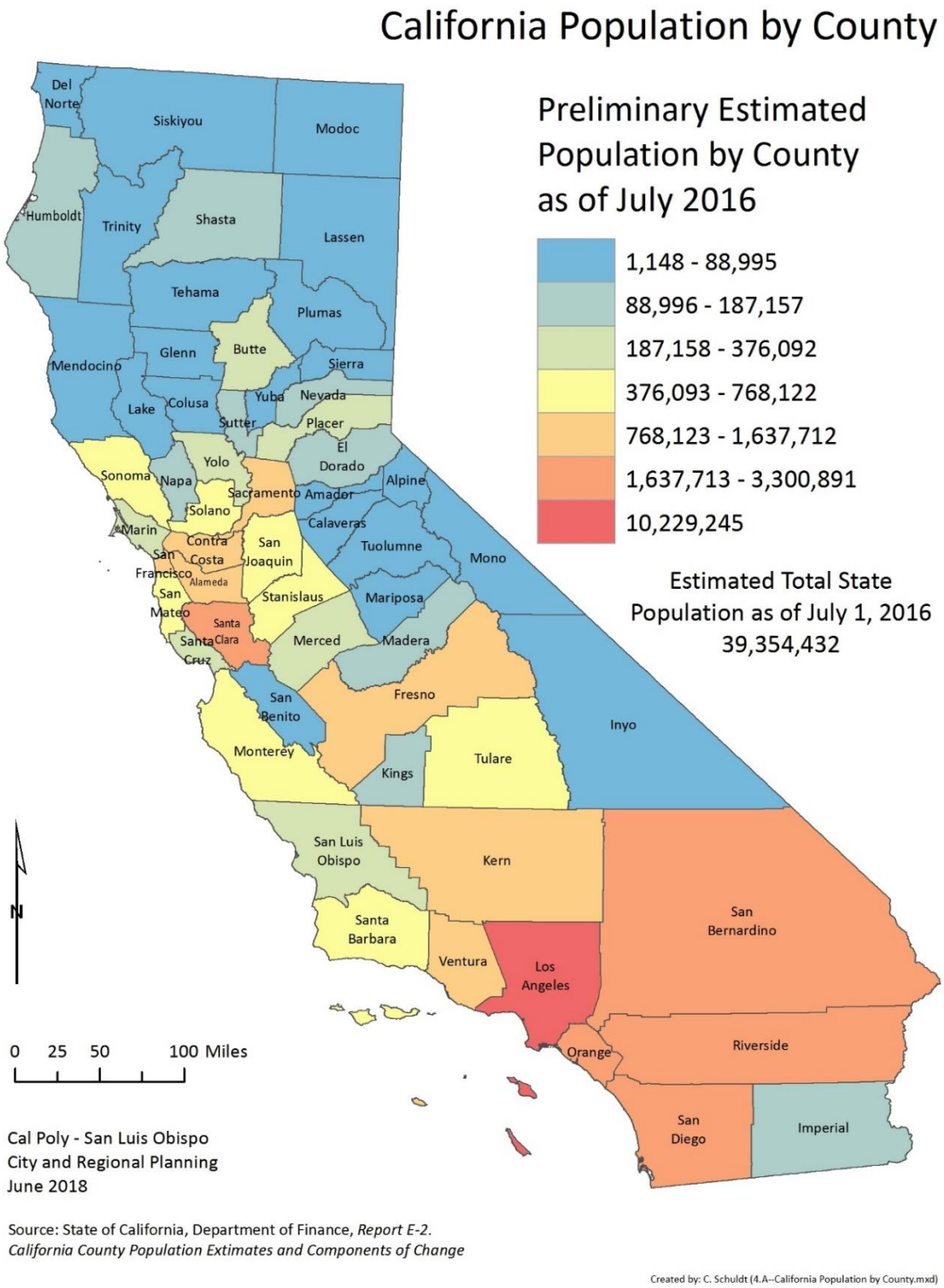
This chapter describes California's setting and key elements influencing the scale and complexity of the state's mitigation challenge. As a state, California is unique in its physical, economic, and demographic diversity. This diversity is a strength of the state, but also a challenge when assessing and mitigating risk. In attempting to mitigate natural and human-caused hazards across the state, it is crucial for state agencies, local and regional jurisdictions, and other stakeholders to understand and acknowledge the state's complexities when creating and implementing mitigation goals, strategies, and actions. This chapter summarizes key elements influencing the scale and complexity of California's mitigation challenge. For a risk assessment of California's hazards, see *Chapters 6 through 9*. Included in this chapter are discussions that address the following questions:

- What assets are at risk?
- Who is at risk?
- Where and what were the consequences from prior disasters?
- What does climate change mean for future risk from disasters?

4.1 STATE ASSETS AT RISK

California is an extraordinarily large, diverse, and complex state. With 12.1 percent of the U.S. population, it is culturally, ethnically, economically, ecologically, and politically diverse. Human, economic, and natural assets worthy of protection from natural and human-caused disasters include the state's people, economy, infrastructure, and environment. If it were a separate nation, California would have the fifth largest economy in the world. A catastrophic disaster here could adversely affect the national and world economies. This confluence of demographic, economic, and environmental characteristics makes mitigating hazards in California both challenging and critically important.

Map 4.A: California Population by County



Map 4.A shows population by county in seven classifications, as of July 2016. Counties with populations of 1 million to 3.5 million inhabitants, shown in darker brown, are concentrated in the San Francisco Bay, Sacramento, and Southern California areas. Los Angeles County, shown in red, is in a class of its own with 10,229,245 people.[29]

[29] http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/

4.1.1 POPULATION, ECONOMY, AND INFRASTRUCTURE

Population

California is the most populous state in the U.S., with a January 1, 2017 population of 39,523,513. California leads the nation in population, employment, manufacturing, and agricultural output. Its 58 counties, and 482 incorporated cities and towns, vary widely in land area, population, and growth. For example, in 2016, the most populous county, Los Angeles, had 10,229,245 residents; while the smallest county, Alpine, had 1,148 people. Los Angeles, the largest county in U.S. in terms of population, also leads the state in permits issued for residential growth; in 2016, the county issued 20,339 such permits, a number estimated to be 59 percent higher than the county with the next largest number of residential permits, which is Orange County.

Table 4.A identifies California's top 10 counties in total population. Together, these counties represent 28,413,848 people, or an estimated 73 percent of the state's population in 2016. Of this total, 21,220,167 people, or over half the state's total population, live in the five southernmost counties (Los Angeles, San Diego, Orange, Riverside, and San Bernardino). Within these counties from 2012 to2016, the overall trend is gradual population increase over the four-year period with projections by the California Department of Finance for the year 2025 showing steady growth.

Table 4.A: Population Change, 2012-2016, in 10 Largest Counties by Population

2016 Rank	County	2016 Population	2012 Population	Percent Change, 2012 to 2016	California Department of Finance Projection 2025
1	Los Angeles	10,229,245	9,988,287	+2.4%	10,701,051
2	San Diego	3,300,891	3,174,446	+4.0%	3,482,977
3	Orange	3,181,371	3,084,036	+3.2%	3,305,644
4	Riverside	2,360,727	2,253,317	+4.8%	2,662,235
5	San Bernardino	2,147,933	2,077,560	+3.4%	2,366,662
6	Santa Clara	1,930,215	1,840,218	+4.9%	2,059,786
7	Alameda	1,637,712	1,554,446	+5.4%	1,763,028
8	Sacramento	1,506,677	1,445,230	+4.3%	1,639,613
9	Contra Costa	1,129,894	1,075,665	+5.0%	1,224,372
10	Fresno	989,183	950,634	+4.1%	1,130,406
	TOTAL	**28,413,848**	**27,443,839**	**+3.5%**	**30,335,774**

Source: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/ http://www.dof.ca.gov/Forecasting/Demographics/projections/ (Table P-1 and P-2)

Table 4.B lists the 10 least populated counties in California. Seven of the 10 least populated counties are located in the eastern portion of the state; two are northern inland, and one is located on the north coast. Together, these counties represent 151,600 people or an estimated 0.39 percent of the total population of California. It should be noted that these counties include a significant amount of public land holdings, as depicted in Map 4.F later in this chapter. Unlike the state's most populous counties, these least populous counties generally saw population decreases over the 2012-2016 period. The exceptions were Inyo and Colusa Counties.

Table 4.B: Population Change, 2012-2016, in 10 Smallest Counties by Population

2016 Rank	County	2016 Population	2012 Population	Percent Change 2012 to 2016	California Department of Finance Projection 2025
58	Alpine	1,148	1,166	-2%	1,329
57	Sierra	3,140	3,206	-2%	3,091
56	Modoc	9,469	9,634	-2%	9,866
55	Trinity	13,482	13,704	-2%	14,510
54	Mono	13,785	14,122	-2%	15,750
53	Mariposa	18,055	18,223	-1%	19,375
52	Inyo	18,649	18,569	+1%	20,004
51	Plumas	19,494	19,883	-2%	20,520
50	Colusa	22,408	21,781	+3%	25,821
49	Del Norte	27,040	27,996	-3%	29,735
	TOTAL	**151,600**	**146,670**	**+2%**	**160,001**

Source: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/

Diversity, Mobility, and Age

California's current population is among the most diverse in the nation. Demographic characteristics tell an important story about the significance of migration to the state. California is one of four states (also including New Mexico, Texas, and Hawaii) where no single ethnic group represents a majority of the population. The historical influx of immigrants highlights the importance of public outreach on disaster mitigation in an accessible, culturally and linguistically appropriate manner. Other demographic factors related to mitigation planning in California are the high mobility of the population,[30] age characteristics,[31] large Native-American populations, and individuals with access and functional needs.

California's population is continuing to become more diverse. The 2015 American Community Survey reported the racial and ethnic composition of California as 38.7 percent White (not Hispanic), 38.4 percent Hispanic, 13.5 percent Asian, 5.6 percent Black, 0.4 percent American Indian, and 3.4 percent Other. Continued population diversification presents a challenge for outreach and implementation of the state's hazard mitigation strategies. Government agencies at all levels find it necessary to address related challenges, such as language, communications, trust of government, adherence to regulations, and extent of participation in mitigation-related community stakeholder groups.

In addition to being diverse, California's population is mobile. Statistics from the California Bureau of Real Estate indicate that the average homeowner in California relocates every seven years. Forty-five percent of California residents live in rental units, and it is anticipated that these residents, as renters, will move more frequently than homeowners. The mobility of the population poses a challenge to continuously educating residents about the hazards and risks associated with their communities. According to the 2015 American Community Survey, California has an estimated 20,695,882 residents in owner-occupied housing units and an estimated 16,908,728 in renter-occupied housing units.[32]

California faces an aging workforce, like the rest of the nation, together with loss of skilled workers due to retirement. The California Department of Finance projects that in 2020 the state will have a population of 6,052,716 persons over 65 years of age. This estimate represents a substantially aging population who are more vulnerable to disasters. Residents over age 65 present a challenge for mitigation by adding to the total number of people in age groups more vulnerable and/or less able to respond to disasters. California also has a substantial population of residents over 75 years of age. In 2010, more than 1.5 million people 75 years and older lived in the 16 counties

[30] The average homeowner moves every seven years, and renters move more often, making educational outreach for mitigation difficult.
[31] The population of California is, on average, slightly younger than the rest of the nation.
[32] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25008&prodType=table

with 50,000 people or more. Additionally, according to the American Community Survey, there are an estimated 1,117,647 households with residents over the age 65 living alone, which illustrates increased vulnerability in the state. The California Department of Finance reports that in 2010 approximately seven percent of the state was comprised of children younger than five years old. This proportion is expected to remain constant through 2020.

Native Americans

California is home to more Native Americans than any other state in the country. Of the 566 federally recognized tribal governments in the United States, 109 have land or offices in California and there are 78 entities petitioning for recognition from the state of California.[33]

The U.S. Census Bureau's 2015 American Community Survey reported an estimated population of 287,028 Native Americans in California. The top five counties for Native American population were Los Angeles (59,340), Riverside (21,535), San Diego (21,237), San Bernardino (17,846), and Orange (12,476). According to the 2010 U.S. Census, California's Native American population represents an estimated 14 percent of the Native American population of the United States.[34]

The California Government Code (Sections 65352.3 to 65352.4) requires local governments to conduct meaningful consultation with California Native American tribes before a city or county government adopts or amends its general plan. The purpose of the consultation is to protect cultural places on lands affected by the proposed general plan. For more information, see the California Native American Heritage Commission website at: http://nahc.ca.gov/codes/.

The State of California recognizes the right of Native American tribes to self-govern and exercise inherent sovereign powers over their members and territory. On September 19, 2011, Governor Jerry Brown issued Executive Order B-10-11, which states that "it is the policy of the administration that every state agency and department subject to executive control is to encourage communication and consultation with California Native American tribes." The State is working with Native American tribes (federally and non-federally recognized) on a government-to-government basis to address issues concerning Native American tribal self-government and tribal trust resources.[35]

Persons with Access and Functional Needs

No two disasters are ever the same, yet virtually all disproportionately affect individuals with access and functional needs.

People with access and functional needs are individuals who have:

- Developmental, intellectual, or physical disabilities
- Chronic conditions or injuries
- Limited or no English proficiency speaking

People with access and functional needs may also be:

- Older adults, children, or pregnant
- Living in institutional settings
- Low-income, homeless, and/or transportation disadvantaged
- From diverse cultures

A study titled "The Impact of Wildfires on People with Disabilities," published by the State Independent Living Council (SILC), noted that individuals with disabilities were especially hard hit by the Southern California fires of 2003. It pointed out that many individuals with disabilities need assistance with evacuation or may be unable to see approaching danger or hear announcements to evacuate. The report identified the following areas that are

[33] http://www.courts.ca.gov/3066.htm
[34] https://www.census.gov/prod/cen2010/briefs/c2010br-10.pdf
[35] www.caloes.ca.gov/cal-oes-divisions/tribal-coordination

particularly key for individuals with disabilities: preparation, notification, evacuation, sheltering and interim services, and recovery. For more information see: https://www.calsilc.ca.gov/.

According to the U.S. Census Bureau's 2015 American Community Survey, an estimated 3,947,390 people in California have some form of disability. Table 4.C lists the top 10 counties that have the most households containing members with a disability. Among these counties, the percentage of households with disabilities ranges from a low of 16 percent of total households (in Santa Clara County) to a high of 22 percent of total households (in Sacramento County). According to the 2015 American Community Survey, 16.4 percent of Native Americans in the United States —and the same percentage in California—have a disability.

Table 4.C: 10 California Counties with Largest Number of Households with Disabled Residents, 2015

County	2012 Total Households in County	2015 Total Households in County	2012 Households with Members with a Disability	2015 Households with Members with a Disability	2012-2015 Change in Households with a Disability
Los Angeles	3,444,644	3,504,348	639,057	663,967	+4%
San Diego	1,169,225	1,194,494	198,829	215,370	+8%
Orange	1,052,535	1,081,042	164,911	179,945	+8%
Riverside	805,050	826,825	164,463	175,701	+6%
San Bernardino	700,200	711,715	143,463	145,923	+2%
Santa Clara	636,293	660,622	98,580	105,826	+7%
Alameda	583,618	595,871	93,854	110,826	+15%
Sacramento	556,314	563,670	119,858	124,165	+3%
Contra Costa	401,397	408,783	76,291	89,514	+15%
Fresno	318 ,451	318,451	73,171	85,163	+14%
TOTAL	**9,667,727**	**9,865,821**	**1,772,477**	**1,896,400**	**+7%**

Source: PUMS DATA, 2017, Association of Bay Area Governments

Based on the data in Table 4.C, the top 10 counties in terms of population also contain 71 percent of households in the state and 68 percent of all households in the state with a disabled member. Additionally, these counties also represent 73 percent of state's population in 2016.

An estimated 5.1 percent of the non-institutional population age 16 and over has an "independent living difficulty," and approximately 28 percent of individuals with a disability live alone. One in four people between the ages of 65 and 74 will experience disability in their lifetime, with the rate increasing to one out of two for people 75 years and older.

Communities in states throughout the country, including California, wrestle with the complexity of integrating access and functional needs considerations during critical incidents. To assist with this effort and to improve the ability for individuals with access and functional needs to maintain independence, health, and safety during disasters, the Governor created the Office for Access and Functional Needs (OAFN) within the California Governor's Office of Emergency Services (Cal OES) in 2008. The purpose of OAFN is to identify the needs of individuals with access and functional needs before, during, and after a disaster and to integrate needs and resources into all aspects of emergency management systems. OAFN uses a whole community approach by offering training and guidance to emergency managers and planners, disability advocates, and other service providers responsible for planning for, responding to and helping communities recover from disasters. For more information about OAFN, visit the OAFN web page at: http://www.caloes.ca.gov/Cal-OES-Divisions/Access-Functional-Needs.

In addition, the California Department of Social Services (CDSS) initiated a planning effort by putting together a stakeholder group that included local, state, and federal government organizations, as well as various community-based organizations and private non-profit organizations, to determine how individuals with access and functional needs could be better supported in general population shelters.

The result of the stakeholder group process was the creation of the Functional Assessment Service Team (FAST) program. The purpose of the FAST program is to provide trained staff in general population shelters to conduct functional assessments of shelter residents. The assessments will evaluate the immediate needs that people with disabilities and others with access and functional needs may have when evacuated to emergency/disaster shelters. Once the needs have been assessed, the FAST member will initiate the appropriate resource request for the shelter resident. FAST members will be deployed to shelters when the resource is requested by the shelter manager and the members will remain in the shelters until it is determined that they are no longer needed. The CDSS administers the FAST program and works with counties and cities to develop their FAST programs and incorporate the program into their local mass care and shelter plans. The CDSS also collaborates with the counties to bring the FAST program training to their communities.

For more information about the FAST program, visit the following link on the CDSS website: http://www.cdss.ca.gov/inforesources/Mass-Care-and-Shelter/FAST.

Economy

As a result of its large population, productive industry, and large agricultural sector, California has the largest economy of any state in the nation. World Bank estimates from 2017 rank California as the fifth largest economy in the world. California's economy represents 13.7 percent of the U.S. gross domestic product. It is a highly diversified economy with jobs and businesses in many different industries.

As of February 2017, California had the largest labor market in the U.S. with an estimated 16 million non-farm jobs and 18 million total employed persons.[36] California's largest industries include trade, transportation, and utilities (3.00 million jobs); professional and business services (2.55 million jobs) and government (2.52 million jobs). California is strong in the manufacturing of electronic equipment, computers and related chips and software, machinery, transportation equipment, and metal products. It continues to be a major center for motion picture, television, film, and related entertainment industries. Tourism is another important source of income.

The state is the nation's largest producer of agricultural products. The Central Valley, covers about 20,000 square miles and, contains 75 percent of California's irrigated land. Using less than 1 percent of U.S. farmland, the Central Valley supplies 8 percent of U.S. agricultural output (by value) and produces 25 percent of the nation's food, including 40 percent of the nation's fruits, nuts, and other table foods.[37] With an unemployment rate of 4.9 percent as of October 2017,[38] the state contains two million people who may be vulnerable to economic distress.

Infrastructure

California has an extensive infrastructure system. The state contains more than 1,250 dams under state jurisdiction, and 11 seaports that handle over half of the shipping freight in the United States. Additionally, California has over 170,000 miles of roads, 50,000 miles of highways, over 12,000 bridges, and 246 public use airports, including Los Angeles International Airport, which is the world's seventh busiest.[39] The state contains over 115,000 miles of oil and natural gas pipelines, 20 refineries and over 100 oil and natural gas terminal facilities, and more than a dozen of the U.S.'s largest oil fields.

California has over 7,400 public drinking water systems serving safe, clean, wholesome potable water reliably and adequately to the citizenry of California. The California State Water Resources Control Board is mandated to regulate and oversee this critical infrastructure. The drinking water infrastructure has a direct effect upon the communities' health.

[36] www.bls.gov/eag/eag.ca.htm
[37] https://ca.water.usgs.gov/projects/central-valley/about-central-valley.html
[38] http://www.ncsl.org/research/labor-and-employment/state-unemployment-update.aspx
[39] http://www.caloes.ca.gov/cal-oes-divisions/law-enforcement/critical-infrastructure-protection

California has the largest public education system in the world, including 23 campuses of the California State University (CSU) system, 10 campuses of the University of California (UC) system, and 109 community colleges within 72 districts, in addition to many K-12 public and private schools. The State of California owns more than 20,000 buildings and leases space at more than 2,298 sites.

Critical infrastructure is essential to the state's ability to provide assistance to its people for their everyday lives. Critical infrastructure such as transportation routes, utilities, government facilities, schools, and hospitals also provides the state with the capacity to respond to disasters. California's resiliency (the ability to withstand, respond to, and recover from a disaster) strongly depends on its capacity to quickly restore the functioning of critical infrastructure and facilities after disasters.

Estimated Animal Population

There are approximately 19 million domestic animals in California, and countless millions of wild animals beyond that. About one out of every three households in California owns a dog or cat.[40] The state is estimated to contain:

- Nearly 6.7 million dogs
- Over 7.1 million cats
- Approximately 500,000 horses
- Approximately 5.5 million cattle
- About 711,000 sheep and goats

For more information on pet planning and preparedness, visit:
http://www.caloes.ca.gov/for-individuals-families/california-animal-response-emergency-system.

4.1.2 GROWTH PATTERNS AND TRENDS

Recent Growth Trends

From 2012 to 2016, California's population grew by an estimated 1,214,394 people, or 3.2 percent.[41] Table 4.D shows the top 10 counties in population growth from 2012 to 2016. Highest growth took place in the five most heavily populated Southern California counties. Growth in the top 10 counties totaled 970,009 people, representing an estimated 70 percent of the state's growth.

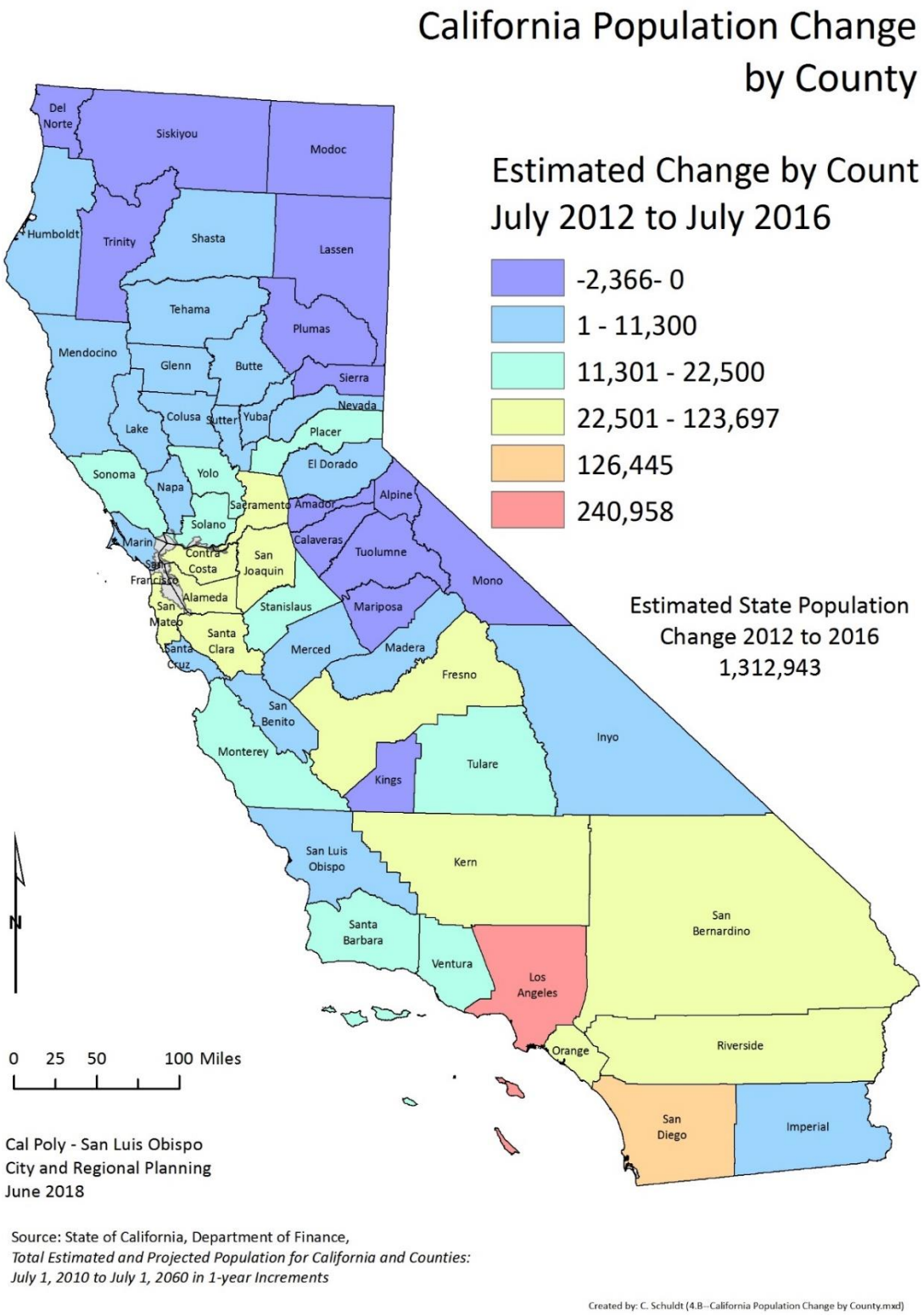
Table 4.D: Top 10 Counties in Population Growth, 2012-2016

County	2012-2016 Rank	2000-2012 Rank	Population Change, 2012 to 2016
Los Angeles	1	2	240,958
San Diego	2	4	126,445
Riverside	3	1	107,410
Orange	4	5	97,335
Santa Clara	5	9	89,997
Alameda	6	--	83,266
San Bernardino	7	3	70,373
Sacramento	8	6	61,447
Contra Costa	9	--	54,229
Fresno	10	8	38,549
TOTAL			**970,009**

Source: http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/ http://www.dof.ca.gov/Forecasting/Demographics/projections/ (Table P-1 and P-2)

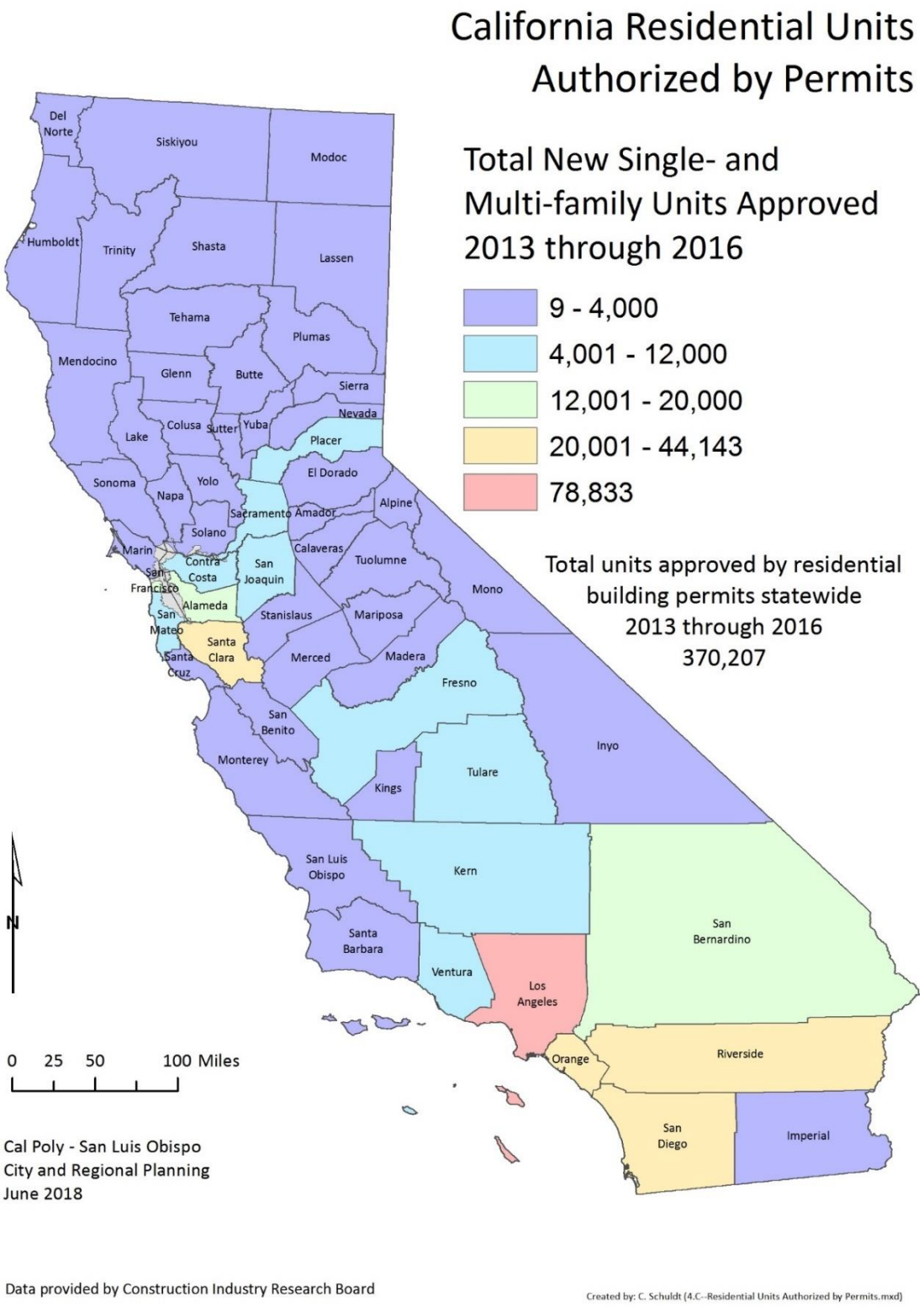
[40] https://cal-cares.com/
[41] http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-1/

Map 4.B: California Population Change by County



Map 4.B shows that population growth from 2012 to 2016 has been concentrated largely in Southern California, San Francisco Bay, Sacramento area, and Central Valley counties.

Map 4.C: California Residential Units Authorized by Permits



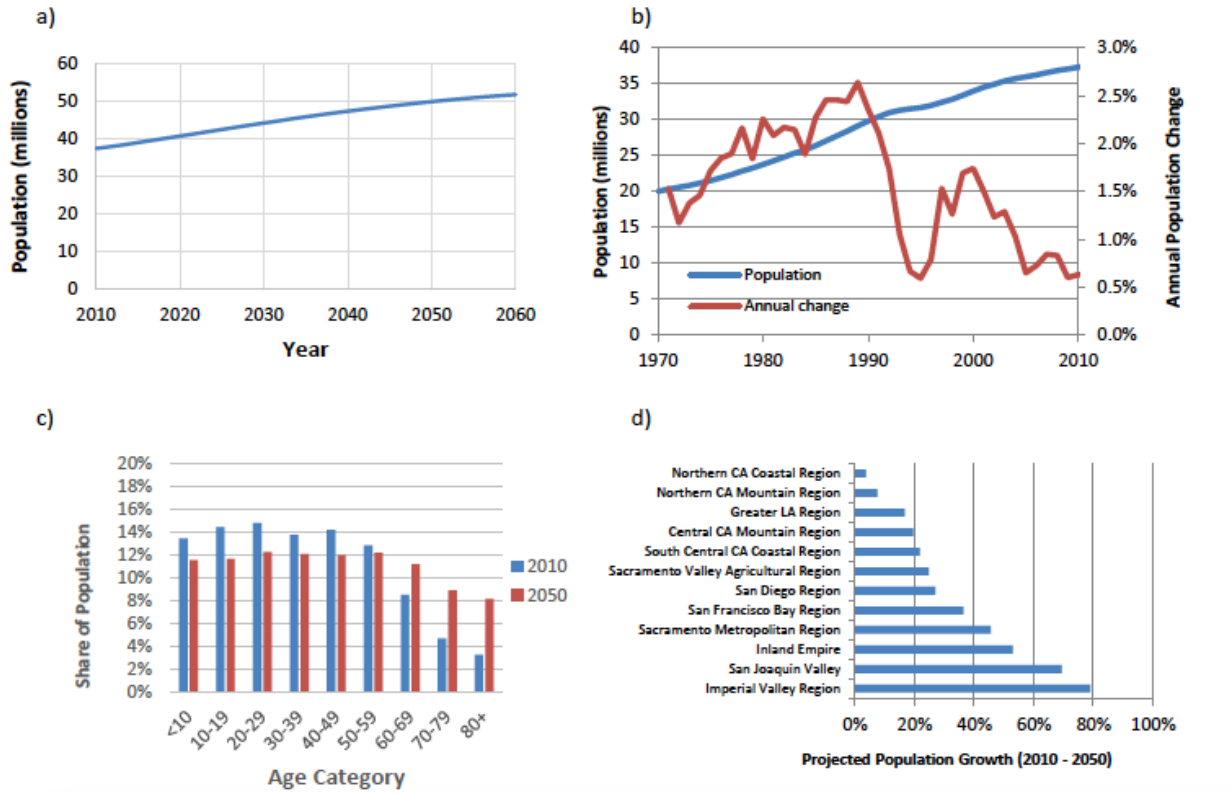
Map 4.C shows the ranges of additional dwelling units authorized by building permits. Most of the approved new units are in Southern California, the Bay Area, and the Sacramento area. Building codes and other state and local mitigation efforts assist in minimizing losses that this new development experiences from future disasters. With

climate change, however, increased severity of storms and prolonged droughts will increase vulnerability of this new development to flooding and wildfires.

Projected Growth Trends

By 2050, the population is expected to reach 50,365,074, roughly 12 million more people than presently live in California. As this growth occurs, California's age demographics are also projected to shift, with a greater percentage of the population 60 years of age or older.

Figure 4.A: California Population Projections

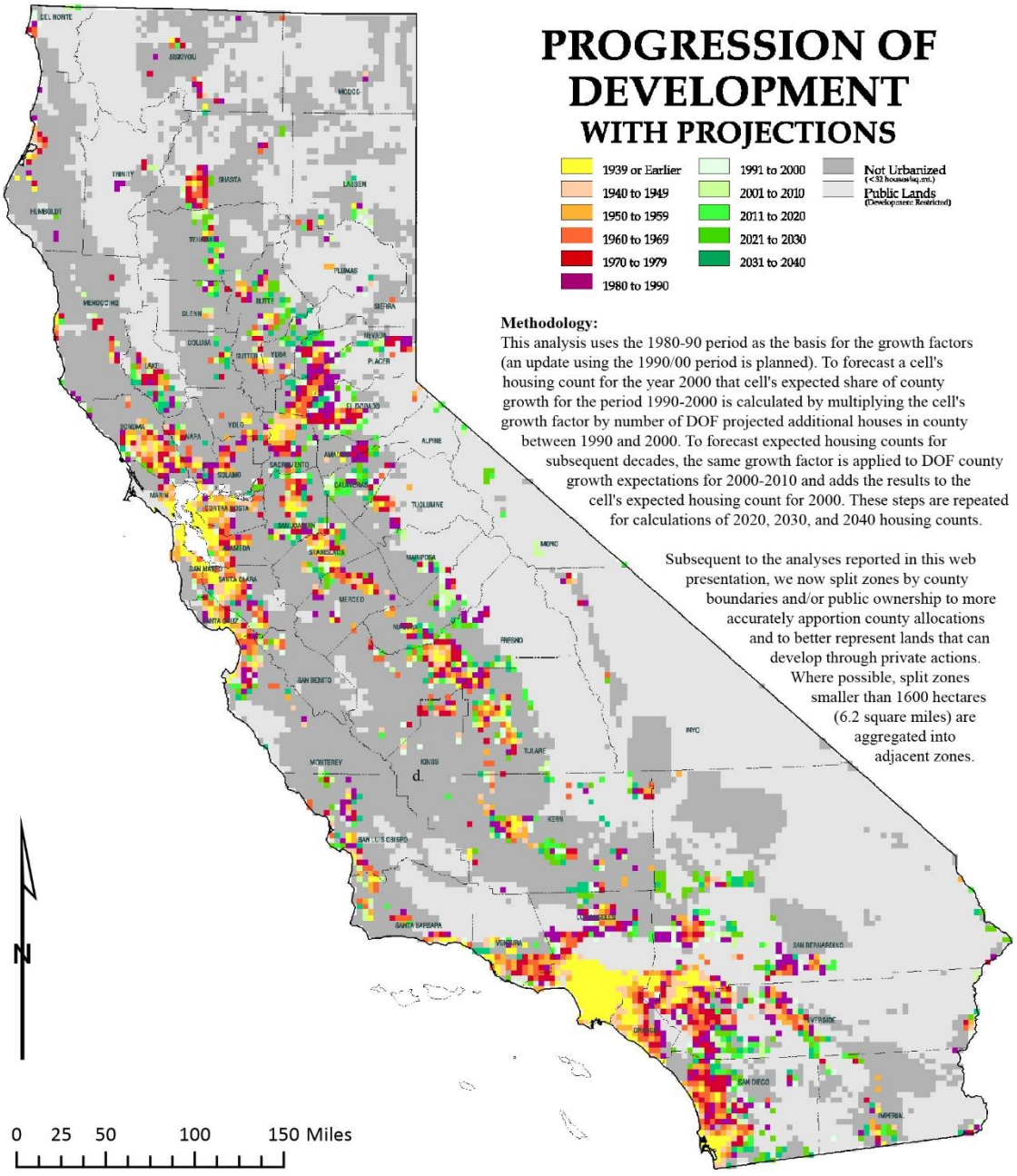


Source: A Strategy for California@50 Million, The Governor's Environmental Goals, and Policy Report, November 2015, http://opr.ca.gov/planning/environmental-goals/

Growth projections shown in Figure 4.A indicate a spatial shift from coastal development (mainly in Los Angeles, Orange, and San Diego Counties) to development inland, mainly in the Central Valley, the Imperial Valley, and the Inland Empire, located east of Los Angeles County. These are warmer and drier areas of the state, with available land for expansion. In order to address this growth, Governor Brown, in his inaugural address, set forth five pillars to support the long-term reduction of climate pollution, protect public health, and steward the state's natural resources to support resilience and other environmental benefits.[42] One of these five pillars is stewarding natural resources, including forests, working lands, and wetlands, to ensure that they store carbon, are resilient, and enhance other environmental benefits. This pillar establishes a basis for a "co-benefit approach" in which state investments may serve more than one purpose.

[42] The other pillars are:
1. Increasing the share of renewable energy in the state's energy mix to at least 50 percent by 2030;
2. Reducing petroleum use by up to 50 percent by 2030;
3. Increasing the energy efficiency of existing buildings by 50 percent by 2030;
4. Reducing emissions of short-lived climate pollutants.
Source: Supporting California's Climate Change Goals (November 2015) State of California Office of Planning and Research

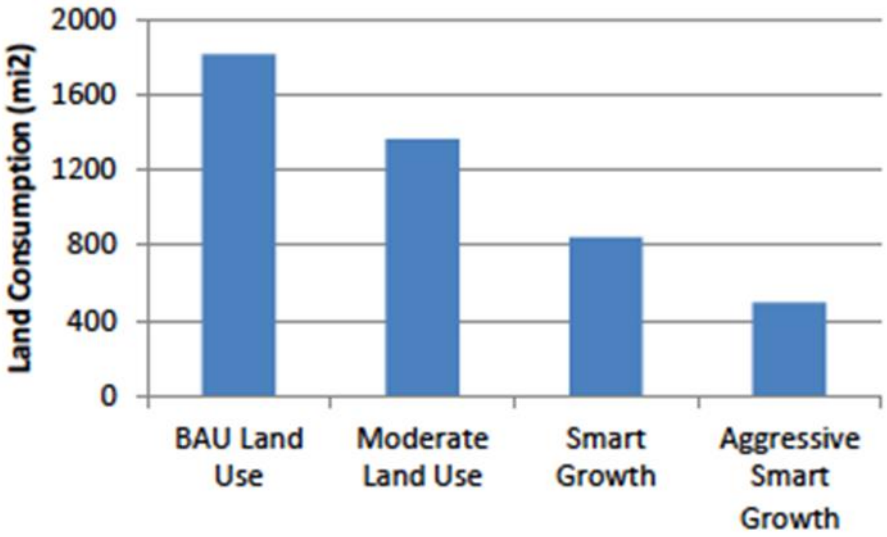
Map 4.D: California's Projection of Development Based on Historical Factors



For the purposes of projecting location of development in the next two decades, Map 4.D indicates a continued inland expansion, mostly occurring in the inland areas of the southern portion of the state and the Central Valley. Land use strategies promoted by the state and coordinated with local governments could affect the rate and location of development.

A major land use strategy to address residential and commercial growth is to pursue "aggressive smart growth." In Figure 4.B, where BAU means "Business As Usual", the amount of land required to accommodate growth is shown using four scenarios. As discussed in the Governor's 2015 Environmental Goals and Policy Report, close to 75 percent less land can be developed under aggressive smart growth policies compared to continuing traditional development patterns. Aggressive smart growth is the scenario yielding less environmental impact and a denser urban pattern (supported by transit services).

Figure 4.B: California Growth Scenarios



Source: State of California: A Strategy for California@50 Million, The Governor's Environmental Goals, and Policy Report. November 2015. Available online at: http://opr.ca.gov/planning/environmental-goals/

In support of "smarter growth" the California Strategic Growth Council has invested over $150 million to support sustainable community planning and urban greening.[43] The Strategic Growth Council is now investing over $100 million annually to support project implementation in the Affordable Housing and Sustainable Community Program, which is being funded with proceeds from Greenhouse Gas Reduction Fund. These efforts are examples of the "co-benefit approach" in action; saving more land supports environmental actions and will lead to a more compact overall urban pattern in the next 30 years.

Implications of Growth on Risk

Growth patterns have a direct bearing on the impacts of hazards, risk, and vulnerability. *Chapter 6* describes rapid growth in Southern California counties, including Los Angeles, Orange, Riverside, and San Bernardino, that has intensified high earthquake hazard exposure of large, vulnerable populations. The San Francisco Bay region constitutes nine counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma), and contains roughly 19 percent of California's population, making this region's earthquake and hazard vulnerability high. As noted in *Chapter 7*, Central Valley counties are highly vulnerable to flood hazards and, as noted in *Chapter 8*, the foothill and mountainous counties have high vulnerability to wildfire hazards. Inland counties are replacing coastal counties as the leading growth areas.

[43] The Council is comprised of agency secretaries from the California Business Consumer Services and Housing Agency (BCSH), California Health and Human Services (CHHS), California Environmental Protection Agency (CalEPA), California State Transportation Agency (CalSTA), the California Department of Food and Agriculture (CDFA) and the California Natural Resources Agency (CNRA); the director of the Governor's Office of Planning and Research (OPR); and three public members - one each appointed by the Governor, Senate Committee on Rules, and Speaker of the Assembly. Its mission is to coordinate the activities of State agencies and partners with stakeholders to promote sustainability, economic prosperity, and quality of life for all Californians.

Table 4.E compares residential permits by county for 2013 and 2016, demonstrating percentage of growth in the top 15 counties listed. As seen in the table, the top three counties in terms of residential growth remained the same in ranking between 2013 and 2016, while there were slight adjustments in the ranking of other counties. Overall, Southern California and the San Francisco Bay Area counties saw the most residential growth in the state.

Table 4.E: Residential Permits by County, 2013 and 2016

County	Permits Issued 2013	2013 Rank	County	Permits Issued 2016	2016 Rank
Los Angeles	16,895	1	Los Angeles	20,339	1
Orange	10,453	2	Orange	12,157	2
San Diego	8,382	3	San Diego	10,100	3
Santa Clara	7,868	4	Riverside	6,506	4
Riverside	6,220	5	Santa Clara	5,367	5
San Francisco	5,277	6	Alameda	5,277	6
Alameda	3,362	7	San Francisco	4,207	7
San Bernardino	3,313	8	San Bernardino	3,765	8
Fresno	3,083	9	Sacramento	3,285	9
Kern	2,472	10	Contra Costa	2,896	10
Contra Costa	1,955	11	Fresno	2,881	11
Sacramento	1,909	12	Placer	2,418	12
Placer	1,476	13	San Joaquin	2,300	13
San Mateo	1,190	14	Kern	2,247	14
San Joaquin	1,136	15	San Mateo	1,754	15
Total	*74,991*		*Total*	*85,499*	
Percent of State	*88%*		*Percent of State*	*85%*	
California Total	**85,472**			**100,658**	

Source: CIRB (Construction Industry Research Board)

Most growth illustrated by residential permit issuance in California has taken place largely in three clusters: the Southern California region, the San Francisco Bay area, and the Sacramento-Delta region. The top 15 counties in these regions, with permit issuance rates at over 1,000 per year, represented approximately 88 percent of growth in the state and accounted for significant physical growth in the state.

This information, when compared with Map 4.G (State and Federal Declared Disasters) later in this chapter, indicates that a substantial amount of growth has occurred in areas that have a significant disaster history. Specifically, in Los Angeles, San Bernardino, and Riverside Counties, there are high rates of disaster declarations alongside physical growth and urban development. This trend illustrates increased disaster risks for populations in these counties.

While earthquake risk in California is a concern, the California Residential Mitigation Program, California Earthquake Authority's Brace + Bolt Program, and State Building Standards have increased physical and community resiliency to earthquake damage in these growth areas and across the state. Hazards of greater concern based on growth areas are flooding (particularly coastal flooding) and wildfire risk, with increased frequency of risks due to a changing climate. California will work to implement mitigation and adaptation strategies in the areas that have seen increased development between 2012 and 2016.

An important objective of future land use planning is to include the consideration of the effects of climate change on fire risk and other aspects of public safety. In anticipation of continued population growth in the state's wildland-urban interface areas and uncertainties related to climate change, public safety impacts from more frequent, intense wildfires will be addressed through strategic planning at both the local level (where building permits are issued) and the regional scale. An example of new local co-benefit action is the "Build Forward" effort in the City of Los Angeles, the aim of which is to encourage buildings of all types to integrate advancements and innovations in design,

engineering, and construction, and to take full advantage of the buildings' ability to improve the environment. Through this effort, buildings become part of the solution to achieve a safer city.

Additionally, the policies the California Department of Housing and Community Development (HCD) creates are in response to California's current housing challenges. Those challenges include:

- *Not enough housing being built*: During the last ten years, housing production averaged fewer than 80,000 new homes each year, and ongoing production continues to fall far below the projected need of 180,000 additional homes annually.
- *Increased inequality and lack of opportunities*: Lack of supply and rising costs are compounding growing inequality and limiting advancement opportunities for younger Californians. Without intervention, much of the new housing growth is expected to be focused in areas where fewer jobs are available to the families that live there.
- *Too much of people's incomes going toward rent*: The majority of Californian renters—more than 3 million households—pay more than 30 percent of their income toward rent, and nearly one-third—more than 1.5 million households—pay more than 50 percent of their income toward rent.
- *Fewer people becoming homeowners*: Overall homeownership rates are at their lowest since the 1940s.
- *Disproportionate number of Californians experiencing homelessness*: California is home to 12 percent of the nation's population, but a disproportionate 22 percent of the nation's homeless population.
- *Many people facing multiple, seemingly insurmountable barriers—beyond just cost—in trying to find an affordable place to live*: For California's vulnerable populations, discrimination and inadequate accommodations for people with disabilities are worsening housing cost and affordability challenges.

While the state's housing challenges appear overwhelming, California's housing crisis is a solvable issue. With focus and continued support, California can begin to reverse the course. Housing affordability and homelessness have far-reaching impacts that affect other important issues facing Californians, including health, education, transportation, economic well-being, and climate change. Land-use policies and planning are more than just tools to increase housing affordability. These processes also drive the type and location of housing, which can translate into the ability for families to live in neighborhoods of opportunity, where children can attend higher-performing schools, where there is a greater availability of jobs that afford entry to the middle-class, and where people have convenient access to transit and services.

As California works to ensure equity and reduce greenhouse gases, the focus has turned to more compact development that reduces sprawl (and many of its negative environmental and health consequences); however, targeting development to specific areas can put pressure on limited land and result in higher costs for a variety of reasons (infrastructure limitations, demand for limited land, etc.). The true costs of sprawl are much higher when taking into account health impacts, environmental damage, and lost productivity, but these costs are often "hidden" from housing prices.

4.1.3 NATURAL ENVIRONMENT

Geography

California has the third largest land area among the nation's 50 states, with roughly 163,695 square miles. Its location and physical configuration make it vulnerable to many different hazards. For example, the state has over 1,100 miles of coastline, and is home to several major coastal cities—including San Francisco, Los Angeles, and San Diego—that are prone to flooding, tsunamis, and rising sea-levels. Associated with much of the coastline are the northern and central coastal mountain ranges, which have rugged terrain.

A key inland feature is the Central Valley, a fertile valley bounded by the coastal mountain ranges to the west, the Sierra Nevada to the east, the Cascade Range to the north, and the Tehachapi Mountains to the south. It contains 11 percent of the state's land mass, and has 18 counties (ten in the northern Sacramento Valley and eight in the southern San Joaquin Valley). Mountain-fed rivers irrigate the Central Valley. With dredging, a number of these

rivers have become sufficiently large and deep that several inland cities, most notably Stockton, are harbor communities that can dock ocean-going vessels.

The Sierra Nevada range runs much of the length of California's eastern border. Located in the Sierra Nevada are Mount Whitney, the highest peak in the continental U.S. at 14,494 feet[44]; Yosemite National Park; and Lake Tahoe. To the east of the Sierra are the Owens Valley and Mono Lake, which are environmentally significant as habitat essential to birds. The south portion of the state has the Transverse Ranges, one of the few east-west trending ranges in the country; the Mojave Desert; and Death Valley, which contains the lowest point in North America (282 feet below sea-level) and has the hottest recorded temperature in the U.S. (134 degrees, on July 10, 1913).

Geology and Seismicity

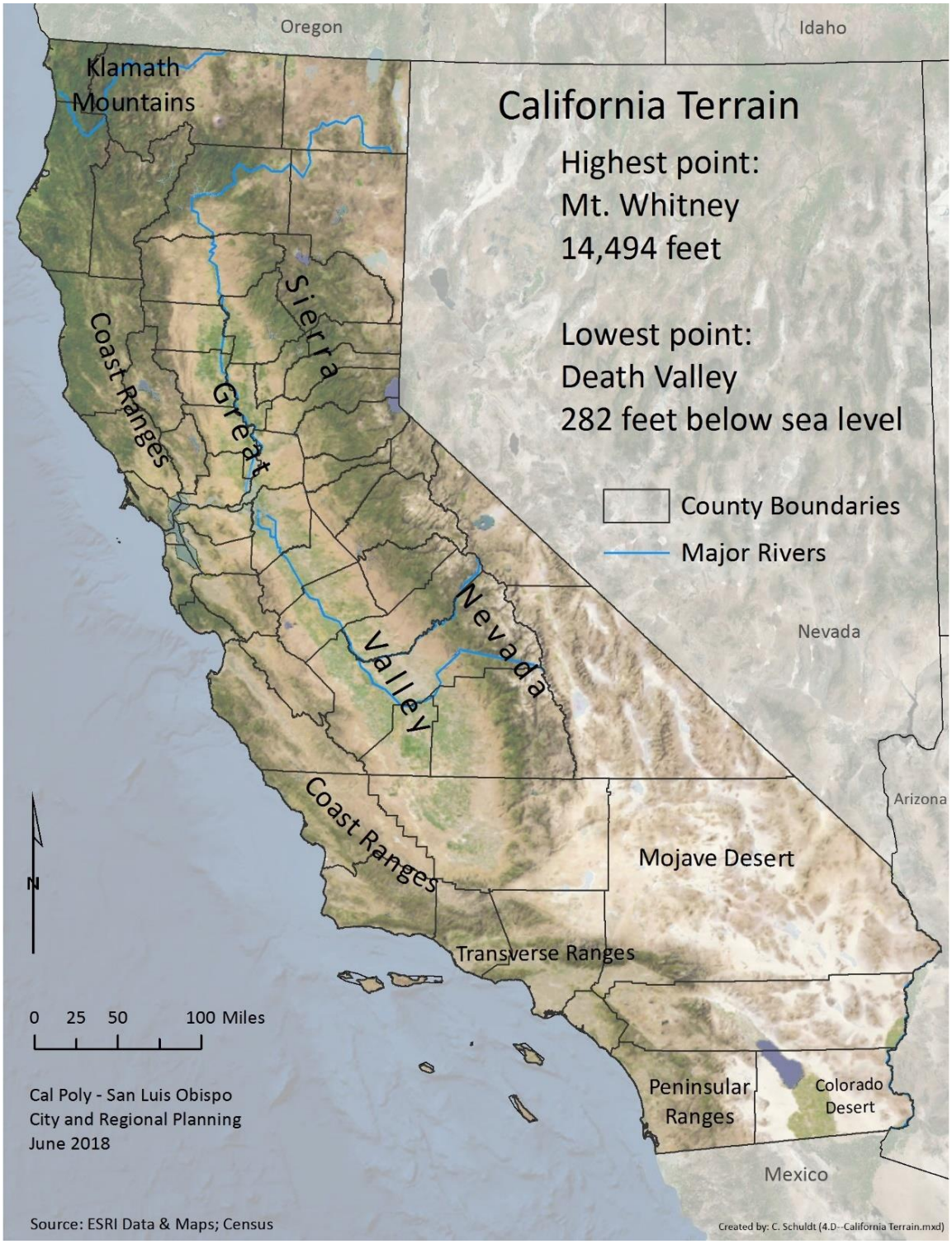
California has extensive seismic activity. While Alaska experiences the greatest number of large earthquakes, most located in remote and uninhabited areas, California experiences the most *damaging* earthquakes[45] because of its greater population and extensive infrastructure. According to the Federal Emergency Management Agency (FEMA) 2017 Estimated Annualized Earthquake Losses for the United States, 61 percent ($3.7 billion) of the country's overall expected annualized losses are concentrated in California alone, consistent with the state's population and building inventory exposed to earthquake hazard.[46] Earthquakes have claimed the lives of more than 3,000 Californians in the past two centuries.

Not only is California more seismically active than all other states except Alaska and Oklahoma, but it also has more than two-thirds of the nation's earthquake risk, according to the California Earthquake Authority. Alaska registers the most earthquakes in a given year, with California placing second until 2014, when a sudden increase in seismicity in Oklahoma pushed it well past California as the second most active in terms of magnitude 3.0 or greater earthquakes. In 2014, there were 585 magnitude 3.0 or greater earthquakes in Oklahoma and about 200 in California. As of April 2015, Oklahoma was still well ahead of California with 260 events compared to California's 29 events.[47]

California sits at the juncture of two major tectonic plates, the North America Plate and the Pacific Plate. The San Andreas Fault generally parallels the coast in a southeasterly direction, coming ashore near Eureka, passing west of San Francisco and east of Los Angeles into Mexico.

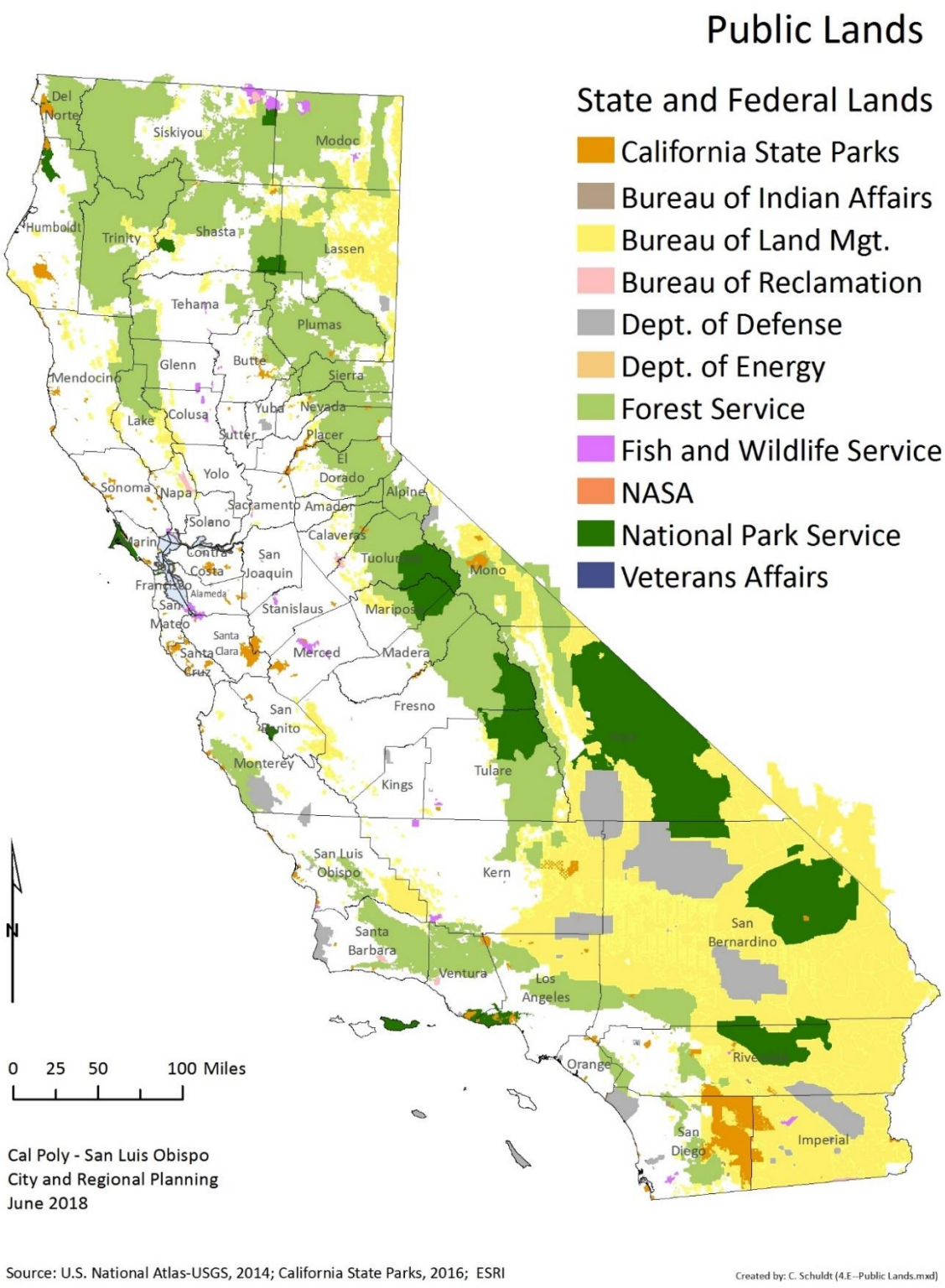
[44] https://www.nps.gov/seki/planyourvisit/whitney.htm
[45] FEMA Earthquake Fast Facts. https://www.fema.gov/earthquake
[46] Hazus Estimated Annualized Earthquake Losses for the United States: FEMA P-336, April 2017. https://www.fema.gov/media-library-data/1497362829336-7831a863fd9c5490379b28409d541efe/FEMAP-366_2017.pdf
[47] https://earthquake.usgs.gov/learn/topics/megaqk_facts_fantasy.php

Map 4.E: California Terrain



Map 4.E shows the general topography of California, including 1,100 miles of coastline from Oregon to Mexico. The Central Valley, labeled as "Great Valley" on the map, is a major topographic feature; the valley collects major river run-off from the Sierra Nevada Range and channels it though the Delta to San Francisco Bay and out to the Pacific Ocean.

Map 4.F: California Public Lands



Map 4.F shows that most state and federal public land holdings are in mountainous regions of the state. Hazards originating on these public lands can affect nearby communities and infrastructure within the area.

The San Andreas Fault is not the only significant fault/plate boundary in California. The seismicity north of the Cape Mendocino is controlled by faults associated with the Cascadia Subduction Zone, a large fault system offshore that separates the Juan de Fuca Plate to the west and the North American Plate to the east. This area is the most seismically active portion of the state.

Watersheds and Terrain

The Sacramento and San Joaquin Rivers and their tributaries, which drain the Central Valley, form California's principal river systems. On average, the state receives about 200 million acre-feet of water per year in the form of rain and snow. In reality, the average rarely occurs, as California has the most variable weather conditions in the nation and climate change may increase the variability.[48]

The Sacramento River, the longest river in the state, flows south for 377 miles to its junction with the San Joaquin River. The Sacramento and San Joaquin Rivers unite to form a large inland delta that drains into Suisun Bay, the eastern arm of San Francisco Bay. Development vulnerable to flooding continues to occur in floodplains associated with this extensive network of rivers.

Coastline

California has 1,100 miles of general coastline encompassing beaches, rocky cliffs, harbors, and estuaries, as well as coastal communities that range from metropolitan cities to rural towns.[49] California's ocean and coast are among its most valuable assets, including diverse and highly productive ecosystems with abundant wildlife, the state's marine fisheries, and many recreational opportunities.

Public Lands

Map 4.F shows California's major public land areas. The largest category is U.S. Forest Service land, which covers over 22 million acres (as of 2014). Other major public holdings include those of the Bureau of Land Management and National Park Service. Collectively, federally owned land in California totals 45,864,800 acres, while state-owned land totals 100,206,720 acres. Forest and rangelands in and near these public holdings are subject to wildfire risk, which is increasing due to climate change.

Ecosystems

According to the California Climate Adaptation Strategy, California is one of the most biologically diverse regions of the world, with the most unique plant and animal species and greatest number of endangered species among all 50 states. Its wide biodiversity stems from its varied climate and assorted landscapes. Ecological communities include coastal ranges, coastal dunes, wetlands, kelp forests, rivers, lakes, streams, deserts, grasslands, chaparral, and inland, forested mountains among others. The vast number of endemic species here, combined with high level of threats to their persistence, makes California one of 25 biodiversity "hotspots" on earth.[50]

[48] California Water Action Plan 2016 Update
[49] http://www.opc.ca.gov/2010/11/the-california-shoreline-mapping-project/
[50] Stein, Bruce A., Lynn S. Kutner, and Jonathan S. Adams (eds., 2000). Precious Heritage: The Status of Biodiversity in the United States. Oxford, UK: Oxford University Press.

4.2 CALIFORNIA'S DISASTER HISTORY

Federal regulations require each state to undertake a risk assessment of the hazards and vulnerabilities that affect it in order to provide a factual basis for developing a hazard mitigation strategy.

The following analysis of California's disaster history provides a foundation for the risk assessment found in *Chapters 6 through 9*. Together those chapters identify emerging hazard, vulnerability, and risk issues, linking them to mitigation strategies and actions.

For a more detailed account of the state's disaster history from 1950 to present, see *Appendix E, California Disaster History*.

4.2.1 STATEWIDE DISASTER LOSS FINDINGS

Over the past six decades, disasters and corresponding losses have grown rapidly as has California's population. Table 4.F shows overall increases in state emergency proclamations and federal disaster declarations from 1950 through 2017.

The table also shows casualties and Cal OES-administered disaster costs by decade. These casualties and costs peaked in the 1990s due to the 1994 Northridge Earthquake. Figures for deaths and injuries are partial for the periods 2000-2009 and 2010-2017, and are based on best available data.

Table 4.F: Disasters and Losses by Time Phase, 1950 – 2017

Year	State Emergency Proclamations [a]	Federal Disaster Declarations [a]	Deaths [b,d]	Injuries [b]	Cal OES-Administered Costs [b, c]
1950 – 1959	8	3	100	227	$332,283,000
1960 – 1969	32	12	99	1,224	$706,931,196
1970 – 1979	60	18	96	2,226	$4,197,670,330
1980 – 1989	60	23	128	5,243	$3,342,205,537
1990 – 1999	48	19	224	15,592	$9,245,038,369
2000 – 2009	63	101	59	885	$1,845,112,390
2010 – 2017	52	91	92	27	$1,120,667,471
Total	**323**	**267**	**798**	**25,424**	**$20,789,908,293**

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

[a] Through 2017.

[b] Information from 2000-2017 remains preliminary based on Incident Command System (ICS) Reporting and Cal OES After Action Reviews

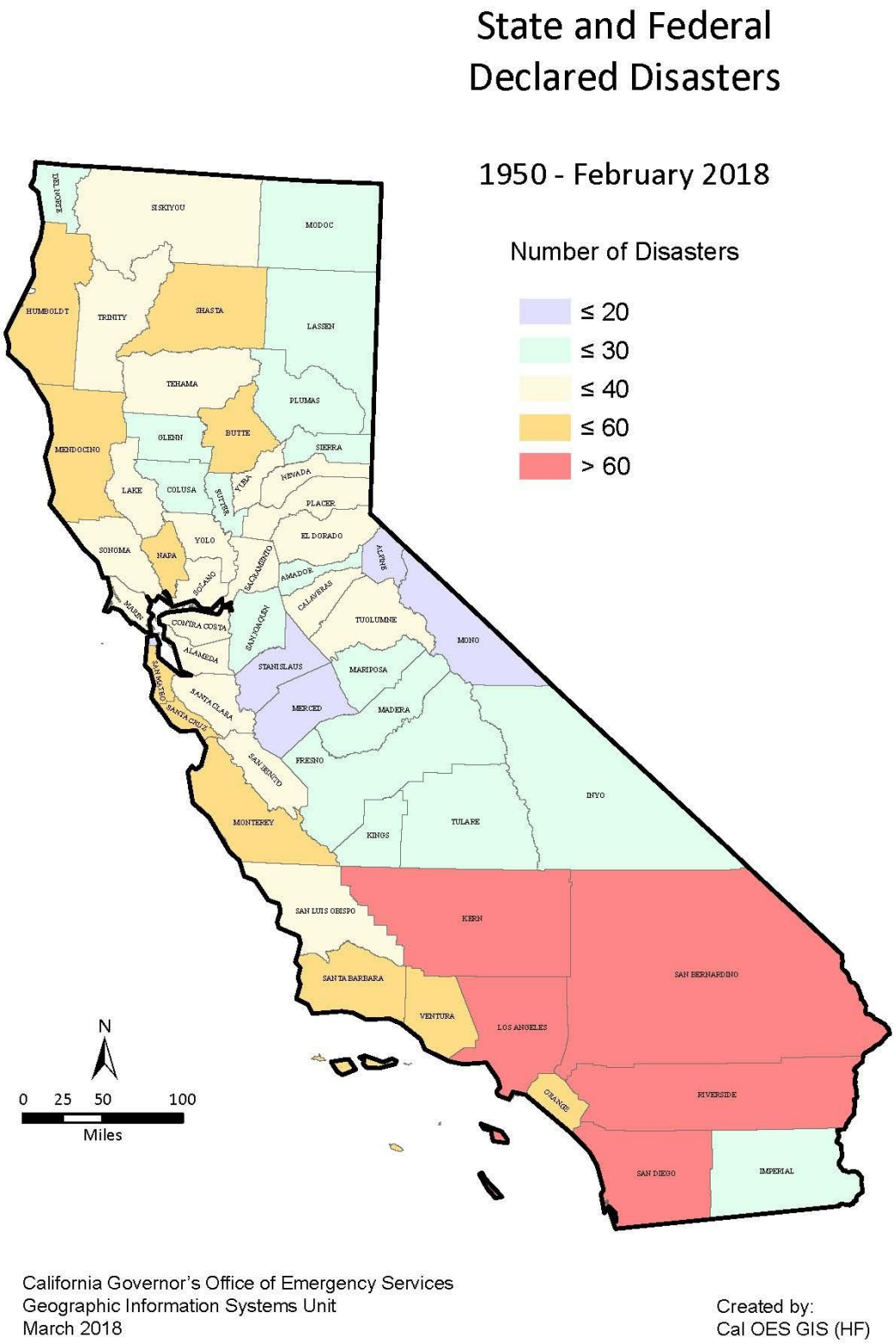
[c] Figures in this column show only certain post-disaster recovery costs, such as Individual and Public Assistance grants, which together reflect only a portion of total disaster costs. Disaster costs reflect actual estimates at the time of incidents not adjusted for inflation through normal means such as applying the Consumer Price Index to get equivalent values.

[d] Information from the California Department of Forestry and Fire Protection (CAL FIRE): http://cdfdata.fire.ca.gov/incidents/incidents_statsevents

As discussed in *Chapter 3*, California's leading mitigation goal is to significantly reduce life loss and injuries. Table 4.G provides an overall perspective on life loss and injury in relation to population growth for the period from 1950 to 2017.

California's population more than tripled from 1950 to 2017, while numbers of deaths resulting from disasters remained within a relatively narrow range. Injuries have varied more widely. Over 11,000 injuries during the 1990s were due to the Northridge Earthquake.

Map 4.G: State and Federal Declared Disasters, 1950-February 2018



Map 4.G shows the pattern of California disasters since 1950. The largest numbers have occurred in Southern California in the state's most heavily populated counties.

Table 4.G: Population and Disaster Deaths and Injuries by Time Phase, 1950 – 2017

Year	State Population Beginning of Decade	Deaths	Injuries
1950 – 1959	10,586,000	100	227
1960 – 1969	15,717,000	99	1,224
1970 – 1979	19,953,000	96	2,226
1980 – 1989	23,668,000	128	5,243
1990 – 1999	29,760,000	224	15,592
2000 – 2009	33,872,000	59	885
2010 – 2017	37,253,956	92[a]	27

Source: California Governor's Office of Emergency Services (Cal OES) database. At the time of this writing, information for "Deaths," and "Injuries," from 2000-2017 remains preliminary based on Incident Command System (ICS) Reporting and After Action Reviews; population from Counting California, UC Libraries

[a] Information from the California Department of Forestry and Fire Protection (CAL FIRE): http://cdfdata.fire.ca.gov/incidents/incidents_statsevents

Table 4.H: Declared or Proclaimed Disaster Incidents, Casualties, and Cost by Type, 1950 – 2017

Disaster Type Per Federal Emergency Management Agency (FEMA)	Declared/ Proclaimed Emergencies Through 2017*	State Emergency Proclamations Though 2017	Federal Disaster Declarations Though 2017	Deaths Through 2017**	Cal OES-Administered Costs Though 2017**
Fire	287	96	191	209[a]	$3,363,404,368
Flood	168	118	50	302	$4,723,407,152
Earthquake	35	22	13	193	$8,144,903,796
Agricultural	18	17	0	0	$389,895,974
Freeze	9	8	4	0	$1,017,890,620
Landslide	9	8	1	24	$126,172,037
Civil Unrest	6	6	1	85	$167,722,732
Drought	9	9	0	0	$2,722,036,634
Hazardous Material	5	3	0	0	0
Wind	3	3	0	0	$82,100
Tsunami	3	3	2	13	$49,617,379
Invasive Species	1	1	0	0	0
Storms	13	9	1	0	$74,115,181
Tornado	1	1	0	0	0
Other	5	5	1	0	$10,660,320
Total	***572***	***309***	***264***	***826***	***$20,789,908,293***

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

**Any event not included in the state proclamation or federal declaration column may be included as a local emergency proclamation.*

***Death and injury estimates from 2003-2017 based on Incident Command System Reports and After Action Reviews. Administered Costs include obligated, but unspent expenditures in the case the incident remains open for Individual and Public Assistance grants. Any additional death information was provided by Cal OES Law Enforcement Branch*

[a] Information from the California Department of Forestry and Fire Protection (CAL FIRE): http://cdfdata.fire.ca.gov/incidents/incidents_statsevents

Table 4.H identifies disaster incidents, casualties, and Cal OES costs by type. This table does not take into account the cost of losses to natural or green infrastructure. Cal OES revised the database from which these summary tables were drawn during the preparation of the 2013 State Hazard Mitigation Plan (SHMP) in an effort to continuously improve disaster history data. At the time of this writing, "Deaths," and "Injuries" information for 2000-2012 remains preliminary based on Incident Command System (ICS) Reporting and After Action Reviews. These figures will be updated when data are available. For a detailed account of the data in the preceding tables, see *Appendix E: California Disaster History*.

Need for Accurate Disaster Loss Data

The preceding disaster summary tables reflect the challenge of providing an accurate analysis of California's true long-term patterns of losses by disaster. Disaster loss databases vary widely in how data are compiled, how loss topics are defined, how data are updated, and what is included. Because no single source provides all needed data, data from such databases need to be used carefully. To compile these tables, data are pulled from various sources, as such best efforts are made to maintain consistency of the data.

It is important to recognize that monetary loss data are limited to costs of federal grant programs administered by Cal OES, such as Individual and Household Assistance, Public Assistance, and Flood Mitigation Assistance grants, and thus are inadequate to reflect the true magnitude of losses experienced in these events. It is clear from this data management challenge that there is a need for a nationwide natural hazard loss database that would provide a comprehensive clearinghouse for disaster loss information by hazard type.[51]

4.2.2 PRIMARY SOURCES OF DISASTER LOSSES

Table 4.H, which shows the pattern of emergencies, disasters, and associated losses by hazard types since 1950, when coupled with seismic knowledge, suggests the following findings:

1. Earthquakes occur less frequently than the other primary hazards causing disasters but account for the greatest combined losses (deaths, injuries, and damage costs).
2. Floods are the second most frequent disaster source and account for the second highest combined losses.
3. Wildfires are the most frequent source of declared disasters and account for the third highest combined losses.
4. Earthquake costs exceeded wildfire costs by four times, using limited measures identified in these tables.
5. Although floods have resulted in a greater number of total deaths during this period, earthquakes have accounted for the highest number of combined deaths and injuries.
6. Earthquakes represent by far the greatest long-term catastrophic disaster threat.

From this analysis, it is clear that three hazards—earthquakes, fires, and floods—are predominant among the sources of disaster since 1950. Therefore, they are referred to in this risk assessment as "primary hazards." Such findings also reflect the basis for past preparation of hazard-specific statewide mitigation plans for each primary hazard, and direct attention to primary hazards risk assessments and mitigation measures identified in *Chapters 6 through 8*.

Earthquake hazard mitigation is particularly relevant to SHMP Goal 1 (Significantly reduce life loss and injuries) and SHMP Goal 2 (Minimize damage to structures and property), set forth in *Chapter 3*. In light of both the social and economic disruption caused by moderate-sized earthquakes, together with the significant potential for catastrophic disasters posed by earthquakes far greater in magnitude than those experienced since 1950, heightened attention is needed to mitigation strategies relating to this particular hazard.

4.2.3 CATASTROPHIC VULNERABILITIES

Overview

The widespread impact of a catastrophe makes it one of the most important topics in emergency management today. Characteristics of the precipitating event will severely aggravate the response strategy and further tax the capabilities and resources available to the area. Lifesaving support from outside the area will be required, and time is of the essence. The event will likely have long-term impacts within the incident area as well as on the state, and to a lesser extent the nation.

[51] Gall, Melanie, Kevin A. Borden, and Susan L. Cutter. "When Do Losses Count? Six Fallacies of Natural Hazard Loss Data." 2009. American Meteorological Society 90(6). 2009. 799.

Catastrophic events can either be fast-moving, such as an earthquake events or in some areas hurricanes, or slow-moving, such as progressive drought events that unfold and deepen over a number of years. A fast-moving catastrophic incident is defined by a sudden event, which results in tens of thousands of casualties and tens of thousands of evacuees; response capabilities and resources of the state and local jurisdictions will be overwhelmed. In the past, California has been faced largely with fast-moving events such as earthquakes and fires. However, slow-moving droughts and climate-related conditions such as sea-level rise are now thought to have the potential to develop into catastrophic-level events in California.

Recent geologic studies suggest that a megaquake could rupture the San Andreas Fault which runs through major urban areas in Los Angeles, Riverside, and San Bernardino Counties. An earthquake of magnitude 8.0 or greater in densely populated areas of Southern California would result in catastrophic destruction.

The 7.8 magnitude Shakeout2 Full Scenario, updated in 2015 with the "Ardentsentry2015 Scenario" depicted in Map 4.H, was developed by the U.S. Geological Survey (USGS) and California Geological Survey (CGS) for catastrophic event planning purposes. This scenario shows that the greatest intensity shaking would occur under densely populated areas of Southern California. Analysis of the Shakeout scenario by USGS and CGS concluded that while mitigation investments in bridges and the electrical grid will allow for a quicker restoration of some functions, there is significant vulnerability in the water conveyance system where pipes and other components cross or are located close to the San Andreas Fault. Major damage to the water system could leave the most affected areas without running water for six months.[52]

A catastrophic earthquake along the San Andreas Fault System will affect water utilities, causing failed pipelines, interrupted sources of supply, damaged facilities (e.g., water treatment plants) and ultimately loss of service. Many cities have performed earthquake seismic and supply redundancy upgrades, but up to 25 percent of households could experience intermittent water supply (or no water, 90 days post-earthquake).

Earthquake effects on the power grid can include damage to transmission lines, both – underground (which are challenging to repair) and above ground, as well as distribution stations (creating the potential for rotating outages). Timely restoration of an affected power grid is determined by several variables, but access to the affected site(s) is seen as one of the most urgent response concerns. Power restoration estimates for some major cities along the San Andreas Fault System are 25 percent within 48 hours, 95 percent within one week, and 100 percent within one month.

Another example of catastrophic vulnerability is the increase in intensity, magnitude, and frequency of fires in California. In the last five years, the state has endured four of the largest wildfires and eight of the most destructive wildfires in the state's history.[53] These events occurred at the same time that other states and countries also experienced disastrous fires, seriously stretching thin and exhausting California's robust fire and rescue mutual aid system. The state's vulnerability to additional catastrophic fire disaster events has substantially increased as a result of state's recent five-year drought (2012-2017) along with associated water shortages (the years 2012-2015 had driest four-year statewide precipitation totals on record [54]), and significant tree mortality (including the die-off of 129 million trees between 2010 and 2017[55]). Additional information regarding wildfire, drought, and tree mortality hazards can be found in *Chapters 8 and 9*.

Need for Mitigation Focus on Potential Catastrophic Events

Since much of the state's population growth in the past 67 years has been in counties with high hazard exposure, these figures ongoing mitigation investments have clearly helped limit what might otherwise have been higher loss totals from more common, small, and moderate-sized disasters. It is important to recognize, however, that during this period there have been no catastrophic events like the 1906 San Francisco Earthquake. Catastrophic events are

[52] The ShakeOut Scenario, USGS Open File Report 2008-1150, Version 1.0, 2008
[53] http://cdfdata.fire.ca.gov/incidents/incidents_statsevents
[54] https://www.water.ca.gov/LegacyFiles/waterconditions/docs/a3065_Drought_8page_v9_FINALsm.pdf
[55] USFS Tree Mortality Team/CAL FIRE News Release, December 12, 2017; https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd566303.pdf

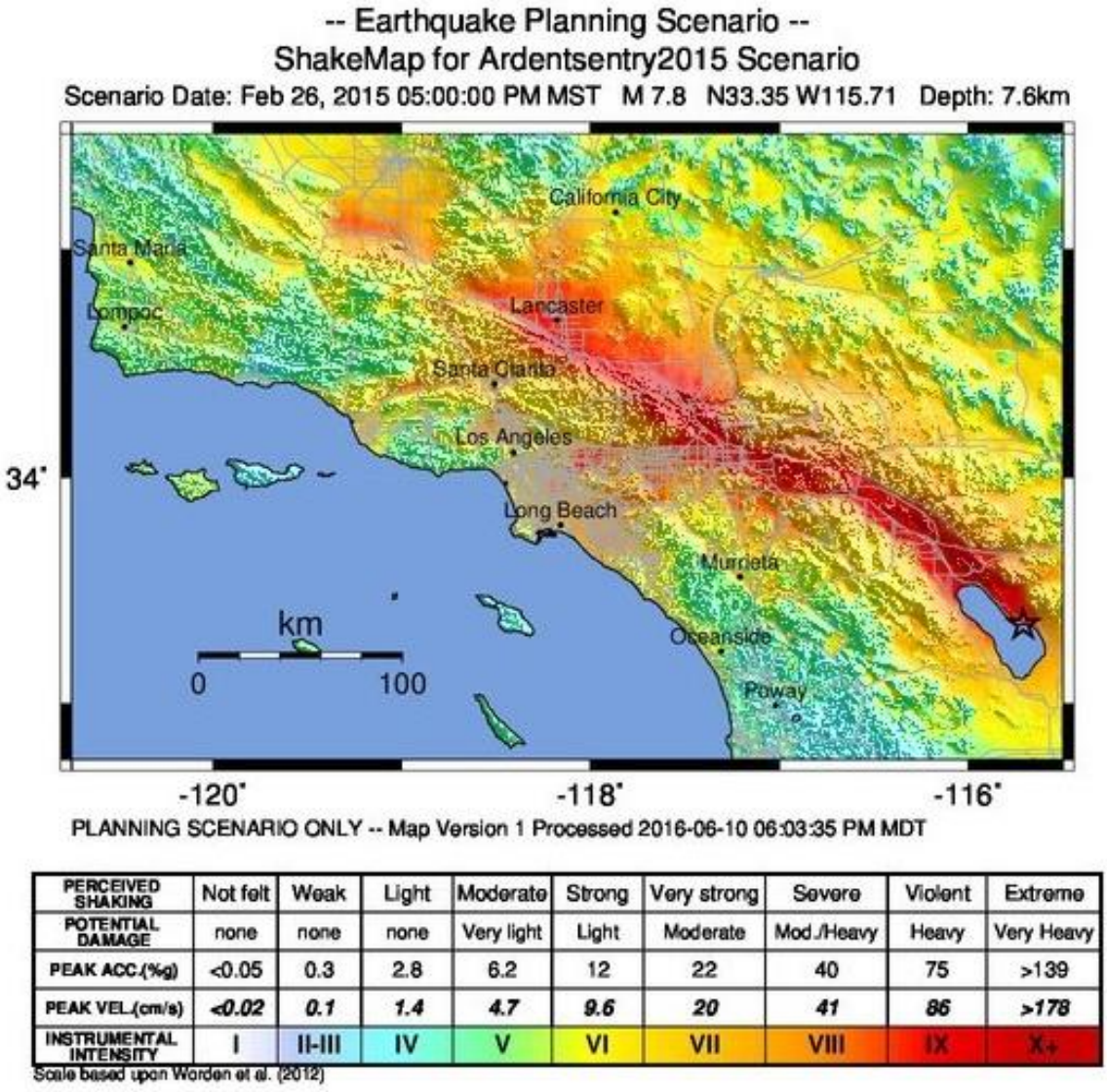
expected on longer time cycles than the many more "routine" disasters reported above. Thus, a major focus of mitigation efforts should be on the question of how to reduce losses from future catastrophic events.

Cal OES' Catastrophic Planning Division facilitates planning efforts to address and coordinate response to potential catastrophic events through development of joint local, state, and federal catastrophic event response plans including the following:

- Bay Area Earthquake Plan
- Southern California Catastrophic Earthquake Response Plan
- Cascadia Subduction Zone – Earthquake and Tsunami Response Plan
- Northern California Catastrophic Flood Response Plan

These catastrophic planning efforts help to prepare the state to respond to various catastrophic events, but only prevention and mitigation efforts and activities will help the state become more resilient to and recover faster from disasters.

Map 4.H: USGS ShakeMap for Ardentsentry2015 Scenario 7.8 Magnitude Earthquake



Source: U.S. Geologic Survey Earthquake Hazards Program

4.3 RISK FACTOR: CLIMATE CHANGE

An increasingly important factor affecting all four disaster management functions is climate change caused by increases in greenhouse gas (GHG) concentrations. Climate change reflects new uncertainties and factors shaping and conditioning hazard mitigation planning. It is addressed in this chapter as a factor intensifying impacts of many natural hazards described in *Chapters 6 through 9*.

California is already experiencing the impacts of climate change including prolonged drought, increased coastal flooding and erosion, and tree mortality.[56,57] The state has also seen increased average temperatures, more extreme heat days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year. In addition to changes in average temperatures, sea-level, and precipitation patterns, the intensity of extreme weather events is also changing. Extreme weather events and resulting hazards, such as heat waves, wildfires, droughts, and floods, are already being experienced.[58]

Climate change not only results in progressive change such as shifting seasonal weather patterns, but also affects the frequency and severity of hazard events. For example, in 2015 there were 1,800 more wildfires than average.[59] Wildfire events are becoming less predictable and more catastrophic; they are occurring in months not previously considered as typical fire season months, and with larger conflagration size and more resulting damage.

This section summarizes the way climate change influences hazard events and describes the manner in which it is addressed in the SHMP.

In order to address these changes, the State of California has developed a variety of laws, policies, and programs to both mitigate (or reduce) the emission of greenhouse gases into the atmosphere and adapt to the changes that will take place. (For further discussion on these laws, policies, and programs, see *Sections 4.3.5* and *4.3.*6.)

In the following sections, climate change and projected outcomes related to hazard probability are described, relevant state laws and policies are explained, preliminary strategies for addressing climate change are outlined, and principles for incorporating climate change into state, local, and regional hazard mitigation planning are identified.

4.3.1 WHAT IS CLIMATE CHANGE?

Climate change refers to changes in conditions that result from increased atmospheric greenhouse gas (GHG) concentrations. Monthly mean GHG levels now exceed 400 parts per million (ppm) for the first time in recorded history.[60] This GHG increase is linked to an increase in average global temperature. These global temperature and GHG increases are resulting in a series of changes to the global climate: shifts in seasonal temperature patterns; altered precipitation timing, amount, and location; sea-level rise; ocean acidification due to increased carbon dioxide (CO_2) absorption; and altered wind and storm event frequency, severity, and location. These climate change outcomes interact, and their potential consequences are the result not only of the shifts in global climate but the variety of characteristics that define biophysical systems and human development.

GHGs stay in the atmosphere for varying periods of time, from just over a decade to hundreds—and even thousands—of years.[61] In recent decades, communities all over the world have begun to curb GHG emissions. Despite these efforts, communities are experiencing the outcomes of emissions that occurred many decades in the past. In 2015, global CO_2 emissions from fossil fuel combustion and other industrial processes were estimated 36

[56] California Natural Resources Agency. Draft Report Safeguarding California Plan: 2017 Update. 2017. Sacramento: author, p. 183
[57] California Natural Resources Agency & California Emergency Management Agency. (2012). California Adaptation Planning Guide. 2012. Sacramento: author.
[58] Ibid
[59] CAL FIRE. Incident Information. 2016. Retrieved on June 2, 2017 from http://cdfdata.fire.ca.gov/incidents/incidents_stats?year=2015
[60] NOAA Earth System Research Laboratory. Trends in Atmospheric Carbon Dioxide, 2017. Retrieved on May 15, 2017 from https://www.esrl.noaa.gov/gmd/ccgg/trends/full.html.
[61] Environmental Protection Agency. Climate Change Indicators. 2017. Retrieved on May 15, 2017 from https://www.epa.gov/climate-indicators/greenhouse-gases.

billion metric tons, accounting for about 68 percent of all GHG emissions.[62] Together, past and present emissions result in climate change impacts that are increasingly apparent. The future progression of climate change is dependent on current and future levels of global GHG emissions. Planning and adaptation to address climate change impacts require flexibility to incorporate new science, projected trajectories of global GHG emissions, and changing conditions in communities.

4.3.2 PROJECTED IMPACTS

Climate change alters the frequency, severity, and location of many hazard events and should be accounted for in hazards planning. The potential impacts and associated risks of climate change have been detailed in several state reports including the 2009 California Climate Adaptation Strategy, updated as Safeguarding California Plan: 2018 Update, and the 2012 California Adaptation Planning Guide built on the findings of California's Climate Change Assessments. The following discussion summarizes some of this material.

In the SHMP, potential climate change outcomes are included in the risk assessments for those specific hazards resulting from, or exacerbated by, climate change. Specific hazard risk assessments are discussed in *Chapters 6 through 9*.

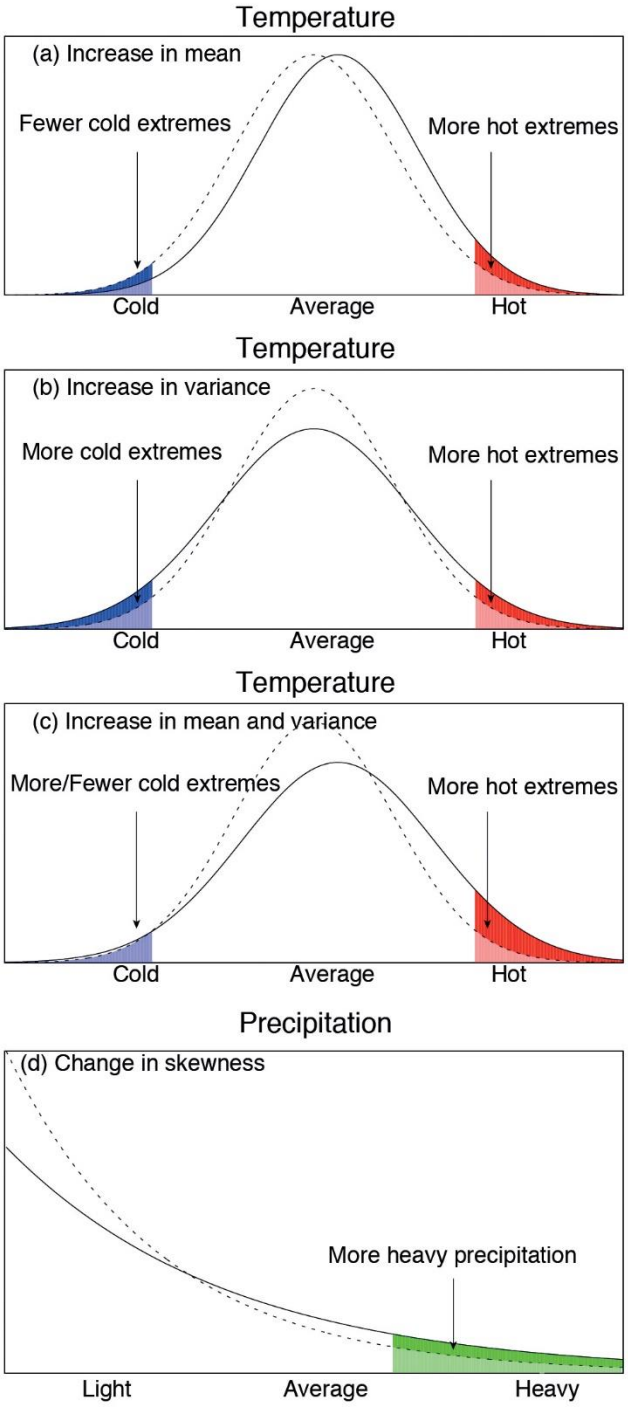
Relation to Hazard Probability

Climate change exacerbates hazards already experienced in California and also introduces new hazards. In addition to increasing global average temperature, climate change results in an increase in variance of climate patterns, as shown in Figure 4.C.[63]

The increase in variance means that extreme events—disasters—may exhibit changes in severity, frequency, and location. For example, the increased variance in climate patterns will result in more frequent incidence of severe events, such as extreme rainfall, wind, wildfire, extreme heat, and extended drought.

The increased variance therefore creates challenges for hazards planning, which previously used historic recurrence rates to predict future events, and now must incorporate changes to frequency, severity, and location due to climate change influences.

Figure 4.C: Climate Change Impacts on Temperature Patterns.



[62] United Nations Environment Programme, The Emissions Gap Report 2016, November 2016. 61 pages. p. 3. Retrieved on October 9, 2017 from http://wedocs.unep.org/bitstream/handle/20.500.11822/10016/emission_gap_report_2016.pdf

[63] Intergovernmental Panel on Climate Change (IPCC) 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

For example, the state is projecting more frequent and higher-temperature heat waves. These increased heat events will require local jurisdictions to use additional resources, not previously allocated, to minimize impacts on vulnerable populations.

It can seem counterintuitive to, for example, plan for increased floods when total rainfall is projected to decrease. However, this is exactly the type of planning needed due to the increasing variance in climate patterns. For this reason, climate change must be incorporated into the assessment of hazards risk. As explained below, however, including climate change in hazards management requires a shift from traditional risk assessment to new methods of evaluating the impacts of climate change on hazard events.

Estimating Risk for Hazards Affected by Climate Change

Risk assessment for hazards is built on the frequency of past events and the assumption that historic occurrence rates are generally a good predictor of future event probability. With the onset of climate change, history has become an inadequate predictor of future occurrence. As a result, planning now must be based on potential (or modeled) scenarios that account for shifts in historic conditions due to anticipated climate change.

Hazards caused or exacerbated by climate change are beginning to be assessed based on scenarios defined by global GHG emissions projections that assume either moderate, global-scale efforts to reduce GHG emissions or the continued growth in emissions through the end of 2100. These two scenarios suggest bounds within which climate change-influenced hazards planning should be framed.

Cal-Adapt, the tool made available by the state to enable exploration of local climate risks, allows California communities to view climate impacts under various global GHG scenarios. The best case, a moderate scenario, used by Cal-Adapt (RCP 4.5)[64], representing substantial international cooperation to limit warming with emissions peaking in 2040 and declining after, offers projections that allow communities to identify unavoidable outcomes (regardless of GHG emissions reduction). The worst-case "Business As Usual" scenario (RCP 8.5)[65] is congruent with continued growth of emissions, a failure of international cooperation to limit climate change, and extreme climate impacts. These two scenarios are consistent with the Governor's Office of Planning and Research (OPR)'s adaptation guidance and represent the range of potential futures for which communities must prepare.

In cases where the worst-case scenario results in outcomes disruptive to critical functions that are permanent or likely to last for protracted periods of time, communities may choose to take mitigative action even if the likelihood of an event occurring is small. California's Adaptation Planning Guide, the Safeguarding California Plan: 2018 Update, and the OPR's "Planning and Investing for a Resilient California" are important resources to help communities assess which potential climate change impacts require adaptation measures, determine where additional studies may be necessary, and define the phasing of these measures through time. The "profiling the hazard" section of the risk assessment template includes climate change considerations in the discussion of each hazard potentially affected by climate change (see *Chapter 1: Introduction, Section 1.2.3* for an overview of the 2018 SHMP risk assessment template).

4.3.3 CALIFORNIA'S CLIMATE CHANGE ASSESSMENT PROGRAM

Overview

California produces periodic scientific assessments on the potential impacts of climate change in California and reports potential adaptation responses. Required by Executive Order S-03-05, these assessments influence legislation and inform policy makers.

The First Climate Change Assessment, released in 2006, looked at the potential impacts of climate change on key state resources such as the water supply, public health, agriculture, coastal areas, forestry, and electricity production

[64] www.cal-adapt.org
[65] www.cal-adapt.org

and demand. The assessment influenced the passage of Assembly Bill 32, the California Global Warming Solutions Act of 2006.

The Second Climate Change Assessment, released in 2009, attempted to provide initial estimates of the economic impacts of climate change. It concluded that adaptation —as a complementary approach to mitigation—could substantially reduce economic impacts of loss and damage from a changing climate. Findings from the Second Assessment were instrumental in preparing California's 2009 statewide adaptation strategy.

The Third Climate Change Assessment, released in 2012, was shaped by the request for more information on vulnerability and adaptation options discussed in the 2009 California Adaptation Strategy. It made significant progress in projecting climate change impacts, but also in better understanding the interactions of those potential impacts with on-the-ground exposure, sensitivity, and response capacity of natural and human systems.

California's Fourth Climate Change Assessment

The *Fourth Climate Change Assessment* is part of California's comprehensive strategy to take action based on cutting-edge climate research. California's 2015 Climate Change Research Plan articulates near-term climate change research needs to ensure that the state stays on track to meet its climate goals. The *Fourth Climate Change Assessment*, released in August 2018, is the first inter-agency effort to implement a substantial portion of the Climate Change Research Plan.[66] *The Fourth Climate Change Assessment* endeavors to provide improved vulnerability assessments based on better understandings of projected extremes, as well as to provide scientific results that can support action. The Assessment program continues to support development of policy-relevant data and studies, and generated data and other information to be integrated into Cal-Adapt, as resources allow. The state will continue to pursue additional opportunities to make climate data accessible and available through Cal-Adapt and other tools.

Overview of Reports

The Fourth Climate Change Assessment is comprised of a series of statewide, regional, and technical reports as well as some external contributions.

Statewide reports, included in the assessment for the first time, cover critical topics for the entire state. In addition to a statewide summary report which provides an overview of the findings and context for the entire Fourth Assessment, three statewide reports were prepared on the following topics:

- Climate Justice
- Tribal and Indigenous Communities within California
- California's Ocean and Coast

To address local and regional information needs, the Fourth Assessment includes nine regional reports. These summary reports were included for the first time as part of the State's assessment process in part because the vast majority of adaptation planning and implementation will happen at local and regional scales. Each of these reports provides a summary of relevant climate impacts and adaptation solutions for a region of the state.

The regional reports which include climate science, impacts, and adaptation information by region are:

- Central Coast—covers Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara Counties
- Inlands Deserts—covers Imperial, eastern parts of San Bernardino, and Riverside Counties
- Los Angeles—covers Ventura, Los Angeles, Orange, and western parts of San Bernardino and Riverside Counties
- North Coast—covers Lake, Mendocino, Humboldt, Trinity, Siskiyou and Del Norte Counties
- Sacramento Valley—covers Sacramento, Yolo, Sutter, Yuba, Colusa, Glenn, Butte, Tehama, Shasta, and the eastern half of Solano and wester part of Pacer Counties
- San Diego—covers San Diego County

[66] http://www.climatechange.ca.gov/climate_action_team/reports/CAT_research_plan_2015.pdf

- San Francisco Bay Area—covers San Francisco, Marin, Contra Costa, Alameda, the western half of Solano, Santa Clara, San Mateo, Sonoma, and Napa Counties
- San Joaquin Valley—covers San Joaquin, Stanislaus, Merced, Kings, and the western parts of Madera, Fresno, Tulare, and Kern Counties
- Sierra Nevada—covers Modoc, Lassen, Plumas, Sierra, Nevada, Placer, El Dorado, Amador, Calaveras, Alpine, Mono, Tuolumne, Mariposa, Inyo, and the eastern parts of Madera, Fresno, Tulare, and Kern Counties

The foundation of California's Fourth Climate Change Assessment are scientific research studies projecting climate change impacts and exploring what those impacts mean for various sectors. A total of 44 reports and 7 external contributions cover the following nine sectors:

- Projections, Data, and Tools—9 documents
- Energy—11 documents
- Water—10 documents
- Oceans and Coasts—5 documents
- Forests and Wildfire—3 documents
- Agriculture—3 documents
- Biodiversity—2 documents
- Public Health—5 documents
- Governance—3 documents

Project Summary: Assessing Vulnerability and Improving Resilience of Critical Emergency Management Infrastructure in a Changing Climate

Climate Change and Emergency Management in California is part of California's *Fourth Climate Change Assessment*: Non-Energy Research Program (Project 6A, state funded at $375,000). It has two components: a Critical Facilities Vulnerability Assessment (CFVAC) system accounting for climate change, and active transportation as a critical lifeline service for resilient communities. The first component, Assessing Vulnerability and Improving Resilience of Critical Emergency Management Infrastructure in a Changing Climate, is a decision support system. The CFVAC identifies, evaluates, assesses, and estimates potential dollar loss of state-owned or -operated critical facilities and lifelines necessary for post-disaster and recovery operations in areas subject to climate change. CFVAC then prioritizes projects in relation to their relative importance to the continuity of state government and recovery operations following a natural disaster, with emphasis on disadvantaged communities. This component will be used to assist emergency management, critical infrastructure risk assessment, and hazard mitigation planning efforts. The second component develops selection criteria for an active transportation program that prioritizes climate change adaptation.

The Assessing Vulnerability and Improving Resilience of Critical Emergency Management Infrastructure in a Changing Climate project includes the interactive "California Emergency Response Infrastructure Climate Vulnerability Tool" (CERI-Climate) that combines a database of California critical emergency response infrastructure with projected flood and wildfire hazard footprints to examine exposure and associated impacts on infrastructure from exposed climate-related hazards. Outputs include maps and tables describing facility exposures, flood, and fire risks, property damage estimates from flooding, and estimates of operational disruption. The analyses examine a range of conditions spanning different emissions scenarios, climate models, hazard severity, and other factors in 20-year intervals through the year 2100. The tool also provides the ability to examine results for particular facility types, for specific counties, and for facilities located in disadvantaged communities. Cal OES uses the tool to conduct its own analysis and data visualization, and can potentially add new data as the state's assets change. The CERI-Climate tool will be available for public use at the end of 2018.

For more information on California's Climate Assessments, see the Natural Resources Agency webpage: http://climatechange.ca.gov/climate_action_team/reports/climate_assessments.html.

4.3.4 CLIMATE CHANGE AND THE 2018 SHMP

Climate change should be considered a standard and integral part of preparing for and mitigating hazard events. Many of the hazards already regularly experienced by the state are likely to be changed in intensity and frequency as a result of climate change. The State of California continues to pass legislation and has taken a series of actions with the aim of improving preparation for climate change, in both climate change mitigation and adaptation actions.

The state defines climate change mitigation and climate change adaptation as follows:

> *Climate Change Mitigation*: A human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.[67]
>
> *Climate Change Adaptation*: Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

The SHMP seeks not only to meet Federal Emergency Management Agency (FEMA) expectations, but also provide a framework for integration with other state actions such as climate change related efforts. The SHMP, as the state's hazard mitigation guidance document, strives to highlight much of the great climate mitigation and adaptation work the state has accomplished in the last five years while not duplicating the efforts of the state's climate adaptation strategy document, Safeguarding California. With the passage of Senate Bill (SB) 246 (2015) and SB 379 (2015), and regular updates of Safeguarding California (all described later in this section), hazard mitigation is explicitly integrated into state climate change adaptation efforts. The individual hazard assessments in *Chapters 6 through 9* include additional detailed discussion on the influence of climate change.

For hazards potentially caused or exacerbated by climate change, the potential impacts of climate change are discussed in the "Profiling the Hazard" section of each affected hazard risk assessment, as explained in *Chapter 1: Introduction, Section 1.2*.

4.3.5 CLIMATE CHANGE MITIGATION EFFORTS

California has been a leader in adopting initiatives to address climate change through the reduction of GHG emissions and taking innovative actions to respond to risks associated with climate change. Although climate change is a global issue, actions taken by California can have far-reaching effects by encouraging other states, the federal government, and other countries to act. Though California ranked 20th in 2012 on the list of the world's largest emitters of energy-related greenhouse gases,[68] many important pieces of legislation have been passed and actions have been taken to improve that ranking for the state. The following summarizes major climate mitigation and adaptation initiatives and progress of the state.

California Legislative History

The initial push for GHG reduction was set in motion in 2005 by Executive Order S-03-05, which established climate change emission reduction targets for the state. The goal at that time was to reduce emission levels to 80 percent below 1990 levels by 2050. To achieve those goals, the California Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32) was passed to establish a comprehensive implementation program, which included setting a GHG emissions cap for 2020, adopting regulations, and creating mandatory reporting rules for significant sources of GHG.

In 2008, the California Air Resources Board (CARB), the lead agency for implementing AB 32, developed a Scoping Plan outlining the state's strategy to achieve the 2020 GHG emissions reduction goals. The Scoping Plan outlined a set of actions designed to reduce overall GHG emissions in California to 1990 levels by 2020 and proposed a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce dependence on oil, diversify energy sources, save energy, create new jobs, and enhance public health. The

[67] California Natural Resources Agency. Safeguarding California: Reducing Climate Risk. 2014. Sacramento: author. 344 p.
[68] Next 10, California Green Innovation Index: International Edition. 2015. 95 pages. p. 15. Retrieved on October 9, 2017 from http://www.next10.org/sites/next10.org/files/2015-Green-Innovation-Index.pdf

Scoping Plan presented GHG emission reduction strategies that combine regulatory approaches, voluntary measures, fees, policies, and programs.

By enacting SB 97 in 2007, California's lawmakers expressly recognized the need to analyze GHG emissions as a part of the California Environmental Quality Act (CEQA) process. SB 97 required the Governor's Office of Planning and Research (OPR) to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines addressing the analysis and mitigation of GHG emissions.

Enacted in October 2008, SB 375 further built on AB 32 by connecting the reduction of GHG emissions from cars and light trucks to regional and local land use and transportation planning. SB 375 also required the CARB to establish GHG emission reduction targets for each region (as opposed to individual cities or households), and required each region's metropolitan planning organization (MPO) to create a Sustainable Communities Strategy (SCS) as part of the Regional Transportation Plan (RTP) that will meet the target for the region.

In September 2008, the Governor signed SB 732 creating the Strategic Growth Council (SGC). The SGC, a cabinet-level committee, was given authority to distribute Proposition 84 funds available for planning grants and incentives to encourage the development of regional and local land use plans designed to promote water conservation, reduce automobile use and fuel consumption, encourage greater infill and compact development, protect natural resources and agricultural lands, and increase adaptability to climate change. All projects and plans must be consistent with the state's planning priorities and reduce GHG emissions on a permanent basis consistent with AB 32 and any applicable regional plan. The planning grant criteria Priority Considerations award extra points for addressing climate change impacts on human and natural areas and adaptation planning to address these issues.

Mitigation Efforts Since 2013

There are many climate mitigation efforts that occurred throughout California since 2013. Below are a few major examples. For more information on California's integrated plan for addressing climate change and climate mitigation legislation visit: http://www.climatechange.ca.gov/.

Greenhouse Gas Emission Reduction

On September 8, 2016, the Governor signed SB 32, putting into law an amended statewide goal to reduce GHG emissions 40 percent below 1990 levels by 2030, and to adopt rules and regulations in an open public process to achieve the maximum, technologically feasible, and cost-effective greenhouse gas emissions reductions. The CARB is the designated lead agency assigned to implement the provisions of the bill. The Climate Action Team (CAT), made up of relevant state agencies, is charged with helping direct state efforts on the reduction of GHG emissions and engaging state agencies. For specific information regarding each agency's climate change mitigation efforts, visit their individual websites. A few examples of current programs are listed below.

In January 2017, the CARB released an update to the 2008 Scoping Plan, building on key programs that include the Cap-and-Trade Regulation, the Low Carbon Fuel Standard, and programs for much cleaner cars, trucks, and freight movement; use of cleaner renewable energy; and reduction of methane emissions from agricultural and other wastes by using the wastes to produce energy. It also comprehensively addresses for the first time the GHG emissions from natural and working lands of California, including the agriculture and forestry sectors. The updated Scoping Plan also highlights an updated strategy: achieving the state's 2030 GHG target and a 40 percent emissions reduction below 1990 levels. The 2017 update also builds on the state's success to date, proposing to strengthen major programs that have already been deemed successful for further integrating efforts to reduce both GHGs and air pollution.

In July 2017, AB 398 was signed by the Governor to extend and improve the state's world-leading cap-and-trade program to ensure that California continues to meet its ambitious climate change goals. This legislation extends the program by 10 years until 2030, and makes the following improvements based on years of operation, analysis, and input:

- Ensures that carbon pollution will decrease as the program's emissions cap declines

- Cuts the use of out-of-state carbon offsets and brings those environmental benefits back to California
- Designates the CARB as the statewide regulatory body responsible for ensuring that California meets its statewide carbon pollution reduction targets, while retaining local air districts' responsibility and authority to curb toxic air contaminants and criteria pollutants from local sources that severely affect public health
- Decreases free carbon allowances over 40 percent by 2030
- Set priorities for cap-and-trade spending to ensure that funds go where they are needed most, including reducing diesel emissions in the most affected communities

Extending California's cap-and-trade program ensures that billions of dollars in auction proceeds continue flowing to communities across California. To date, these investments have preserved and restored tens of thousands of acres of open space, helped plant thousands of new trees, funded 30,000 energy efficiency improvements in homes, expanded affordable housing, boosted public transit, helped more than 100,000 Californians purchase ZEVs, and supported many other programs.

The Budget Act of 2017, Senate Bill 109, allocates $11 million from the greenhouse gas reduction fund through the Strategic Growth Council for research to address reduction of GHG emissions with an emphasis on serving disadvantaged and vulnerable communities. Additional, the Budget Act of 2017 allocates funding to other state agencies for climate change programs such as urban greening and healthy forest and fire prevention.

In September 2018, Governor Brown issued Executive Order B-55-18 in a significant step for California toward achieving carbon neutrality. The executive order establishes a new statewide goal to achieve net carbon neutrality as soon as possible, but no later than 2045, and to maintain net negative emissions thereafter. The executive order tasks the California Air Resources Board (CARB) with developing an implementation framework and working with other state agencies to achieve this goal. CARB is also responsible for developing an accounting system to track progress toward this goal.

Zero-Emission Vehicles and Infrastructure

Transportation accounted for about 37 percent of California's GHG emissions in 2014. Transforming California's transportation system away from gasoline to zero-emission vehicles (ZEV) and near zero-emission vehicles is a fundamental part of the state's efforts to meet its climate goals. The Governor established the foundation to support 1.5 million ZEV by 2025 and published a ZEV action plan to achieve this goal. The Energy Commission provides funding for plug-in electric vehicle charging and hydrogen refueling stations, and guidance on plug-in electric and hydrogen vehicle infrastructure deployment. For additional information about this program, see the Energy Commission website at: http://www.energy.ca.gov/.

Alternative Energy Sources

In 2002 Senate Bill 1078 established California's Renewables Portfolio Standard (RPS). In a series of subsequent legislation and Executive Order S-14-08, the RPS targets were accelerated. The Energy Commission and the California Public Utilities Commission work collaboratively to implement the RPS.[69]

Reduced GHG emissions from the electricity sector are largely attributable to increases in renewable energy and decreases in coal-fired generation. Installed capacity of renewable energy in California has more than tripled from 6,800 megawatts (MW) in 2001 to 26,300 MW (including small self-generation such as rooftop solar) as of October 31, 2016. Meanwhile, coal-fired electricity served about 11 percent of California's electricity demand in 2000 but has steadily declined, serving less than 6 percent by the end of 2015; the percentage is expected to decline to zero by the middle of the next decade. Criteria pollutant emissions from the electricity sector (emissions that cause smog and harm human health) are modest, contributing just 2 percent of total emissions in 2000, and were cut by more than half by 2015.

[69] http://www.energy.ca.gov/portfolio/

Senate Bill 100, passed in September 2018, further advances the state's RPS to 50 percent by 2025, and 60 percent by 2030. It also sets a goal for California to implement a zero-carbon electricity grid by 2045.

Under2MOU

The Under2 Coalition, the collective of governments who have signed or endorsed the Under2 MOU, a Subnational Global Climate Leadership Memorandum of Understanding (MOU), was formed in 2015 by the states of California and Baden-Württemberg, Germany to galvanize bold climate action from like-minded city, state and regional governments around the globe. Coalition members pledge to limit GHG emissions to 2 tons per capita or 80 to 95 percent below 1990 levels by 2050.

U.S. Climate Alliance

In response to the federal government's decision to withdraw the United States from the Paris Agreement on climate change, Governors Andrew Cuomo, Jay Inslee, and Jerry Brown created the United States Climate Alliance. This bi-partisan coalition of states is committed to the goal of reducing GHG emissions consistent with the goals of the Paris Agreement. Smart, coordinated state action can ensure that the United States continues to contribute to the global effort to address climate change.

General Plan Guidelines

California communities need to respond to climate change both through policies that promote adaptation and resilience and by significantly reducing GHG emissions. The 2017 General Plan Guidelines chapter on climate change summarizes how a general plan or climate action plan can be consistent with CEQA Guidelines Section 15183.5 (b) (entitled Plans for the Reduction of Greenhouse Gas Emissions). The 2017 General Plan Guidelines note that California is unique in requiring that an environmental impact report, using CEQA procedures, be prepared as a final document for updating and adopting a city or county general plan. A GHG emissions reduction plan can be either a stand-alone climate action plan or part of the general plan. The CEQA Guidelines recognize either approach. Regardless of approach, local governments should inventory and mitigate GHG emissions "within a defined geographical area"—typically the city or unincorporated county over which they have land use authority. Under CEQA, lead agencies should analyze the GHG emissions of proposed projects, and should reach a conclusion regarding the significance of those emissions. Chapter 8 of the 2017 General Plan Guidelines provides resources and information on the CEQA Guidelines that local jurisdictions can use as guidance for GHG inventory, planning, and reduction implementation efforts.

Climate Action Portal Map

The California Air Resources Board (CARB) developed the Climate Action Portal Map (CAP-Map), an interactive web resource that is intended to help local governments learn more about other climate action plans and climate change policies being implemented across California. The resource was launched December 2017 on the www.CoolCalifornia.org local government portal. The CAP-Map aggregates the climate action planning efforts of California jurisdictions, and provides a searchable database of climate action strategies. OPR and CARB hosted webinars in late 2017, providing demonstrations of the tool's features and CAP-Map's relationship to other state efforts such as the 2017 General Plan Guidelines. For more information about CAP-Map visit the local government portal: http://www.coolcalifornia.org/local-government.

4.3.6 CLIMATE CHANGE ADAPTATION INITIATIVES

To respond to the threat of climate change, the state has enacted executive orders, legislation, regulations, and programs that address the impacts of climate change on the state by promoting adaptation efforts at state, regional, and local levels. This section summarizes the state's most significant adaptation efforts.

4.3.6.1 EXECUTIVE ORDERS AND PROCLAMATIONS SINCE 2013

Governor's Executive Order B-30-15

In addition to issuing new interim statewide targets and further addressing greenhouse gas emission reduction, Governor's Executive Order B-30-15 (EO B-30-15), issued in April 2015, also addresses the need for climate adaptation, and directs the state government to:

- Update the Safeguarding California Plan (the state's climate adaptation strategy) on a three-year time schedule to identify how climate change will affect California infrastructure and industry and what actions the state can take to reduce the risks posed by climate change. As part of this effort, the plan outlines primary risks to residents, property, communities, and natural systems that should be used as the basis for identifying priority actions needed for risk reduction.
- Identify climate change vulnerabilities by sector, including at a minimum the water, energy, transportation, public health, agriculture, emergency services, forestry, biodiversity and habitat, and ocean and coastal resources sectors, and identify a lead agency to lead the adaptation efforts for each sector.
- Develop Implementation Action Plans by sector outlining the actions that will be taken as identified in Safeguarding California.
- Factor climate change into state agencies' planning and investment decisions, considering action to protect the state's most vulnerable populations and prioritizing natural infrastructure solutions.
- Incorporate current and future climate change impacts into the state's Five-Year Infrastructure Plan.
- Continue a rigorous climate change research program for understanding of impacts of climate change to inform adaptation efforts.
- Establish a Technical Advisory Group (TAG) to support agencies in incorporation of climate change into planning and investment decisions (See *Section 4.3.6.3* for more information on the TAG).

For the text of Governor's Executive Order B-30-15, see the executive order press release on the Governor's website: https://www.gov.ca.gov/news.php?id=18938.

Tree Mortality Emergency Proclamation

In October 2015, Governor Brown issued an Emergency Proclamation that supplemented his January 17, 2014 proclamation of a State of Emergency, addressed tree mortality, and established the Tree Mortality Task Force (TMTF). For specific information about tree mortality hazard and mitigation, see *Chapter 9, Section 9.1.11*.

Governor's Executive Order B-42-17

This executive order, issued in September 2017, continues the 2015 Tree Mortality Emergency Proclamation with modifications to better facilitate dead/dying tree removal across the state. Tree mortality hazard is discussed in *Section 9.1.11*.

Governor's Executive Order B-52-18

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

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

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

Executive Order B-52-18 will improve the health of the state's forests and help mitigate the threat and impacts of deadly and destructive wildfires, which hinder the state's progress toward its climate goals.

Other Climate-Related Executive Orders and Proclamations

The Governor has issued several executive orders and emergency proclamations addressing drought conditions. These are discussed in *Section 9.1.5*.

4.3.6.2 ADAPTATION LEGISLATION SINCE 2013

The following is a list of climate change adaptation legislation passed since 2013. While legislation specifically addressing climate change mitigation has also been passed in this time frame, it is not included in this list as the focus of this section is specifically on climate change adaptation.

Assembly Bill 1471 (August 2014)

The Water Quality, Supply, and Infrastructure Improvement Act of 2014, among other things, funds for projects which help water infrastructure systems adapt to climate change (including but not limited to sea-level rise).

Assembly Bill 2516 (September 2014)

Requires the California Natural Resources Agency, in collaboration with the Ocean Protection Council (OPC), to conduct biannual surveys of sea-level rise planning information to catalog California's efforts to prepare for rising seas.

Senate Bill 379 (October 2015)

Senate Bill 379 (2015) establishes a framework for incorporating climate change adaptation into local and regional hazard mitigation plans and general plan safety elements.

Senate Bill 246 (October 2015)

Senate Bill 246 (2015) establishes the Integrated Climate Adaptation and Resiliency Program (ICARP) to "coordinate regional and local efforts with State climate adaptation strategies", including, at a minimum:

- Developing tools and guidance
- Promoting and coordinating State agency support for local and regional efforts
- Informing State-led programs to better reflect the goals, efforts, and challenges faced by local and regional agencies
- Coordinate with Cal OES on updates to the California Adaptation Planning Guide
- Create a Technical Advisory Council and Clearinghouse to support the goals of ICARP

The bill requires Cal OES to work with stakeholders to review and update (as necessary) the California Climate Adaptation Planning Guide within one year of an update to Safeguarding California. The bill also requires coordination with the Climate Action Team, Strategic Growth Council, Cal OES, the California Natural Resources

Agency (CNRA), the California Department of Public Health (CDPH), and other agencies to inform state-led adaptation programs.

Assembly Bill 1482 (October 2015)

AB 1482 requires regular updating of the State's climate adaptation strategy Safeguarding California by January 2017 and every three years after. The bill requires the CRNA to report to the Legislature annually on the actions being taken to implement Safeguarding California. Additionally, the bill expands the role of the Strategic Growth Council (SGC) to include consistency with Safeguarding California in its review of the State activities and funding activities. The bill also requires that at a minimum the SGC include consistency with Safeguarding California in its review of the 5-year infrastructure plan.

Senate Bill 2800 (September 2016)

Requires State agencies to take into account current and future impacts of climate change in all stages of planning, designing, building, operating, maintaining, and investing in State infrastructure. Senate Bill 2800 requires a Climate-Safe Infrastructure Working Group be established from 2017 to 2020 to examine how to integrate scientific data concerning projected climate change impacts into State infrastructure engineering.

Senate Bill 1000 (September 2016)

This bill requires that an environmental justice element be included in a jurisdiction's general plan or that goals, objectives, and policies addressing environmental justice be integrated into the other elements of the general plan. Senate Bill 1000 (2016) also builds on the requirement to address climate change in the Safety Element of the General Plan.

Senate Bill 1383 (September 2016)

Addressing Short-lived Climate Pollutants on September 19, 2016 the Governor signed Senate Bill 1383, which directed the CARB to adopt the Short-Climate Pollutant Reduction Strategy. The Strategy requires an immediate reduction of specific pollutants (black carbon, methane, and fluorinated gasses) by 2030. Short-lived climate pollutants are estimated to be responsible for about 40 percent of net climate forcing (a net gain of energy resulting in warming). Action to reduce these "super pollutants" will provide immediate benefits and help mitigate the impacts of climate change. While reducing CO_2 emissions limits climate change over the long-term, reducing emissions of short-lived climate pollutants will effectively slow the rate of climate change in the near-tem. The Short-Lived Climate Pollutant Reduction Strategy, provides specific direction for reductions from dairy and livestock operations and from landfills by diverting organic materials, and requires actions to support in-State production and use of renewable natural gas.

Senate Bill 1 (2017)

The Road Repair and Accountability Act of 2017 is a ten-year transportation funding bill provide source of funds to maintain and integrate the State's multi-modal transportation system. As a result of this transportation funding, $20 million in climate change adaptation planning grants has been allocated to local and regional agencies for adaptation planning. Seven million dollars are available for the Fiscal Year 2017-2018 grant cycle, seven million dollars will be available in 2018-2019, and six million dollars in 2019-2020. This funding will advance adaptation planning on the state transportation system. Applicants who have adaptation planning efforts underway as well as those who have not yet started adaptation work are encouraged to apply. For more information visit Caltrans Transportation Planning Grant Program webpage: http://www.dot.ca.gov/hq/tpp/grants.html.

4.3.6.3 AGENCY AND STAKEHOLDER COORDINATION AND INTEGRATION

Climate Action Team and Climate Action Initiative (Established 2005)

Overview

The Climate Action Team (CAT) was created by Governor's Executive Order S-03-05 in 2005 and is an important venue for cross-agency collaboration on climate activities. The CAT's objective is to coordinate statewide efforts to implement both GHG reduction and climate adaptation efforts. The CAT members are state agency secretaries and the heads of agencies, boards, and departments, led by the Secretary of the California Environmental Protection Agency (Cal/EPA). CAT members are mandated by Executive Order S-03-05 to provide biannual reports to the Governor and State Legislature regarding the status of the impacts on the state from global warming and the mitigation and adaptation plans underway to combat those impacts.

Within the CAT are the following topic-specific working groups, or sub-CATs:

- Agriculture (http://www.climatechange.ca.gov/climate_action_team/agriculture.html)
- Biodiversity (http://www.climatechange.ca.gov/climate_action_team/biodiversity.html)
- Coastal and Ocean Climate Adaptation Team (http://www.opc.ca.gov/2010/07/coastal-and-ocean-climate-action-team-co-cat/)
- Interagency Forestry Working Group (http://www.climatechange.ca.gov/climate_action_team/forestry.html)
- Intergovernmental Working Group (http://www.climatechange.ca.gov/climate_action_team/partnerships.html)
- Land Use and Infrastructure Working Group (http://www.climatechange.ca.gov/climate_action_team/land_use.html)
- Public Health Working Group (http://www.climatechange.ca.gov/climate_action_team/health.html)
- Research Working Group (http://www.climatechange.ca.gov/climate_action_team/research.html)
- State Government (http://www.climatechange.ca.gov/climate_action_team/state.html)
- Water Energy Working Group (http://www.climatechange.ca.gov/climate_action_team/water.html)

Each of the 10 CAT working groups listed above has a separate purpose, set of activities and deliverables, and roster of participating agencies.

Safeguarding California Climate Action Team (SafeCAT) (Established 2017)

The Safeguarding California CAT was established as a new Climate Action Team in 2017 to provide a venue for cross-sector collaboration and information sharing on development of the Safeguarding California plan, Executive Order B-30-15 TAG guidance implementation, and engagement with local and regional agencies. Co-led by the Office of Planning and Research (OPR) and California Natural Resources Agency (CNRA), this sub-CAT meets quarterly to provide updates on adaptation-related guidance documents, report updates, programs, and other matters, and provides a venue to discuss other collaborative efforts involving all agency members.

The SafeCAT, together with the Integrated Climate Adaptation and Resiliency Program and its associated Technical Advisory Council, provide a suite of agency bodies and resources to foster information sharing and engagement with local and regional governments working to address the impacts of climate change. Cal OES participates in the SafeCAT meetings as well as sits on the aforementioned Technical Advisory Council for the Integrated Climate Adaptation and Resiliency Program. For more information about the Safeguarding California Climate Action Team, visit: http://resources.ca.gov/climate/safeguarding/.

Strategic Growth Council (Established 2008)

In September 2008, the Governor signed SB 732 creating the Strategic Growth Council (SGC). The SGC is a cabinet-level committee that is tasked with coordinating the activities of state agencies to:

- Improve air and water quality
- Protect natural resource and agriculture lands
- Increase the availability of affordable housing
- Promote public health and equity
- Improve transportation
- Encourage greater infill and compact development
- Strengthen the economy
- Promote water conservation
- Revitalize community and urban centers
- Assist state and local entities in the planning of sustainable communities and meeting AB 32 goals
- Advance the priorities developed in Safeguarding California, the state's climate adaptation strategy

SB 732 (2008) gives the council authority to distribute Proposition 84 funds available for planning grants and incentives to encourage the development of regional and local land use plans designed to promote water conservation, reduce automobile use and fuel consumption, encourage greater infill and compact development, protect natural resources and agricultural lands, and increase adaptability to climate change. All projects and plans must be consistent with the state's planning priorities and reduce greenhouse gas emissions on a permanent basis consistent with AB 32 and any applicable regional plan. The planning grant criteria Priority Considerations award extra points for addressing climate change impacts on human and natural areas and adaptation planning to address these issues.

AB 1482 (October 2015) expanded the role of the Strategic Growth Council (SGC) to include review of the Five-Year Infrastructure Plan and other state program activities for consistency with state climate goals, including adaptation and resilience.

Department of Water Resources Climate Change Technical Advisory Group (Established 2009)

In support of the California Water Plan Update 2009, the California Department of Water Resources (DWR) assembled an external advisory group to provide technical support and feedback for climate change issues. Known as the Climate Change Technical Advisory Group (CCTAG), the nominally 28-member expert panel advised DWR on the scientific aspects of climate change, its impacts on water resources, the use and creation of planning approaches and analytical tools, and the development of adaptation responses for California's water sector. CCTAG panel experts from state, local, research, and education sector backgrounds will work with DWR on incorporating climate change into water resources planning and management, with a particular focus on climate adaptation and extreme events.

For more information about the CCTAG, visit: https://www.water.ca.gov/Programs/All-Programs/Climate-Change-Program.

California Fire Service Task Force on Climate Impacts (Established 2015)

Responding to Executive Order B-30-15, the California Fire Service Task Force on Climate Impacts builds on the work of the Governor's Blue Ribbon Fire Commission that was established following the 2003 wildfires. In continuing to expand the State of California's wildfire preparedness, capability, and resilience efforts, the California Fire Service Task Force on Climate Impacts will review and develop policy and operational recommendations associated with the effect of future conditions on California fire service to be used by fire service providers, emergency responders, and emergency managers at all levels of government.

Membership on the task force includes local, state, federal, and professional organizations representing fire services, emergency management, and state climate policy. The Cal OES director acts as the task force chair and Cal OES organizes and conducts all meetings. Information produced by the task force is also shared with the Governor of California. More information about the task force can be found on the Cal OES website at the following link: http://www.caloes.ca.gov/FireRescueSite/Pages/Fire-Service-Task-Force-on-Climate-Impacts.aspx.

Executive Order B-30-15 Technical Advisory Group and Sub-TAGs (Established 2015-2016)

This Technical Advisory Group was convened by OPR in response to Governor's Executive Order B-30-15, with the purpose of providing guidance for agencies to incorporate and integrate climate change into all planning and investment decisions. The Technical Advisory Group (TAG) included members from nearly every state agency, local and regional governments, non-governmental and community-based organizations, and the private sector. The TAG met from April 2016 through January 2017, and various sub-TAG working groups were also created to support the implementation efforts of the directives in Executive Order B-30-15. These groups included:

- Built Infrastructure Sub-TAG
- Climate Scenarios Sub-TAG
- Green and Natural Infrastructure Sub-TAG
- Local, Regional, and State Collaboration Sub-TAG
- Metrics and Tracking Progress Sub-TAG
- Vulnerable Populations and Community Development

The sub-TAGs met separately from the main TAG group and discussed specific topics that were outlined by the TAG as needing to be addressed based on Executive Order B-30-15. The efforts of the TAG and sub-TAGs led to the development of a guidance document called "Planning and Investing for a Resilient California: A Guidebook for State Agencies." This guidebook provides a step-by-step process for state agencies to analyze climate risk and apply the resulting information to decision-making, and also provides direction on integrating climate benefits into infrastructure investment. To download the guidebook, visit: http://opr.ca.gov/planning/icarp/resilient-ca.html.

Coastal and Ocean Resources Working Group for the Climate Action Team (CO-CAT) (Established 2016)

The Coastal and Ocean Resources Working Group for the Climate Action Team (CO-CAT) is a working group comprised of senior level staff from state agencies with ocean and coastal resource management responsibilities. CO-CAT's task is to ensure the state's ability to adapt to climate change impacts on ocean and coastal resources, including implementing the ocean and coastal resources chapter of the 2014 Safeguarding California Plan and the 2009 California Climate Adaptation Strategy. For more information about CO-CAT, visit: http://www.opc.ca.gov/2010/07/coastal-and-ocean-climate-action-team-co-cat/.

Integrated Climate Adaptation and Resiliency Program (ICARP) Technical Advisory Council (Established 2016)

The Integrated Climate Adaptation and Resiliency Program (ICARP) Technical Advisory Council (TAC) was created with the approval of Senate Bill (SB) 246 (2015). SB 246 requires that an advisory council be established to support coordination efforts among state, regional, and local agency efforts to adapt to the impacts of climate change by:

- Developing tools and guidance
- Promoting and coordinating state agency support for local and regional efforts
- Informing state-led programs, including state planning processes, grant programs, and guideline development, to better reflect the goals, efforts, and challenges faced by local and regional entities pursuing adaptation, preparedness, and resilience

The TAC also works together to facilitate development of strategies that increase California's resilience to climate change, advance equity and environmental justice, and benefit both greenhouse gas (GHG) emissions reduction and adaptation efforts.

In accordance with SB 246, the TAC should have expertise in climate change and areas that include, but need not be limited to, the following:

- Public health
- Environmental quality
- Environmental justice
- Agriculture

- Transportation and housing
- Energy
- Natural resources and water
- Planning
- Recycling and waste management
- Local or regional government
- Tribal issues
- Emergency services and public safety

For more information about ICARP and the TAC, visit: http://opr.ca.gov/planning/icarp/.

Climate-Safe Infrastructure Working Group (Established 2017)

Assembly Bill (AB) 2800 (2017) required that a Climate-Safe Infrastructure Working Group be established from 2017 to 2020 to examine how to integrate scientific data concerning projected climate change impacts into state infrastructure engineering.

As of early September 2018, the working group had completed six meetings to date and used the input from those meetings to produce "Paying It Forward: The Path Toward Climate-Safe Infrastructure in California", a 160-page report addressing the problem of climate change impacts on aging or poorly maintained infrastructure in response to AB 2800. Key sections of the report present: 1) the problem, 2) a vision, and 3) elements of a framework to action to ensure resilient and sustainable infrastructure in the future. The report is intended to provide a path toward realizing climate-safe infrastructure in California and provides 9 specific recommendations for the state to follow to achieve stronger climate-safe infrastructure practices.

4.3.6.4 STATE CLIMATE ADAPTATION PLANNING

In addition to being a leader in greenhouse gas emissions reduction, California has also led efforts to prepare for and respond to climate change impacts. These actions are referred to as adaptation.

The people of California face escalating threats related to climate change, including extreme storm events, more frequent and severe wildfires, disruptions to water and energy delivery systems, disruptions to transportation systems, more frequent and severe heat waves and associated air quality issues, environmental degradation such as tree mortality, and the potential loss of species and habitats due to various climate related stressors. These climate impacts threaten not only public health and safety, but also billions of dollars of property and the economic livelihood of California. Adjustments in natural or human systems can help reduce the potential harm from climate changes that is occurring or expected.

California Climate Adaptation Strategy and Safeguarding California 2018

Pursuant to Executive Order S-13-08, a multi-sectoral 2009 California Climate Adaptation Strategy (2009 CAS) was developed.[70] The 2009 CAS was based on best available science at the time and included recommendations to inform state decision-makers in developing policies to prepare for climate impacts, reduce exposure and vulnerability, and build more resilient California communities. A First Year Progress Report was issued in 2010.[71]

Given the diversity of potential outcomes, most assessments and policy responses break climate change impacts into sectors. California has a regularly updated Climate Change Adaptation Strategy, first published in 2009 and updated in 2013, as a coordinated effort between the California Natural Resources Agency and other state agencies.

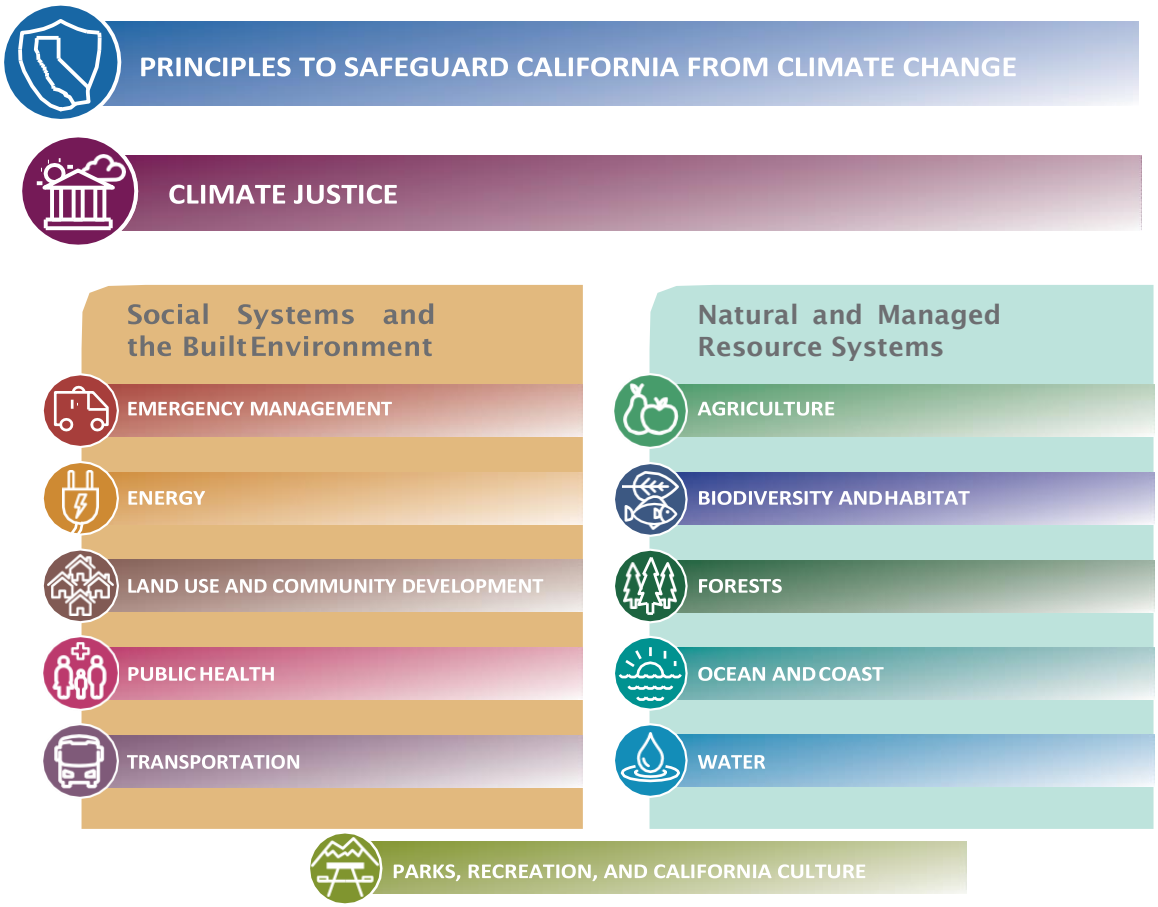
In order to augment previously identified strategies, and in light of advances in climate science and risk management options, the California Natural Resources Agency, in coordination with other state agencies and partners, developed an update to the California Climate Adaptation Strategy, 2014 Safeguarding California. The 2014 update included

[70] http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf
[71] http://www.energy.ca.gov/2010publications/CNRA-1000-2010-010/CNRA-1000-2010-010.PDF

two additional sector chapters not previously included in the 2009 CAS (an energy chapter and an emergency management chapter) and communicates current and needed actions state government should take to build climate change resiliency. The primary objective of *Safeguarding California Plan: 2018 Update – California's Climate Adaptation Strategy*, as with the prior 2009 and 2014 drafts, is to communicate current and needed actions state government should take to build climate change resiliency, with the ultimate goal of ensuring that people, communities, and natural systems are able to withstand the impacts of climate disruption. To this end, the document presents recommended adaptation strategies.

In the 2018 update to the Safeguarding California Plan, strategies are organized into 10 sectors, with five for social systems and the built environment and five for natural and managed resource systems and an additional sector, new to the 2018 update, for Parks, Recreation, and California Culture.[72] The Parks, Recreation, and California Culture sector is categorized under both systems, as it deals with social systems, the built environment, and natural resources. Climate justice recommendations, also new to the 2018 update, are included in all policy sectors. Figure 4.D is a graphical representation of the framework of the Safeguarding California Plan: 2018 Update. For more information on the 2018 update, visit: http://resources.ca.gov/climate/safeguarding/.

Figure 4.D: 2018 Safeguarding California Climate Change Impact Sector Breakdown



Source: Safeguarding California Plan: 2018 Update

[72] California Natural Resources Agency. Draft Report Safeguarding California Plan: 2017 Update. 2017. Sacramento: author, 183 p., p. 4.

Integrated Climate Adaptation and Resiliency Program (ICARP) and the State Adaptation Clearinghouse

The Integrated Climate Adaptation and Resiliency Program (ICARP), discussed in *Section 4.3.6.3*, Agency and Stakeholder Coordination and Integration, is responsible for coordinating and maintaining the State Adaptation Clearinghouse (Public Resources Code 71360).

The ICARP has two components:

- The Technical Advisory Council (TAC): An entity that brings together local government, practitioners, scientists, and community leaders to help coordinate activities that better prepare California for the impacts of a changing climate. (TAC members bring expertise in the intersection of climate change and the sector-based areas outlined in SB 246 [2015], Public Resources Code 71358(b)).

- The State Adaptation Clearinghouse: A centralized source of information and resources to assist decision-makers at the state, regional, and local levels when planning for and implementing climate adaptation projects to promote resiliency across California. This allows local and regional governments access to climate data, which is a direct cost and staff benefit to these governments.

The Adaptation Clearinghouse aims to support a community of practice across the state through knowledge exchange between communities and businesses and across levels of government. The Adaptation Clearinghouse provides a clearinghouse and a searchable database of adaptation and resilience resources that have been organized by climate impact, topic, and region. The Clearinghouse also provides an important platform where Californians can find and share case studies and stories about how and why their communities, businesses, and organizations are responding to climate change impacts.

The types of resources included in the Clearinghouse include, but are not limited to:

- Assessments, plans, and strategies
- Communication and educational materials
- Planning and/or policy guidance
- Data, tools, and research
- Case studies, projects, or examples

Visit OPR's website for more information on the ICARP and State Adaptation Clearinghouse: http://opr.ca.gov/clearinghouse/adaptation/.

General Plan Guidelines and the Governor's Office of Planning and Research Guidance on Climate Adaptation

Climate change has also been recognized by the Governor's Office of Planning and Research (OPR) as a factor to be considered in preparation of local general plans. The 2017 State of California General Plan Guidelines prepared by OPR further address the need for climate adaptation with the inclusion of new chapters on healthy communities, equitable and resilient communities, economic development, and climate change.

The General Plan Guidelines include two general plan preparation directives, the first of which is preparation of seven required general plan elements. The second directive requires the inclusion of content on climate change and environmental justice within the general plan. This information can be included in a stand-alone general plan element or can be weaved into other general plan elements. Each jurisdiction determines which form is most appropriate to local needs.

Chapter 8 of the 2017 General Plan Guidelines reemphasizes the climate adaptation discussion presented in the safety element content in General Plan Guidelines Chapter 4 and reminds jurisdictions that while the safety element may be "home" to adaptation discussions in the general plan, "climate change adaptation should be integrated throughout the elements of a general plan to create internal consistency and support holistic consideration of this

important issue."[73] General Plan Guidelines Chapter 8 also provides a listing of resources and climate change policy recommendations for use by local jurisdictions.

Local agencies are encouraged by California law to adopt Local Hazard Mitigation Plans (LHMPs) as part of their general plan safety elements.[74] The LHMP must be consistent with the goals and objectives of both the local general plan and the SHMP. As such, the general plan and LHMP provide a local vehicle for implementation of the SHMP, including provisions dealing with climate change.

OPR provides tools and guidance for use by local governments in address climate change including:

- Technical advisories and regulatory guidelines
- Coordination of state online resources that local governments can use to understand how climate change might affect their jurisdiction and how to reduce greenhouse gas (GHG) emissions
- Ongoing creation and support of a technical assistance and best practices learning network for local governments
- "Climate Changers," an innovative video initiative to share hot lessons and cool solutions. A full video library can be found on OPR's YouTube page at the following link: https://www.youtube.com/user/OPRClimateChange.

Guidance publications are available on OPR's web page: http://opr.ca.gov/.

OPR also provides technical advice on issues affecting land use planning including some advisory publications on climate change, adaptation, and action planning. These advisories, for use by local jurisdictions and public agencies, support integration of climate adaptation and action with general plans and other regulations. OPR's technical advisories are available at the following link: http://opr.ca.gov/ceqa/technical-advisories.html.

OPR has many ongoing partnerships and programs that help to produce case studies of replicable best practices, some of which are highlighted in the Best Practice Pilot Program (BP3). BP3 includes a collection of climate adaptation and resiliency action best practices in the process of being adopted and implemented at the local and regional levels around California. The intent of BP3 is to develop a comprehensive library of case studies for local and regional partners to use in their planning and policies, while informing state policy and providing training, tools, and networking opportunities for stakeholders. OPR is continually collecting a variety of case studies that are updated on an ongoing basis. For information about BP3 and other efforts, visit: http://opr.ca.gov/planning/land-use/case-studies/.

For further discussion of the 2017 General Plan Guidelines related to hazard mitigation integration and social justice and vulnerability, see *Sections 2.3.3* and *4.4.6*.

Cal-Adapt

In 2011, California launched Cal-Adapt, a web-based tool that allows users to see how climate is projected to change in local areas in California. Cal-Adapt has been designed to provide access to the wealth of data and information produced by the State's scientific and research community. Cal-Adapt affords the opportunity for jurisdictions and individuals to participate in community and knowledge-sharing activities.

Cal-Adapt's development is a key recommendation of the 2009 California Climate Adaptation Strategy:

> *"The California Energy Commission will develop the Cal-Adapt Web site that will synthesize existing California climate change scenarios and climate impact research and to encourage its use in a way that is beneficial for local decision-makers."* – Page 9, 2009 California Climate Adaptation Strategy

The Cal-Adapt tool was originally developed by UC Berkeley's Geospatial Innovation Facility (GIF) with funding and advisory oversight by the California Energy Commission (CEC)'s Public Interest Energy Research program. Since then, CEC has continued to support Cal-Adapt, and GIF released Cal-Adapt version 2.0 in August 2017, which includes new,

[73] State of California 2017 General Plan Guidelines, Governor's Office of Planning and Research, 2017, p232.
[74] AB 2140 provides financial incentives for local agencies to adopt LHMPs as part of the safety elements of their general plans.

higher-resolution climate projections; more powerful visualizations; improved access to data and a new public Applications Programming Interface (API); and connections with supporting resources.

The tool helps translate climate research from the scientific community into a format that is usable for local planning purposes through a combination of locally relevant information, visualization tools, and access to primary data. With continued funding support, Cal-Adapt can be maintained and enhanced so that it continues to serve as a central resource for those working on preparing for climate risks in California.

One feature of Cal-Adapt is a series of interactive maps and charts that can be used to obtain climate change impact statistics based on what climate change modeling predicts for specific locations within California. Maps and charts displaying temperature change, extreme heat, snowpack, precipitation, sea-level rise, and wildfire risk can be used to project future risk from climate change. Cal-Adapt also allows the user to evaluate different scenarios, such as GHG emissions scenarios, inundation scenarios, and seasonal weather pattern scenarios.

All data presented on Cal-Adapt are available for download and users can use the API to integrate climate projections for California into their own tools and workflows. For more information on Cal-Adapt, visit: http://cal-adapt.org/.

California Adaptation Planning Guide

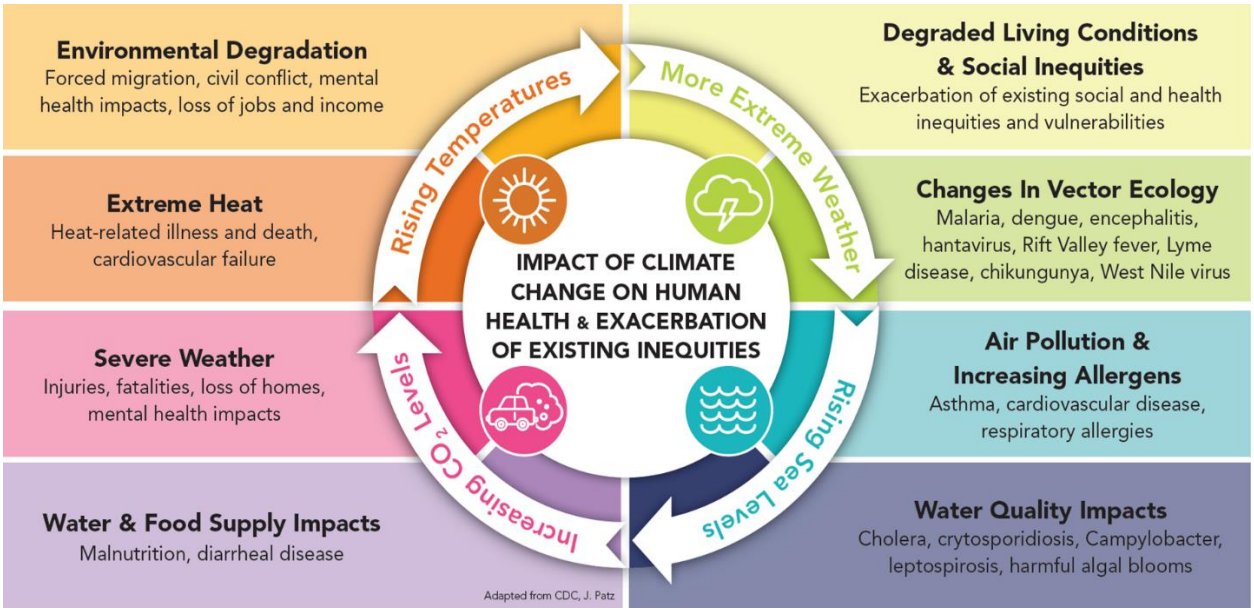
In 2012, the state released the California Adaptation Planning Guide (APG), a set of four complementary documents that provide guidance to support communities in addressing the unavoidable consequences of climate change. The APG provides a step-by-step guide for local and regional governments to assess relevant climate impacts in their area and develop local climate action plans. The APG is discussed in more detail in *Section 4.3.6.5*.

Climate Change and Health Equity Program

The Climate Change and Health Equity Program (CCHEP) promotes health as part of local "climate action planning" and regional sustainable community planning efforts under laws like SB 375 (2008), the Sustainable Communities and Climate Protection Act. CCHEP embeds health and equity in California climate change planning, and embeds climate change and equity in public health planning. CCHEP works with local, state, and national partners to assure that climate change mitigation and adaptation activities have beneficial effects on health while not exacerbating already existing unfair and preventable differences in health status of some groups (health inequities). CCHEP implements California's climate change laws and executive orders, adding health equity considerations to the process, and works to reduce vulnerability to climate impacts by improving living conditions with and for people facing inequities.

Climate change-related health impacts can include an increased number of cases of heat-related illness and death, more air pollution-related exacerbations of cardiovascular and respiratory diseases, increased injury and loss of life due to severe storms and flooding, increased occurrences of vector-borne and water-borne diseases, and stress and mental trauma from loss of livelihoods, property loss, and displacement. Figure 4.E provides a graphical representation of how climate change might affect human health and how these impacts exacerbate inequities.

Figure 4.E: Impact of Climate Change on Human Health and Exacerbation of Existing Inequities



Source: https://www.cdph.ca.gov/Programs/OHE/Pages/CCHEP.aspx

CDPH has a unique role in identifying and assessing GHG reduction strategies that improve the health of Californians or that may have unintentional harms. Many of the key strategies for reducing GHGs are some of the same strategies used by public health departments to improve community health and health equity. There are a number of co-benefit areas that can be actively linked within and across climate mitigation and healthy community efforts. These efforts can help achieve healthier communities in the short term, while also addressing longer-term climate risks. Cal OES' Office of Access and Functional Needs and CDPH work together to better understand the impact of climate change on access and functional needs populations and collaboratively plan for these considerations.

For more information about the CCHEP, visit: https://www.cdph.ca.gov/Programs/OHE/Pages/CCHEP.aspx#.

CalBRACE: California Building Resilience Against Climate Effects Project

The goals of the California Building Resilience Against Climate Effects (CalBRACE) project are to enhance CDPH's capability to plan for and reduce health risks associated with climate change. The program provides resources and technical assistance for the state and local public health departments to build climate adaptation capacity and enhance resilience at the local and regional levels.

Efforts are underway to identify and understand how climate change is affecting public health and to enhance preparedness and resilience to the specific threats and changes posed by climate change at the state and local level. Climate change threatens public health now and will continue to affect California's way of life. Some changes—including increased temperatures, drought, extreme storms, wildfires, rising sea-levels, ocean acidification, and decreased air quality—are already apparent in California.

The CalBRACE project focuses primarily on preparing for three of the major climate impacts facing our state: increasing temperature/extreme heat, wildfire, and sea-level rise (including flooding). In order to improve our understanding of the health implications of climate change, it is important to start with short and long-range climate projections. Then, climate change can be incorporated into a variety of public health planning and response activities.

The federal Centers for Disease Control and Prevention (CDC) has developed a five-step BRACE framework that enables health departments to incorporate the best available climate projections and epidemiology analysis into a traditional preparedness planning process. This approach supports the development and implementation of a unified climate and health adaptation strategy for a jurisdiction, while allowing flexibility for local and regional conditions and needs. The steps are not necessarily linear and can be addressed in a sequence that best aligns with local priorities, opportunities, and resources. Key principles for the framework include adaptive management, evidence-based public health practice, and stakeholder engagement.

For more information about CalBRACE, visit the CalBRACE program website: https://www.cdph.ca.gov/Programs/OHE/Pages/CalBRACE.aspx.

As part of CDPH's CalBRACE project, Climate Change and Health Profile Reports are published to help counties in California to prepare for the health impacts related to climate change through adaptation planning. The reports present projections for county and regional climate impacts, climate-related health risks, and local populations that could be vulnerable to climate effects. The report information is based on available science compiled from previously published, state-sponsored research and plans.

To download Climate Change and Health Profile Reports by county, visit CDPH's Climate Change and Health Profile Reports page: https://www.cdph.ca.gov/Programs/OHE/Pages/ClimateHealthProfileReports.aspx#.

California Environmental Health Tracking Program

The California Environmental Health Tracking Program (CEHTP) works to improve public health with science-based information on the trends and distributions of diseases and environmental threats, as well as the often complex relationships between them. To date, over 50 statewide programs routinely use CEHTP's web-based services to visualize and link environmental hazard and health data across time and geography, and to explore possible associations between the environment and health outcomes.

CEHTP collaborates with diverse stakeholders including community organizations, local health departments, researchers, and journalists who use the CEHTP website as an essential tool for surveillance, research, program planning, and reporting. Additionally, CEHTP expertise has informed cutting-edge public health projects such as mapping community vulnerability to climate change, evaluating autism-pesticide associations, and conducting statewide mapping of breast cancer at the sub-county level. Visit the CEHTP website at http://cehtp.org/page/main.

4.3.6.5 LOCAL AND REGIONAL CLIMATE ADAPTATION PLANNING

It is now clear that the scientific community generally expects natural disasters to intensify due to climate change in the coming decades. Emergency managers, planning agencies, private companies, and communities especially affected by climate change will be challenged to adapt their planning to take into account an increase in the type, extent, and intensity of natural hazards.

Disasters expected to be more widely experienced in the future include avalanches, coastal erosion, flooding, sea-level rise, extreme heat, drought, landslides, severe weather and storms, and wildland fires. Particular interest and priority should be given to those climate change impacts having the potential to escalate to catastrophic levels.

Senate Bill 379 (2015)

SB 379 requires all cities and counties to include climate adaptation and resiliency strategies in the safety elements of their general plans upon the next revision of their Local Hazard Mitigation Plan on or after January 1, 2017, or, if the local jurisdiction has not adopted a local hazard mitigation plan, beginning on or before January 1, 2022. These are additional requirements beyond those related to seismic and geologic factors. The intent of the legislation is to ensure that cities, counties, and other local jurisdictions integrate adaptation into their general planning process.

SB 379 requires the update to: include a set of goals, policies, and objectives based on a vulnerability assessment; identify the risks that climate change poses to the local jurisdiction and the geographic areas at risk from climate change impacts; and provide implementation measures, which include the conservation and utilization of natural infrastructure that may be used in adaptation projects.

Jurisdictions can meet the requirements of SB 379 by including the relevant information into their Local Hazard Mitigation Plan (LHMP) and adopting the LHMP into the safety element of their general plan. Cal OES and OPR are working with other stakeholders to coordinate the implementation of this bill and support the alignment of general plans and LHMPs through guidance provided in the 2017 General Plan Guidelines. Other state adaptation resources such as the California Adaptation Planning Guide, and sector specific guidance, discussed in more detail below, are also available for use by local jurisdictions to support their climate adaptation efforts.

General Plan Guidelines – Adaptation Guidance for SB 379 (2015) Implementation

The recent introduction of climate risk to the discussion of the safety element, adds a focus on longer-term preparation and adaptation by each community to address a changing climate. Senate Bill 379 (2015) establishes a state-mandated climate adaptation requirement and further strengthens the safety element's hazard mitigation content by requiring that climate adaptation and resiliency strategies applicable to the jurisdiction be addressed its next required general plan element update.

The 2017 General Plan Guidelines provide a description of the requirements and timing of updates for climate change adaptation that must be addressed in the safety element and note that, while the safety element is the "statutory 'home'"[75] for the climate change adaptation discussion, this issue should be addressed throughout a jurisdiction's general plan. The 2017 General Plan Guidelines note the importance of consideration of the end year of a jurisdiction's general plan and the changes to future conditions and environmental change that may occur through that time frame to guide long-range policy. To support jurisdictions in addressing climate change, OPR has included a full chapter on climate change that offers additional guidance on how a jurisdiction might link its general plan to a climate action plan or adaption plan.

The 2017 General Plan Guidelines notes that numerous tools are now available to support the climate change analysis outlined by the APG steps and that OPR's Integrated Climate Adaptation Resiliency Program (ICARP) webpage includes case studies which can be helpful to a jurisdiction's adaptation analysis and planning efforts. ICARP staff are also available to provide support to jurisdictions to choose appropriate resources. The General Plan Guidelines also encourage jurisdictions to consider working with regional collaboratives, such as collaboratives working through the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), to identify opportunities to partner on analysis or implementation efforts.

To further support local jurisdictions' climate change analysis, OPR has launched the General Plan Guidelines Data Mapping Tool, which can be used in conjunction with outputs from Cal-Adapt (see *Section 4.3.6.4* for more information on Cal-Adapt). This mapping tool is a free resource that draws from data sets from multiple sources to allow users to incorporate local, regional, and statewide data in their general plans. For access to the mapping tool, visit: http://opr.ca.gov/planning/general-plan/data-mapping-tool.html.

See Chapters 4 and 8 of the 2017 General Plan Guidelines, which can be downloaded from the OPR website: http://opr.ca.gov/.

California's Adaptation Planning Guide: Steps in Climate Adaptation Strategy Development

The APG was developed cooperatively by the California Natural Resources Agency and California Emergency Management Agency (now Cal OES), with support from California Polytechnic State University San Luis Obispo, and with funding through the Federal Emergency Management Agency (FEMA) and the California Energy Commission (CEC).

[75] Governor's Office of Planning and Research. State of California 2017 General Plan Guidelines. 2017. pp152.

The APG consists of the following four documents:

- *APG: Planning for Adaptive Communities* – This document presents the basis for climate change adaptation planning and introduces a step-by-step process for local and regional climate vulnerability assessment and adaptation strategy development. All communities should start with this document.
- *APG: Defining Local and Regional Impacts* – This supplemental document provides a more in-depth understanding of how climate change can affect a community. Seven "impact sectors" are included to support communities conducting a climate vulnerability assessment.
- *APG: Understanding Regional Characteristics* – The impact of climate change varies across the state. This supplemental document identifies climate impact regions, including their environmental and socioeconomic characteristics.
- *APG: Identifying Adaptation Strategies* – This supplemental document explores potential adaptation strategies that communities can use to meet adaptation needs. Adaptation strategies are categorized into the same impact sectors used in the APG: Defining Local and Regional Impacts document.

In accordance with SB 246, the APG is required to be reviewed and updated within one year of Safeguarding California updates. The state is in the process of reviewing the APG with other stakeholders and the final updated products are anticipated to be available to the public in the summer of 2019.

The state developed the APG as a step-by-step guide for local and regional governments to assess relevant climate impacts in their area and develop local climate action plans. The APG serves as a foundational resource for climate adaptation planning in California. Ongoing implementation of Senate Bill 379 relies heavily on the APG to assist local governments with general plan updates.

The process of developing climate change adaptation strategies can vary from a short, initial qualitative process to a much more detailed, lengthy, comprehensive approach. Regardless of where a community falls in this spectrum, the basic steps are the same, as follows:

Vulnerability Assessment

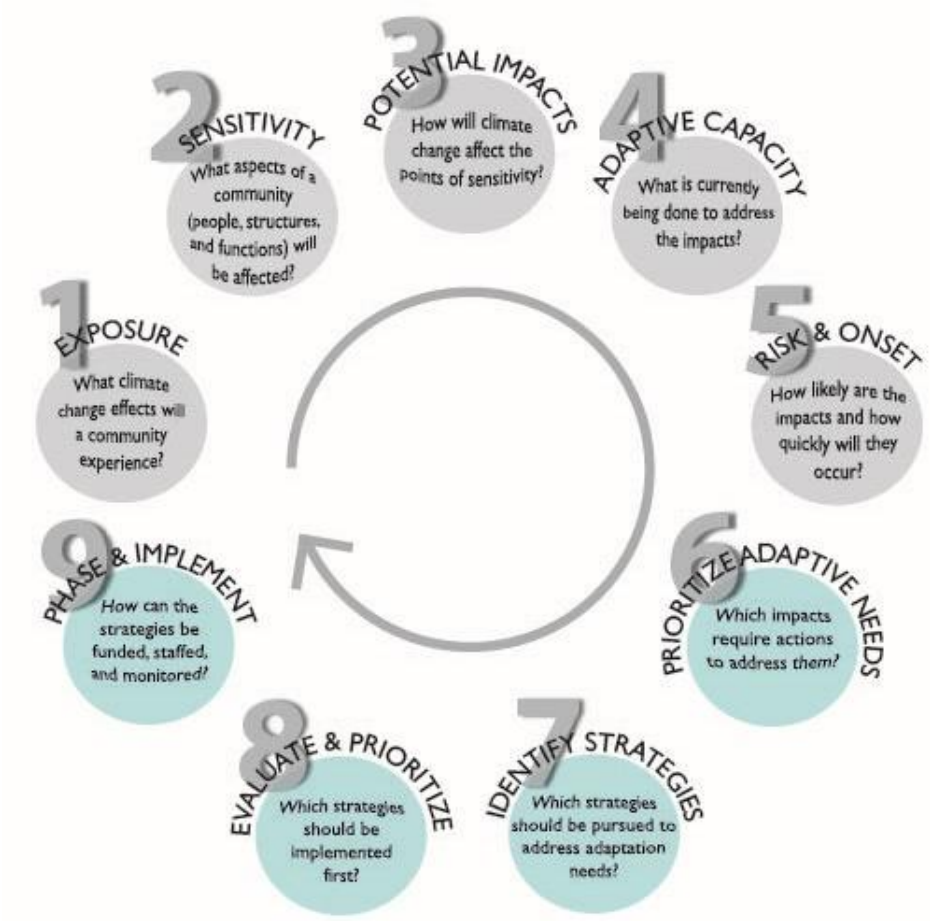
1. Exposure: Identify the climate change effects a community will experience
2. Sensitivity: Identify the key community structures, functions, and populations that are potentially susceptible to each climate change exposure
3. Potential Impacts: Analyze how the climate change exposure will affect the community structures, functions, and populations (impacts)
4. Adaptive Capacity: Evaluate the community's current ability to address the projected impacts
5. Risk and Onset: Adjust the impact assessment to account for uncertainty, timing, and adaptive capacity

Adaptation Strategy Development

6. Prioritize Adaptive Needs: Based on the vulnerability assessment, set priorities for adaptation needs
7. Identify Strategies: Identify strategies to address the highest priority adaptation needs
8. Evaluate and Prioritize: Evaluate and rank strategies based on the projected onset of the impact, projected cost, co-benefits, and other feasibility factors
9. Phase and Implement: Develop an implementation plan that includes phasing of strategies and a monitoring system to assess effectiveness

In Figure 4.F, the gray steps indicate vulnerability assessment efforts (Steps 1-5) and the blue steps indicate adaptation strategy development efforts (Steps 6-9).

Figure 4.F: The Nine Steps in Adaptation Strategy Development



Source: California APG: Defining Local and Regional Impacts

A key to execution of *Step 1: Identifying Community Exposure* is using available online climate change resources such as Cal-Adapt or other available regional data. Since projected changes to the climate vary based on location, each community must determine what primary climate change impacts, and in some cases associated secondary impacts, may be experienced in their locale. Cal-Adapt serves as good starting point for California communities to determine local and regional climate exposure.

Cal-Adapt's website includes the next generation of downscaled climate data for temperature, precipitation, and snowpack. Cal-Adapt is discussed in more detail in *Section 4.3.6.4*. For more information on Cal-Adapt visit: http://cal-adapt.org/. Communities seeking to understand their vulnerability to climate change and develop strategies to address the issue should refer to the APG: http://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/california-climate-adaptation.

Progress Summary 4.A: California Adaptation Planning Guide (APG) Updates

Progress as of 2018: Released in 2012, the California Adaptation Planning Guide (APG), was developed by the state to provide guidance and support to communities in addressing the unavoidable consequences of climate change. The APG introduces the basis for climate change adaptation planning and details a step-by-step process for local and regional climate vulnerability assessment and adaptation strategy development.

In October 2015, Senate Bill 246 was passed, requiring the California Governor's Office of Emergency Services (Cal OES) to review and update (as necessary) the California Adaptation Planning Guide (APG) within one year of an update to Safeguarding California. Updates to Safeguarding California were completed in early 2018. As of early 2018, the APG is in the process of being reviewed and updated by Cal OES and other stakeholders and is anticipated to be available to the public sometime in 2019.

State Adaptation Progress and Resources for Jurisdictions

In addition to the APG, other guidance documents from state agencies are intended to assist local governments in planning for climate change. While the 2018 Safeguarding California Plan provides a comprehensive picture of California's continued needs with respect to preparing for climate impacts and sector specific strategies, more in-depth, sector-specific guidance, policies, and actions are also being developed and/or updated. State progress to date includes, but is not limited to, the documents and other resources listed in Table 4.I.

Progress Summary 4.B: Additional Local Climate Adaptation Guidance Sources

Progress as of 2018: California state agencies continue to prepare additional guidance documents to assist local governments in planning and preparing for climate change. These documents assist local planners and managers in assessing risk, identifying at risk-assets and populations, and developing climate adaptation policies and strategies. Table 4.I lists many of the adaptation guidance documents and efforts by state agencies.

Table 4.I: Climate Adaptation Sector Specific Guidance

Lead Agency	Guidance Document	Resource Website
AGRICULTURE SECTOR		
California Department of Food and Agriculture	2012 California Department of Food and Agriculture launch of the Climate Change Consortium to help specialty crop growers prepare for climate impacts	https://www.cdfa.ca.gov/oefi/climate/climate_change_consortium.html
California Energy Commission	2009 Potential for Adaptation to Climate Change in an Agricultural Landscape in the Central Valley of California	http://www.energy.ca.gov/2009publications/CEC-500-2009-044/CEC-500-2009-044-F.PDF
BIODIVERSITY SECTOR		
Department of Fish and Wildlife	Habitat Connectivity Planning for Fish and Wildlife Program and the 2010 California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California	https://www.wildlife.ca.gov/Conservation/Planning/Connectivity https://www.wildlife.ca.gov/Conservation/Planning/Connectivity/CEHC
Department of Fish and Wildlife	2011 Vision for Confronting Climate Change in California: Unity-Integration-Action; Climate Science Program	https://www.wildlife.ca.gov/Conservation/Climate-Science
COAST & OCEANS SECTOR		
State Coastal Conservancy	Climate Ready Program supporting planning, project implementation, and multi-agency coordination to advance actions that will increase the resilience of coastal communities and ecosystems	http://scc.ca.gov/climate-change/

Lead Agency	Guidance Document	Resource Website
Ocean Protection Council	Rising Seas in California: An Update on Sea-Level Rise Science	http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf
Ocean Protection Council	State of California Sea-Level Rise Guidance Document 2018 Update	http://www.opc.ca.gov/updating-californias-sea-level-rise-guidance/
California Coastal Commission	2015 Sea-level Rise Policy Guidance – Interpretive Guidelines for Addressing Sea-level Rise in Local Coastal Programs and Coastal Development Permits *(2018 update pending)*	https://documents.coastal.ca.gov/assets/slr/guidance/August2015/0_Full_Adopted_Sea_Level_Rise_Policy_Guidance.pdf
San Francisco Bay Conservation and Development Commission	Adapting to Rising Tides Program	http://www.adaptingtorisingtides.org/
California Coastal Commission (CCC)	Local Coastal Programs Activity	https://www.coastal.ca.gov/lcps.html
National Oceanic and Atmospheric Administration (NOAA)	Coastal Plan Alignment Compass	https://resilientca.org/topics/plan-alignment/
ELECTRICITY & NATURAL GAS SECTOR		
California Energy Commission	2013 Integrated Energy Policy Report that includes policy recommendations on vulnerability of the California energy system to extreme weather events and climate change	http://www.energy.ca.gov/2013_energypolicy/index.html
California Energy Commission	Our Changing Climate 2012: Vulnerability & Adaptation to the Increasing Risks from Climate Change in California	http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf
California Public Utilities Commission	2016 Climate Adaptation in the Electric Sector: Vulnerability Assessments and Resiliency Plans	http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/PPD%20-%20Climate%20Adaptation%20Plans.pdf
FORESTRY SECTOR		
California Department of Forestry and Fire Protection (CAL FIRE)	2012 relaunch of the CAL FIRE wildfire preparedness website with added features and steps to assist homeowners in preparing for wildfires	www.ReadyForWildfire.org
CAL FIRE	Tree Mortality Task Force, that mainly documents Task Force work but, also provides information on grants for tree mortality efforts	http://www.fire.ca.gov/treetaskforce/
LAND USE SECTOR		
Climate Change Land Use & Infrastructure (CCLU)	Climate Change, Land Use, and Infrastructure Web Portal (The CCLU working group is a multi-agency subcommittee to the Climate Action Team)	http://www.climatechange.ca.gov/action/cclu/
PUBLIC HEALTH SECTOR		
Department of Public Health	California Environmental Health Tracking Program, climate change topic area	http://cehtp.org/page/climate_change

Lead Agency	Guidance Document	Resource Website
Public Health Alliance of Southern California	California Healthy Places Index interactive data and mapping tool providing snapshots of the social determinants of health across the state	http://healthyplacesindex.org/
Office of Environmental Health Hazard Assessment (OEHHA)	2018 Office of Environmental Health and Hazard Assessment Indicators of Climate Change in California	https://oehha.ca.gov/climate-change/document/indicators-climate-change-california
Department of Public Health	California Building Resilience Against Climate Effects (CalBRACE) Climate Change and Health Profile report (one for each county)	https://www.cdph.ca.gov/Programs/OHE/Pages/ClimateHealthProfileReports.aspx#
Natural Resources Agency	California Heat Adaptation Tool (CHAT) (developed by Four Twenty Seven)	www.cal-heat.org http://427mt.com/cal-heat/
Department of Public Health	2013 Preparing California for Extreme Heat: Guidance and Recommendations	http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf
Department of Public Health	2012 Climate Action for Health: Integrating Public Health into Climate Action Planning	https://www.cdph.ca.gov/Programs/OHE/Pages/CCHEP.aspx
OEHHA	2010 Indicators of Climate Change in California: Environmental Justice Impacts	https://oehha.ca.gov/media/downloads/risk-assessment/document/climatechangeej123110.pdf
STATE GOVERNMENT OPERATIONS		
Department of Fish and Wildlife	2012-2013 launch of the Climate College to promote climate literacy by providing open lectures on the fundamentals of climate science and providing tools and resources necessary to empower participants to better incorporate climate change into their professional responsibilities	http://www.dfg.ca.gov/Climate_and_Energy/Climate_Change/Climate_College/
TRANSPORTATION		
Department of Transportation (Caltrans)	Climate Change Vulnerability Assessments: 2017 District 4 Technical Report	http://www.dot.ca.gov/transplanning/ocp/vulnerability-assessment.html
Caltrans	2014 District 1 Climate Change Pilot Study	http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/projects_and_studies.shtml
Caltrans	2013 California Department of Transportation release of "Addressing Climate Change Adaptation in Regional Transportation Plans - A Guide for California MPOs and RTPAs"	http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/assessment.shtml
Caltrans	2012 Cool Pavements Bill (Assembly Bill 296) regarding materials that can be used to reduce extreme heat in urban areas	http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0251-0300/ab_296_bill_20120927_chaptered.pdf
Caltrans	2011 California Department of Transportation Guidance for Incorporating Sea-level Rise for Use in the Planning and Development of Project Initiation Documents	http://www.dot.ca.gov/ser/downloads/sealevel/guide_incorp_slr.pdf

Lead Agency	Guidance Document	Resource Website
WATER		
Department of Water Resources NOAA California Ocean Science Trust	October 2016 Relating Future Coastal Conditions to Existing FEMA Flood Hazard Maps: Technical Methods Manual	http://www.oceansciencetrust.org/wp-content/uploads/2016/12/Technical-Methods-Manual_FINAL_2016_12_02_clean.pdf
Department of Water Resources	2011 Climate Change Handbook for Regional Water Planning developed cooperatively by Department of Water Resources, the U.S. Environmental Protection Agency, Resources Legacy Fund and the U.S. Army Corps of Engineers	https://www.water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Integrated-Regional-Water-Management/Files/Climate_Change_Handbook_Regional_Water_Planning.pdf
State Water Resources Control Board (SWRCB)	SWRCB Comprehensive Response to Climate Change (Resolution No. 2017-0012), which builds on previous work and requires a proactive approach to climate change in all board actions with the intent to embed climate change consideration into all programs and activities	https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2017/rs2017_0012.pdf

Progress on preparing for climate impacts in California is not limited to state efforts. As noted in the 2009 CAS, the federal government, tribes, local and regional governments, businesses, non-governmental organizations, and Californians all play an important role in preparing for climate impacts. The 2014 CAS Update (Safeguarding California) describes some of the successes of non-state entities and individuals, as well as a number of collaborative efforts.

Continued cooperation and innovative solutions will be important in ensuring resilient California communities. Significant local adaptation efforts are underway around the state to address various impacts of climate change.

Progress Summary 4.C: Creation of a Coastal Plan Alignment Compass: A Planning Tool for Coastal Communities

New as of 2018: During 2017 and 2018, the California Governor's Office of Planning and Research (OPR), California Coastal Commission (CCC), the Ocean Protection Council (OPC), Cal OES, and other state agencies collaborated with National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), and FEMA in an informal working group to develop a coastal plan alignment tool for local jurisdictions. This tool supports efforts by local jurisdictions to align local coastal programs with local hazard mitigation plans, as well as general plans and adaptation plans.

Guidance in the Compass explains common elements between various plans and how these elements can be can be aligned across planning documents to further support adaptation and mitigation efforts, and assists local governments to begin to coordinate plans.

For more information about the compass, visit: https://resilientca.org/topics/plan-alignment/.

Best Practices Highlight 4.A: Santa Cruz County Plan for Climate Action and Adaptation

In 2017, the Santa Cruz County Board of Supervisors approved a county Climate Action Strategy that incorporated adaptation efforts. In addition to addressing greenhouse gas emissions through emission reduction targets and strategies, the Strategy also identified the vulnerabilities to climate change that the county is expected to face by 2100, but acknowledges that uncertainly is a condition that must be accepted and dealt with through the decision-making process. Based on these identified vulnerabilities, the Strategy provides a risk assessment of the effects of climate change, followed by goals and strategies to assist in reducing significant impacts from climate change. A key element of the Strategy is its structure, which emphasizes partnership between public and private county stakeholders to achieve the Strategy's eight adaptation goals.

Other Climate Change Adaptation Resources

California Energy Commission California Climate Change Center Report Series

In 2012, the California Energy Commission's California Climate Change Center commissioned the preparation of case studies evaluating regional climate adaptation efforts. These studies resulted in white papers that in part, identified adaptation barriers encountered by the jurisdictions evaluated and define lessons from these adaptation efforts to help inform future research priorities and policies.

Case studies can be downloaded at the following links:
http://www.energy.ca.gov/2012publications/CEC-500-2012-034/CEC-500-2012-034.pdf
http://www.energy.ca.gov/2012publications/CEC-500-2012-038/CEC-500-2012-038.pdf
http://www.energy.ca.gov/2012publications/CEC-500-2012-027/CEC-500-2012-027.pdf

National Disaster Resilience Competition Award: A Model of Large-Scale Co-Benefit Climate Adaptation

California will receive more than $70 million in federal funding for an innovative disaster recovery and resilience program in Tuolumne County following the devastating 2013 Rim Fire. The funding, part of the U.S. Department of Housing and Urban Development's National Disaster Resilience Competition, will be used to help restore forest and watershed health, support local economic development and increase disaster resilience in the rural mountain areas affected by the fire.

The funding will be used to pilot Tuolumne County's Community and Watershed Resilience Program, which will provide co-benefits of supporting forest and watershed health and economic development, develop a community resilience center, and create a long-term economically and environmentally sustainable program that can be replicated throughout the state. For more information about the program, visit: http://www.tuolumnecounty.ca.gov/951/National-Disaster-Resilience-Competition.

4.4 ENVIRONMENTAL JUSTICE, EQUITY, AND HAZARD MITIGATION IN CALIFORNIA

The United States Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." The EPA notes that within the goal of environmental justice all persons would be afforded "the same degree of protection from environmental and health hazards."[76]

Since President Clinton's signing of Executive Order 12898 on Environmental Justice in 1994, the environmental justice movement has gained greater mainstream awareness. The 1994 executive order mandated that federal agencies address disproportionate pollution experienced by minority communities.

In California, environmental justice is defined in Government Code as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (Government Code Section 65040.12(e)).

Environmental justice principles are an important part of the California Environmental Protection Agency (CalEPA) goal to restore, protect, and improve the environment, and to ensure the health of people, the environment, and the economy.

According to the State of California 2017 General Plan Guidelines (GPG) the environmental justice field has expanded significantly and now overlaps with equity and healthy community issues, as evidenced by the 2016 environmental justice legislation, Senate Bill 1000. As such, Chapter 5 of the 2017 GPG specifically addresses "Equitable and Resilient Communities" and also "Healthy Communities."

Inequities are systemic differences that disadvantage an individual or group in favor of another. Equity is the full and equal access to opportunities, power, and resources so that all people achieve their full potential and thrive.[77,78]

4.4.1 SOCIAL VULNERABILITY

According to the Centers for Disease Control and Prevention (CDC), a number of factors, including poverty, lack of access to transportation, and crowded housing may weaken a community's ability to prevent human suffering and financial loss in the event of disaster. These factors are known as social vulnerability.[79]

Social vulnerability varies across communities and also across households within communities. Variations in social vulnerability can increase or decrease the effect of hazard exposure. Three impact conditions—social vulnerability, structural vulnerability, and hazard exposure—can largely determine the effects of a disaster.

The resilience of a community when confronted by external stresses on human health—stresses such as natural or human-caused disasters, or disease outbreaks—is influenced by its level of social vulnerability. Reducing social vulnerability can increase a community's resilience and decrease both human suffering and economic loss.

In Executive Order B-30-15 Governor Brown declared that "climate change will disproportionately affect the state's most vulnerable citizens," and thus "State agencies' planning and investment shall…protect the state's most vulnerable populations." The state is developing guidance to help agencies identify vulnerable populations to help reduce their vulnerability to disaster impacts by providing increased resources, training, services, jobs, access to meaningful participation in decision-making, or other benefits that increase equity. Promoting equity can be thought of as consideration of how and why some communities face more disaster impacts and therefore deserve more investment and services.

[76] https://www.epa.gov/environmentaljustice
[77] King County, Washington. King County Equity and Social Justice Strategic Plan, 2016-2020. 2016. Available at http://your.kingcounty.gov/dnrp/library/dnrp-directors-office/equity-social-justice/201609-ESJ-SP-INT-ToC-Strat-VAL.pdf
[78] King County Equity and Social Justice Ordinance (16948)
[79] https://stacks.cdc.gov/view/cdc/27762/Share

Climate change and its effects threaten the health and well-being of California's diverse population of nearly 38 million people. Climate change affects human health and well-being through environmental changes including more extreme heat and other severe weather events, a decline in air quality, more frequent wildfires, increases in allergens, and altered environmental conditions that foster the spread of communicable and other diseases. Climate change also threatens the basic life support systems on which humans depend—water, food, shelter, clean air, and security. The resulting human health impacts include increases in the risk of asthma, allergies, and other respiratory ailments; cardiovascular disease; vector-borne diseases; mental illness; cognitive impairment; civil conflicts and migrations; malnutrition; injuries; and heat-related illness and death.[80,81] These challenges amplify risks among the state's most vulnerable populations, making climate change a threat multiplier.

While all Californians are affected by climate change, different groups are affected in unique and overlapping ways. The people most vulnerable to the impacts of climate change are largely the same communities that already experience health inequities, or systemic differences in health status that are preventable and therefore considered unfair. Consequently, climate change has the potential to exacerbate a wide array of pre-existing inequities and conditions of vulnerability for many already-disadvantaged people. Those most vulnerable to climate change impacts are low-income people, some communities of color, people with disabilities, people with existing health conditions such as chronic diseases and mental illness, young children, older adults, people experiencing homelessness, outdoor workers including farmworkers, immigrants and refugees, people who are linguistically isolated, indigenous people and tribal nations, individuals who are or have been incarcerated, lesbian, gay, bisexual, transgender, queer, and questioning (LGBTQQ) communities and people who are physically or socially isolated.[82,83,84]

These populations are more vulnerable to climate change impacts for a number of distinct or overlapping reasons. First and foremost, due to existing inequities, institutionalized racism, or exclusion, people in these groups often have lower socio-economic status, with its attendant lack of resources and economic and political power. Vulnerable populations often also experience higher rates of health and living conditions that may be affected by extreme weather impacts, such as asthma or cardiovascular disease, poor housing quality, living in high-poverty neighborhoods or areas with high risk of harm from sea-level rise, extreme heat, drought, wildfire, or poor air quality associated with climate change. Vulnerable populations often have less adaptive capacity to manage extreme weather events and adapt to a changing climate. In many cases, people in these groups are not inherently vulnerable to these impacts. Rather, their vulnerability is created by social, economic, and other systems that inequitably distribute power and resources.

Other populations that have been shown to be at higher risk of harm from climate change impacts include people who are uninsured or underinsured or lack access to health care, lack access to transportation; are pregnant; live in areas with poor air quality; live on upper floors of tall buildings; live in areas with lots of impervious surfaces and little tree cover and lack life-supporting resources such as adequate housing, ways to cool living space, food security, and medications; or are tenants or renters.

In addition, people often are affected by multiple forms of vulnerability at once. For example, an individual may experience racism, have a low income, and live in substandard housing without tree cover and surrounded by impervious surfaces, and thus may experience higher risk of heat illness, respiratory illness, and cardiovascular disease. State agencies can provide resources to improve living conditions and reduce multiple forms of vulnerability at once through strategic investments and involvement of vulnerable populations in policy decisions. The capacity for climate resilience is significantly driven by living conditions and the forces that shape them including income, education, housing, transportation, environmental quality, and access to services.

[80] https://www.epa.gov/environmentaljustice
[81] King County Equity and Social Justice Ordinance (16948).
[82] California Health and Safety Code Section 131019.5
[83] California Natural Resources Agency. Safeguarding California: Reducing Climate Risk. 2014.
[84] Shonkoff SB, Morello-Frosch R, Pastor M, Sadd J. The climate gap: environmental health and equity implications of climate change and mitigation policies in California – a review of the literature. Climate Change. 2011;109(1):485-503.

Vulnerable communities have historically experienced lack of investment and opportunities, leading to degraded living conditions and limited influence over decisions that affect their lives. Therefore, achieving a fair distribution of power and access to resources will require *extra* (not equal) investment and *additional* opportunities in and for these communities. Efforts to achieve this broad-based fairness, and ultimately well-being, involve striving for equity.

Decisions, plans, and investments by state and local agencies can help residents least able to cope with damage to their homes, communities, and physical and mental health. This can be achieved by making services and resources for vulnerable populations a top priority, so that their quality of life is not worsened due to disasters, but rather their living standard is improved through hazard mitigation-related investments, and reliable avenues for meaningful participation in decision-making.

In the 2018 SHMP, the CDC definition forms the basis for a California-specific social vulnerability approach as explained in *Section 4.4.4* of this chapter.

In California, the highest concentrations of socially vulnerable communities occur in the highly populated San Francisco Bay, Los Angeles-San Bernardino, and San Diego areas, as well as in rural and urban areas of the Central Valley. Smaller concentrations of socially vulnerable communities can be found in other rural areas including the foothills and north coast.

4.4.2 HEALTH EQUITY

Environmental injustice and social vulnerability are two contributing factors to health inequities, or preventable and systemic differences in health status among groups. Working to achieve health equity involves eliminating systemic and preventable differences in health status among groups that are strongly associated with social disadvantage and unequal access to resources and opportunity. The state of health equity is full and equal access for all people to opportunities that enable them to lead healthy lives, with a focus on improving conditions for those who have had fewer opportunities.

4.4.3 HAZARD EVENTS AND DISPROPORTIONATE IMPACTS ON ENVIRONMENTAL JUSTICE COMMUNITIES AND SOCIALLY VULNERABLE POPULATIONS

Today the concept of environmental justice is applied beyond environmental pollution to identify communities with disproportionate exposure to and lack of capacity to address or respond to natural hazards (such as floods or hurricanes) and climate change. Environmental justice communities are disproportionately:

- More vulnerable to disasters and illness
- More vulnerable to extreme heat
- More likely to be in areas with higher rates of air pollution
- More likely to be at risk from energy and food price shocks
- More economically vulnerable to disaster[85]

The conditions in which people live, learn, work, and play affect individual and community vulnerability to disasters. These vulnerabilities are further deepened by climate change, which exacerbates existing health threats and creates new public health challenges. Disadvantaged, vulnerable, and environmental justice communities have thus far and will likely bear a disproportionate burden of climate change impacts.

For example, temperatures in most urban areas are significantly higher than in less urbanized areas because pavement and building materials absorb sunlight and heat. This is known as the urban heat island effect. The most intense effects are often in neighborhoods where impervious paved surfaces predominate, and trees, vegetation, and parks are less common. These features are not evenly or fairly distributed. Nationally, African-Americans were

[85] https://www.epa.gov/sites/production/files/2015-10/documents/post_2_-_environmental_justice_climate_change.pdf

52 percent more likely, Asians 32percent more likely, and Hispanics 21 percent more likely than Whites to live in areas where impervious surfaces covered more than half the ground, and more than half the population lacked tree canopy.[86] Populations of color are less likely to have air conditioning, more likely to have one or more chronic conditions, and less likely to own cars to escape from climate-related events such as extreme heat, floods, or wildfires.[87,88,89]

This vulnerability to extreme heat is further compounded for low-income communities, which are less likely to have access to heat adaptive features. Communities facing inequities, which have the fewest resources to adapt, feel the impacts of climate change first and are hit the hardest. As climate impacts become more pronounced across the state, climate adaptation efforts focused on communities most vulnerable to potential increased burdens from the effects of climate change, such as air emissions and extreme heat days, will be increasingly important.

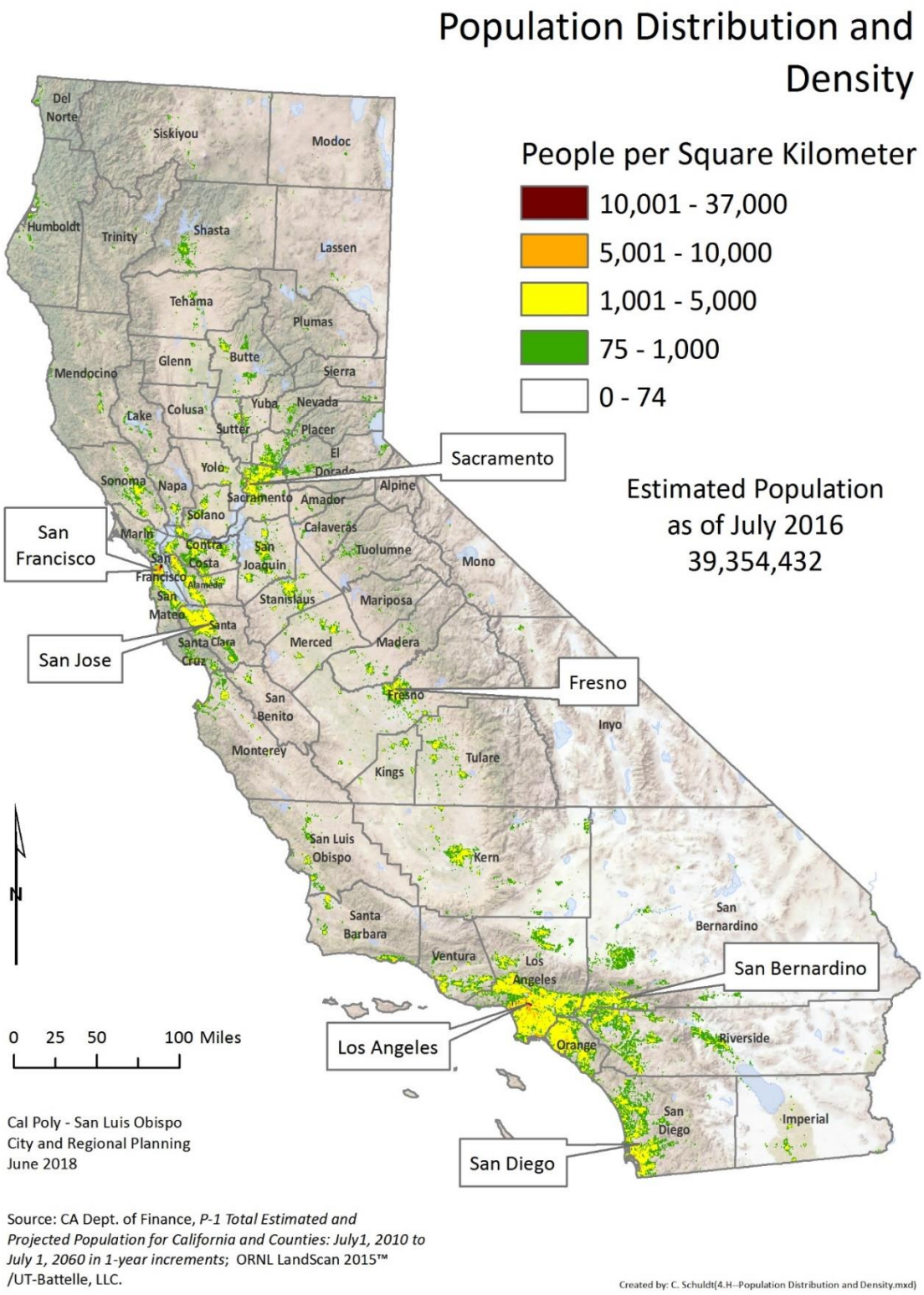
While it is broadly recognized that environmental justice communities experience a disproportionate amount of chronic exposures and risks, as discussed above, it is important to note vulnerabilities to acute exposures resulting from hazardous material releases due to earthquakes, floods, or other natural or human-induced disasters. For example, a study in Houston, Texas found that linguistically isolated households tend to reside in areas with greater exposure to severe incidents that may require public evacuation, yet such households are likely to face evacuation problems should an incident occur.[90]

In addition to linguistic isolation, evacuation challenges in disadvantaged communities may include lacking a car or other transportation, inability to access information, or not having outside support. This is an important consideration for any neighborhood with facilities that store or use hazardous substances, where infrastructure damage due to a natural disaster could result in a chemical release.

See Maps 4.I and 4.J for an overview of areas of the state with higher population densities and areas of highest concentrations of social vulnerability based on based on the index detailed in *Appendix N*.

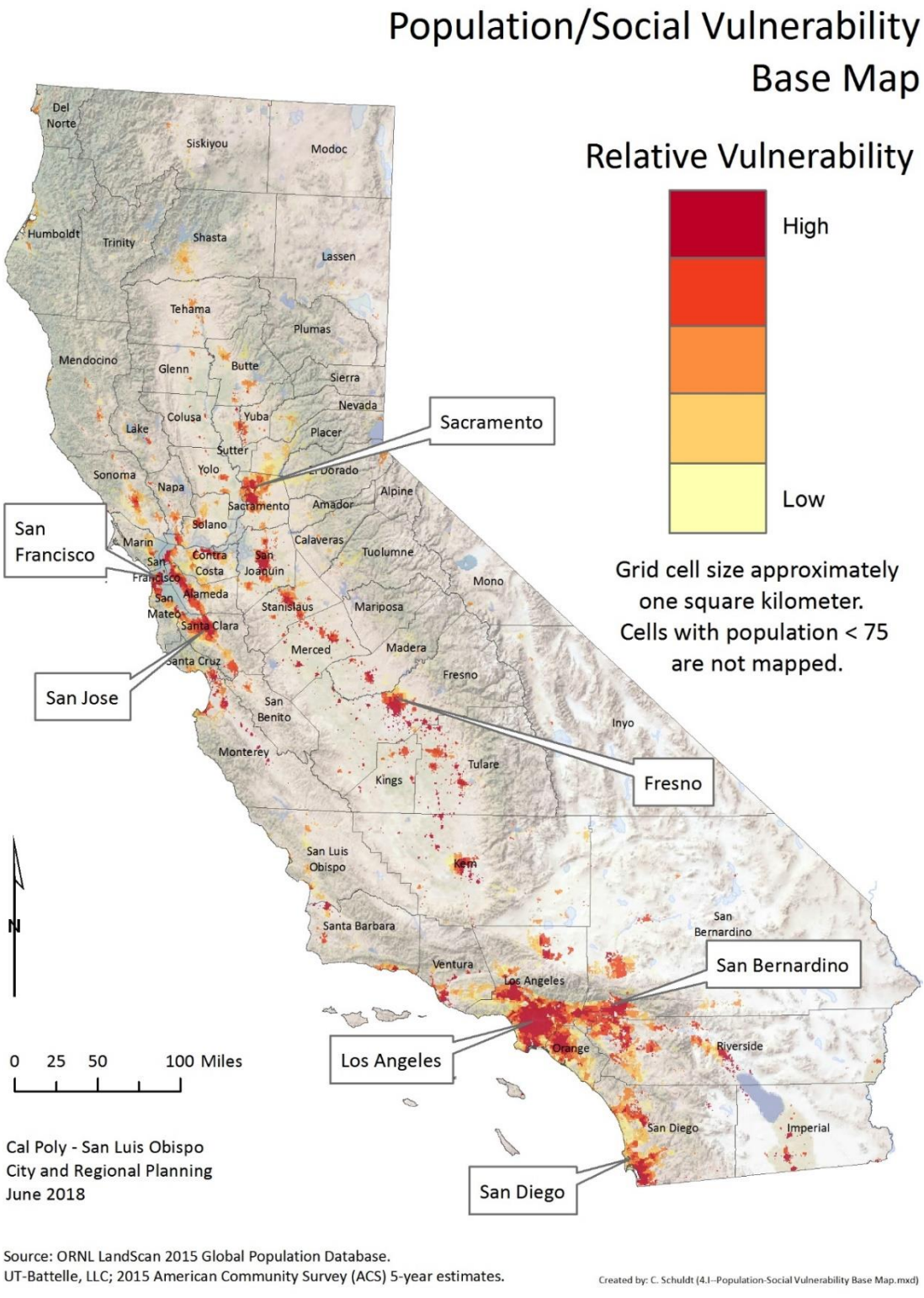
[86] Jesdale BM, Morello-Frosch R, Cushing L. The racial/ethnic distribution of heat risk-related land cover in relation to residential segregation. Environ Health Perspect. 2013 Jul;121(7) 811-817.
[87] Shonkoff SB, Morello-Frosch R, Pastor M, Sadd J. The climate gap: environmental health and equity implications of climate change and mitigation policies in California – a review of the literature. Climate Change. 2011;109(1):485-503.
[88] English P, Richardson M, Morello-Frosch R, Pastor M, Sadd J, King G, Jesdale W and Jerrett M. Racial and income disparities in relation to a proposed climate change vulnerability screening method for California. 2013. International Journal of Climate Change: Impacts & Responses, 4(2).
[89] Gronlund CJ. Racial and socioeconomic disparities in heat-related health effects and their mechanisms: a review. Current Epidemiology Reports. 2014. 1(3) 165-173.
[90] Chakraborty, et al. Comparing Disproportionate Exposure to Acute and Chronic Pollution Risks: A Case Study in Houston, Texas. 2014. Risk Analysis, Vol. 34, No. 11.

Map 4.I: Population Distribution and Density



Map 4.I differentiates areas of 75 to 1,000 people per square kilometer, which are more rural and suburban, from those with 1,000 people or more per square kilometer, which are more urban. Most urban residents live in the Southern California, San Francisco, and Sacramento regions.

Map 4.J: Population/Social Vulnerability Base Map



Map 4.J shows that the highest concentrations of combined population density and social vulnerability (based on the index described in *Appendix N*) are in Southern California, the San Francisco Bay Area, and the Central Valley area.

4.4.4 STATEWIDE GIS ANALYSIS OF VULNERABILITY TO HAZARDS

California's Geographic Information Systems (GIS) resources include a suite of web-accessible mapping tools available to communities, stakeholders, and the public that provide distributed information about hazards and vulnerable populations. Examples of these tools include:

- General Plan Guidelines Online Mapping tool
- MyPlan
- MyHazards
- Cal-Adapt
- CalEnviroScreen
- California Environmental Health Tracking Program
- California Healthy Places Index
- Seismic Hazard Zone Maps and Alquist-Priolo Earthquake Fault Zone Maps
- Awareness Floodplain Map
- Fire and Resource Assessment Program (FRAP) Maps
- Sea-level Rise Viewer
- Tree Mortality Viewer

For a list of examples of California's GIS resources and other hazard data tools, see *Section 3.11* in *Chapter 3: California's Mitigation Framework: Goals, Objectives, Strategies, and Priorities*, which outlines the state strategy to "Enhance collaboration on the development and sharing of data systems and GIS modeling." Further GIS mapping tools may be found on the gallery page of the state's Geoportal website, which is provided as a data portfolio of California GIS mapping tools: http://portal.gis.ca.gov/geoportal/catalog/gallery/gallery.page.

Updating GIS Risk Assessment Modeling and Maps for the 2018 SHMP

To determine appropriate hazard mitigation strategies and actions, California has used GIS analysis to undertake a risk and vulnerability assessment of socially vulnerable populations for the state's primary hazards—earthquakes, floods and wildfires—and has also the applied the social vulnerability model data to the secondary hazard of extreme heat. GIS is helpful for analyzing spatial relationships between natural hazards and populations that live within areas affected by natural hazards.

In the 2018 SHMP, the population/social vulnerability maps from the 2013 and 2010 SHMPs are revised using updated hazard and population data and a redeveloped GIS model, previously based on a model developed for the 2010 SHMP to analyze vulnerability of California's population to disasters. Four maps were created through the GIS model: a population/social vulnerability base map and three hazard maps, for earthquakes, floods, and wildfires. Population/social vulnerability data were combined with each GIS hazard dataset to show vulnerability for that hazard as it varies throughout the state.

Although the 1-kilometer grid cell size used in the vulnerability maps is appropriate for generalized statewide analysis, it is generally not useful for interpretation of hazards, risk, and vulnerability at the community level. Users are cautioned that, although they may use the portable document file (PDF) version of the 2018 SHMP to zoom in on these maps to a closer scale, more detailed information useful for hazard mitigation planning by communities may not necessarily be revealed.

ArcGIS ModelBuilder is a tool for designing and implementing geoprocessing of GIS layer data. It allows creation of a series of steps to manipulate GIS data that can be run repeatedly to test and refine the outcome. Because the 2018 SHMP risk analysis was created in ModelBuilder, as new base datasets become available, the model can be rerun and the vulnerability maps updated.

As part of the 2018 SHMP, the population indicator variables used to model social vulnerability within the state were reviewed and updated by a State Hazard Mitigation Team (SHMT) Social Vulnerability Working Group, a subset of the Geographic Information Systems Technical Advisory Working Committee (GIS TAWC), over a series of conference call meetings and follow-up email communications.

Through this series of communications, the Working Group developed an updated set of population indicator variables to model social vulnerability. The selected indicator variables were grouped in three sub-indices: differential access to resources and information, cultural or linguistic isolation, and access and functional needs. Table 4.J lists each variable and its indicator and the sub-index grouping.

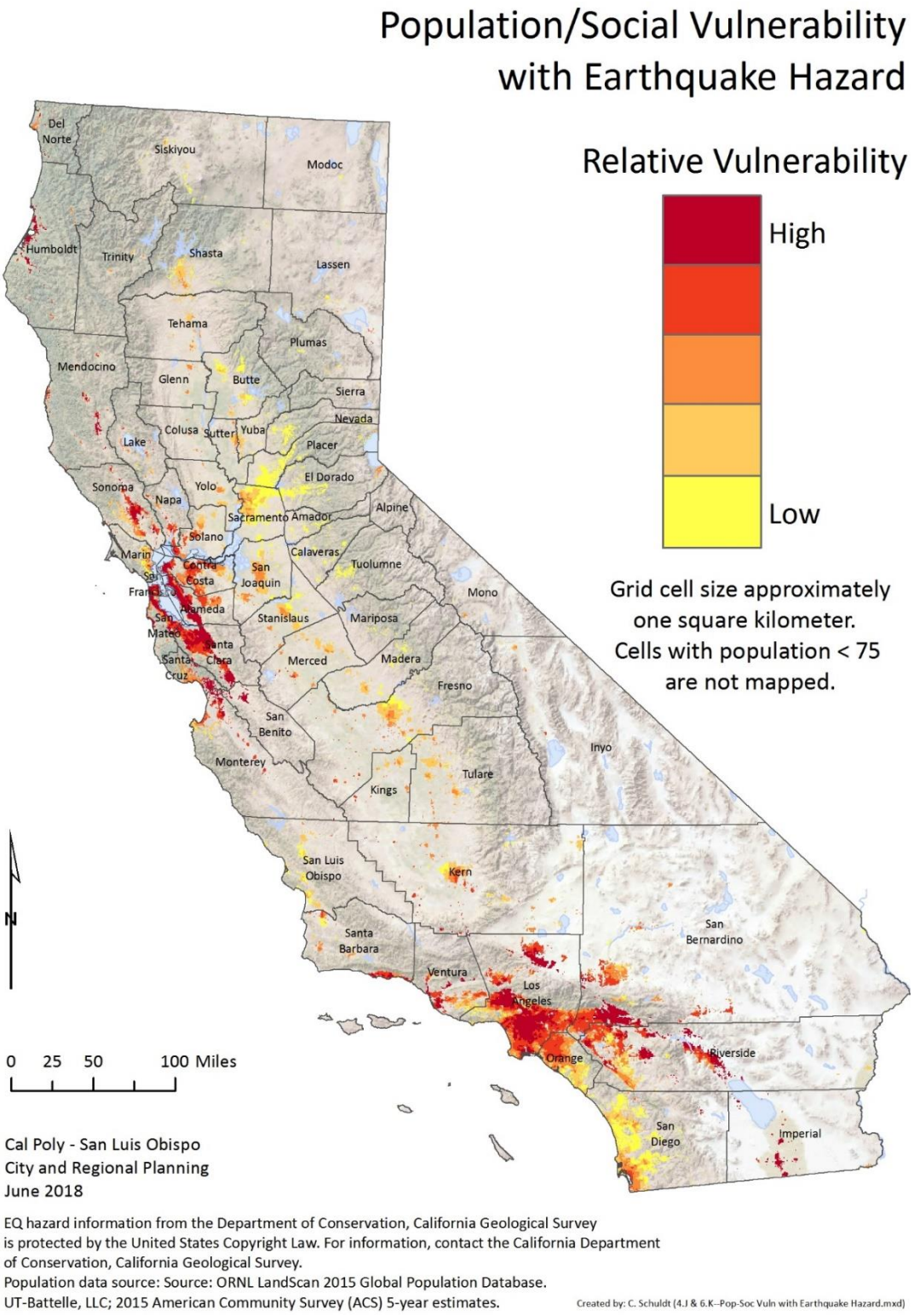
Table 4.J: Social Vulnerability Index Conceptual Model and Associated Variables

Sub-Index	Indicator	Variable
Differential Access to Resources and Information	Poverty/ Income	Annual housing costs to income ratio
	Education	Percent of the population 25 or older without a high school diploma or equivalent
	Housing Tenure	Percent renter occupied housing units
	Gender	Percent female population
	Food Access	Modified Retail Food Environment Index (mRFEI)
Cultural or Linguistic Isolation	Linguistic Isolation	Percent of population 5 or older who speak English less than very well
	Minority Status	Percent non-White or Hispanic population
Access and Functional Needs	Disability	Percent of population with a disability
	Long-Term Care Facility Residents	Beds in licensed long-term care facilities per person
	Age	Percent of population 65 or older, or younger than 5
	Vehicle Access	Percent of households with no available vehicles

The input variables for each indicator were processed and weighted within each sub-index and each overall sub-index was further weighted. The model was then run with varying combinations of the reasonable alternatives for each set of indicators to produce the social vulnerability intermediate output that was then combined with the hazard layer to generate the model metrics.

This model is the basis for the social vulnerability maps shown on the following pages of this section. For more information about the SHMP GIS vulnerability modeling methodology, see *Appendix N*.

Map 4.K: Population/Social Vulnerability with Earthquake Hazard

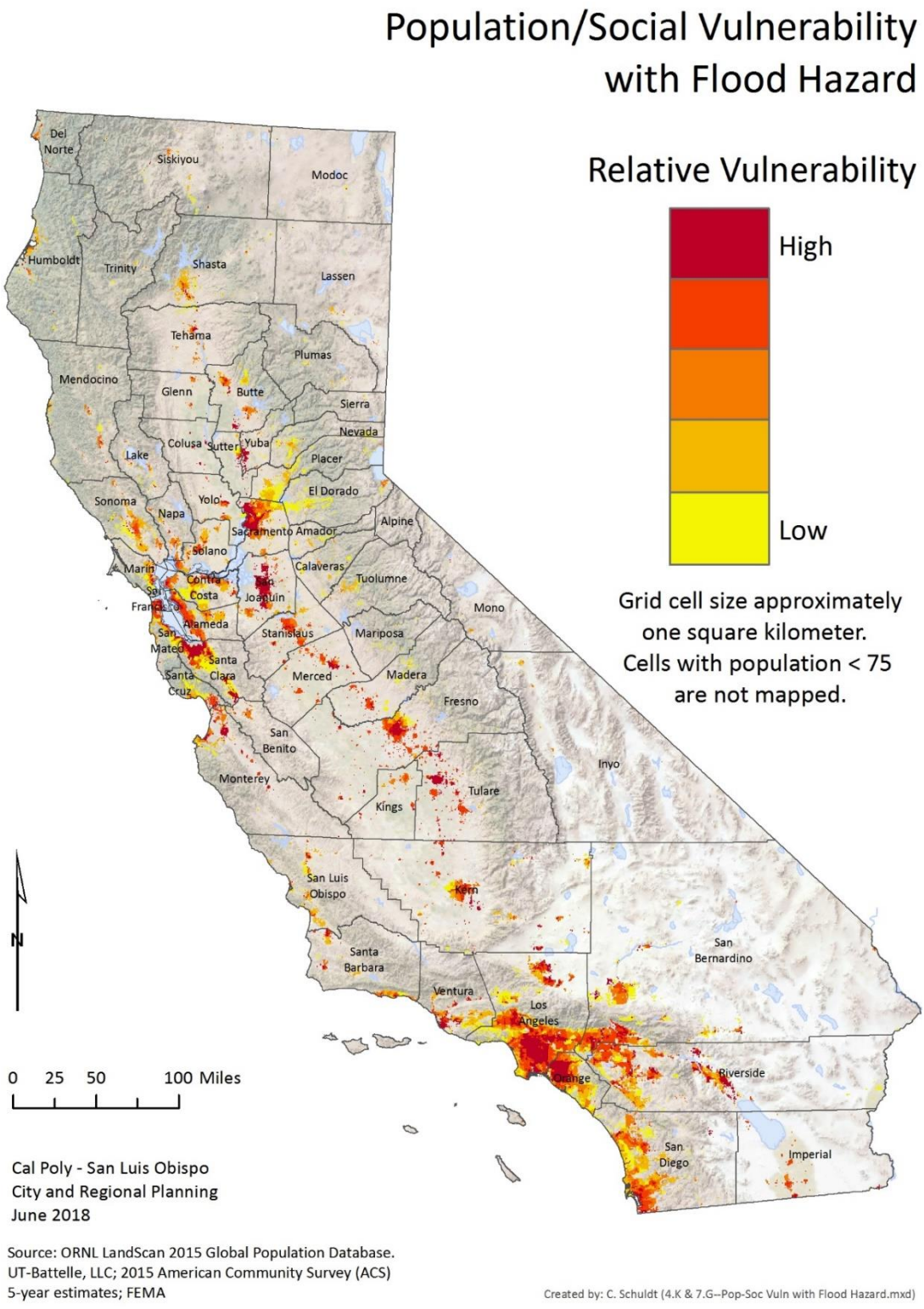


Population data source: Source: ORNL LandScan 2015 Global Population Database. UT-Battelle, LLC; 2015 American Community Survey (ACS) 5-year estimates.

Created by: C. Schuldt (4.J & 6.K--Pop-Soc Vuln with Earthquake Hazard.mxd)

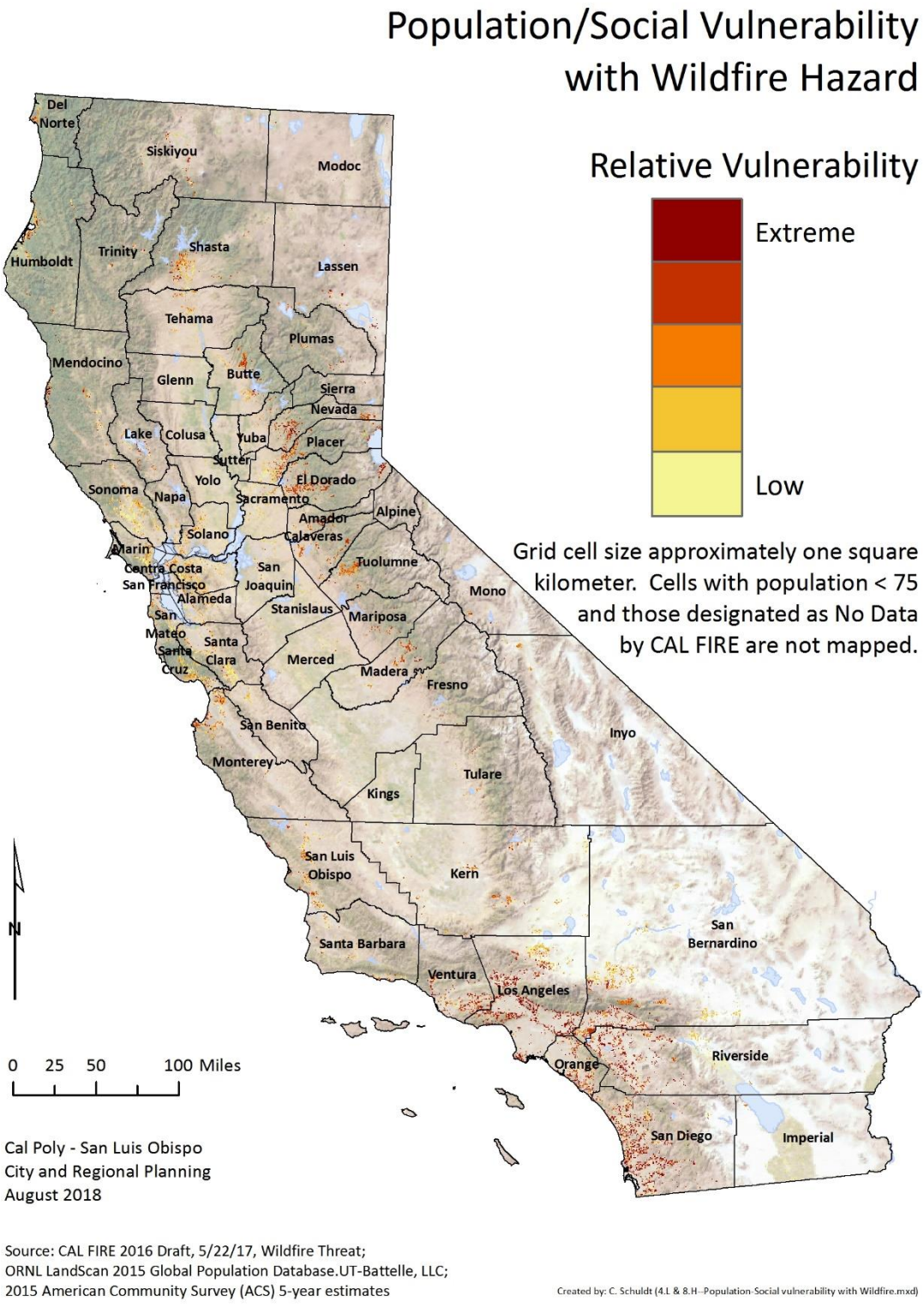
Map 4.K shows population/social vulnerability (based on the index described in *Appendix N*) in areas at high risk of earthquake hazards. Greatest concentrations are in Southern California and the San Francisco Bay Area.

Map 4.L: Population/Social Vulnerability with Flood Hazard



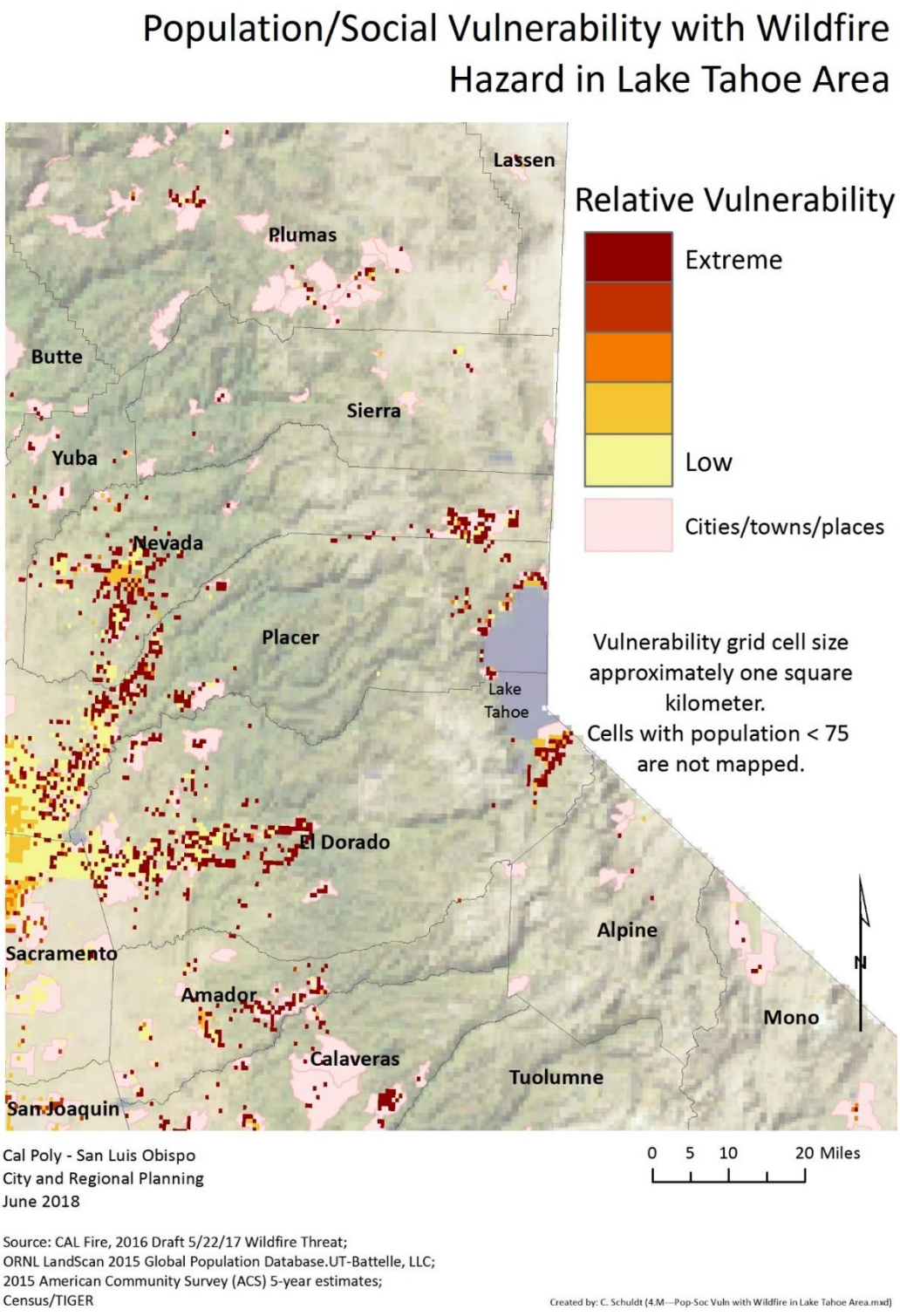
Map 4.L shows high concentrations of population/social vulnerability (based on the index described in *Appendix N*) in areas at high risk of flood hazards with low-lying areas spread across the state. Most heavily affected counties are in the San Francisco Bay Area, the Central Valley area, and Southern California.

Map 4.M: Population/Social Vulnerability with Wildfire Hazard



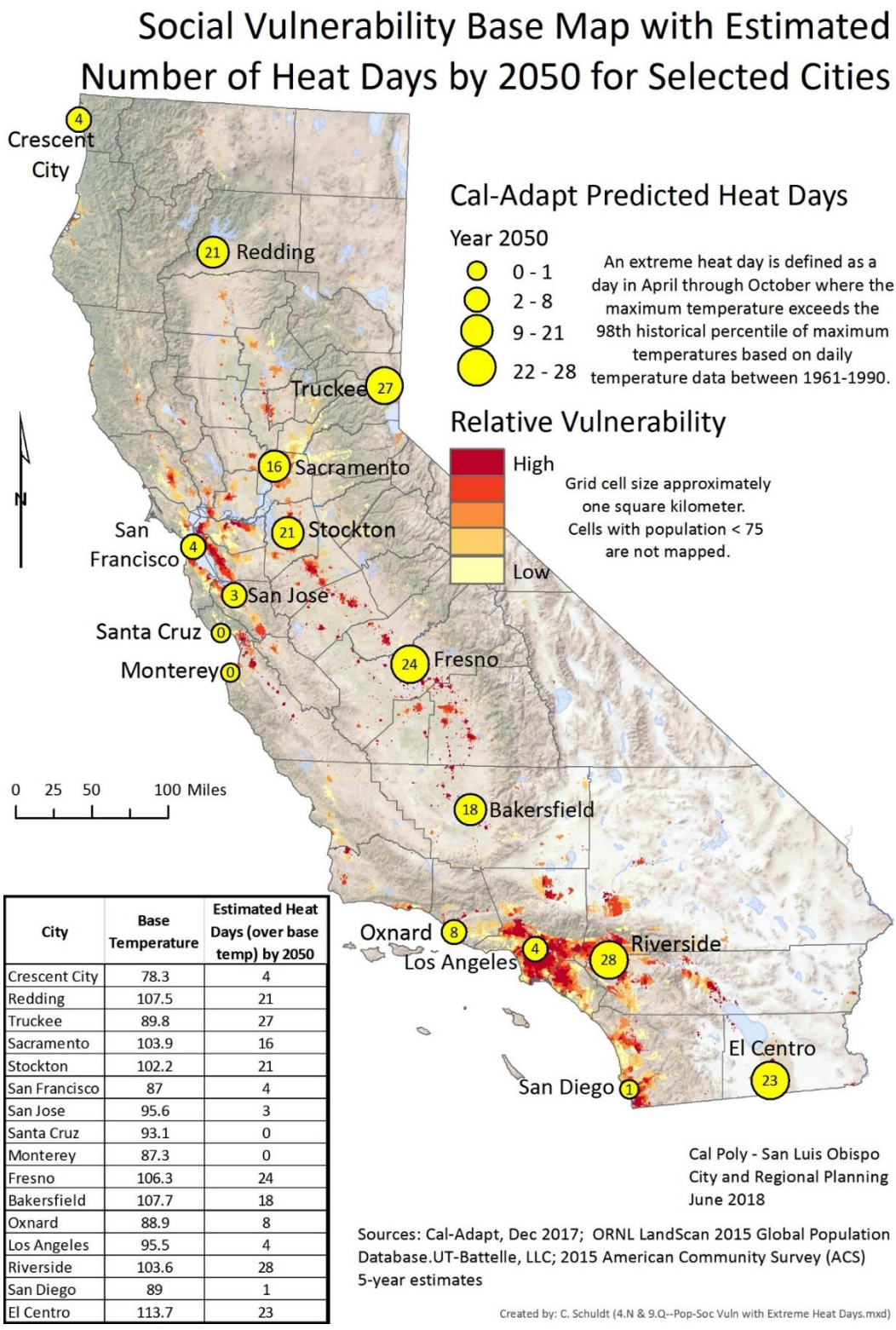
Map 4.M shows moderate to high concentrations of population/social vulnerability (based on the index described in *Appendix N*) in areas at high risk of wildfire hazards. Most heavily affected areas are in the hilly and mountainous portions of the San Francisco Bay Area, Southern California, and the Sierra Nevada.

Map 4.N: Population/Social Vulnerability with Wildfire Hazard, showing Northeastern California at Closer Scale



Map 4.N shows a close-up of a northwestern portion of the state taken from Map 4.M. illustrating that, at a county level, many smaller communities have extreme vulnerability to wildfire hazards. It should be noted that the Lake Tahoe map area is used only as an example ; other lesser populated areas in the state could also be used in such a map to illustrate the presence of smaller communities with vulnerable populations across the state.

Map 4.O: Population/Social Vulnerability with Extreme Heat Days for Selected Cities



City	Base Temperature	Estimated Heat Days (over base temp) by 2050
Crescent City	78.3	4
Redding	107.5	21
Truckee	89.8	27
Sacramento	103.9	16
Stockton	102.2	21
San Francisco	87	4
San Jose	95.6	3
Santa Cruz	93.1	0
Monterey	87.3	0
Fresno	106.3	24
Bakersfield	107.7	18
Oxnard	88.9	8
Los Angeles	95.5	4
Riverside	103.6	28
San Diego	89	1
El Centro	113.7	23

Map 4.O shows moderate to high concentrations of population/social vulnerability (based on the index described in *Appendix N*) in selected cities at risk of increased extreme heat days.

For a detailed discussion of GIS modeling used to initially create the population/social vulnerability and related maps, see *Appendix N: GIS Risk Exposure Methodology*.

Earthquake Vulnerability

As noted in earlier in this chapter, while earthquakes occur less frequently than the other primary hazard events, they have accounted for the greatest combined losses (deaths, injuries, and damage costs) in disasters since 1950 and have the greatest catastrophic disaster potential.

The earthquake hazard base map began with statewide vector (areas) data supplied by the California Geological Survey showing differing levels of expected relative intensity of ground shaking in California from anticipated future earthquakes.[91]

The relationship of social vulnerability to earthquakes is shown by the intensity of the color in the Population/Social Vulnerability with Earthquake Hazard Map (Map 4.K). For example, while earthquake-shaking hazards are lower in the Central Valley than other parts of the state, relative vulnerability shown in Map 4.K is high through portions of the Central Valley due to higher density of socially vulnerable populations.

Flood Vulnerability

Flooding in California is widespread and the second most frequent disaster source. Since 1950, floods have accounted for the second highest combined losses and the largest number of deaths.

As with earthquake hazards, the relationship of social vulnerability to flood is shown by the intensity of the color in the Population/Social Vulnerability with Flood Hazard Map (Map 4.L). The patterns shown in the map reflect the greater frequency of flooding, combined with greater social vulnerability in portions of the Central Valley region.

Wildfire Vulnerability

Wildfires are the most frequent source of declared disasters and account for the third highest combined losses. The Population/Social Vulnerability with Wildfire Hazard Map (Map 4.M) uses data from the 2017 Wildfire Threat GIS map created by the California Department of Forestry and Fire Protection (CAL FIRE)'s Fire and Resource Assessment Program (FRAP). Its original data take into account fuel loads and fire history, among other factors, to create five threat classes: extreme, very high, high, moderate, and low or no threat.

Wildfire vulnerability in California is found chiefly in wildland-urban interface (WUI) communities, located largely on the periphery of suburban areas in Southern California, coastal mountains, and heavily wooded areas of the Sierra Nevada. Some areas burn frequently, particularly the hills surrounding Los Angeles; the eastern parts of the San Francisco Bay Area, San Diego, and Big Sur; and more isolated areas of the Coast Ranges and Sierra Nevada.

WUI areas tend to be less heavily populated than other parts of urban California. Therefore, the vulnerability patterns shown in a statewide map such as Map 4.M tend to be understated when viewed at a statewide scale. Densely populated urban areas will appear at higher relative vulnerability due to the larger concentrations of socially vulnerable communities in these areas. However, less populated areas have socially vulnerable populations that can be at high risk of wildfire hazard.

Map 4.N, a close-up of a portion of Map 4.M, is included as an example to illustrate how vulnerability may be identified at county level. When the state is looked at on a county-by-county basis, the vulnerability in less populated counties is more readily depicted, as example Map 4.N shows in a zoomed-in view of the counties between Sacramento and Lake Tahoe. Individuals can use the MyPlan or MyHazards internet mapping tools to develop fire risk assessments for their specific communities or at a county level.

[91] 1.0 second spectral acceleration with 2-percent probability of exceedance in 50 years.

Extreme Heat Vulnerability

Effects of climate change are already occurring due to increasing temperature. As the climate changes in California, one of the more serious threats to the public health of Californians will stem primarily from the higher frequency of extreme conditions, principally more frequent, more intense, and longer heat waves. Temperature records continue to be broken with increasing temperatures on record.[92]

Temperatures in urban areas can exacerbate already warm conditions due to materials such as asphalt absorbing heat and then releasing it, causing urban heat islands. Increased exposure to heat puts children, the elderly, and people with pre-existing health conditions at more serious risk of heat stroke and heat-related complications. For many urban areas with moderate to high socially vulnerable populations, Cal-Adapt climate models show a notable rise in the number extreme heat days per year, as shown in Map 4.O.

Extreme heat days are calculated by Cal-Adapt as the 98th percentile of historical maximum temperatures for an area between April 1 and October 31, based on observed daily temperature data from 1961 to 1990. In Map 4.O, extreme heat day data were sourced from Cal-Adapt 2.0 using scenario RCP 8.5 and HadGem2-ES modeled data for 2006-2099. For more information about this extreme heat days data, visit the Cal-Adapt website: http://cal-adapt.org/tools/extreme-heat/.

MyPlan Internet Mapping Tool

In the 2010 SHMP, three primary hazards and various secondary hazards were evaluated for their potential impacts across California using Geographic Information Systems (GIS) software. Part of that effort included analyzing California's population density in relation to social vulnerability and creating a GIS dataset that visually displayed that vulnerability at a scale of approximately 1 square kilometer for each square kilometer of the state. That dataset was then combined with hazard location data for wildfire, flood, and earthquake to identify areas most at risk.

Cal OES's MyPlan Internet Mapping Tool (IMT) website (http://myplan.caloes.ca.gov/) was launched in the fall of 2011 through collaborative efforts of the then-California Emergency Management Agency (Cal EMA), the California Natural Resources Agency, the GIS TAWC, and other state agency partners.

Since its release, MyPlan has been available for creation of community-scale GIS hazard maps. It is aimed primarily at local planners and other professionals working for local communities. MyPlan now offers many data layers that can be turned on and off as needed to create community-scale hazard maps. The intent is to provide support for preparation of Local Hazard Mitigation Plans (LHMPs), general plan safety elements (all elements of a general plan, whether mandatory or optional, must be consistent with one another), and Local Coastal Programs (LCPs).

The MyPlan website provides a simple-to-use interface for viewing the hazard and base data layers and creating user-specific maps. The GIS TAWC continues to provide updated GIS hazard datasets and to develop suggestions for improving MyPlan. The basic design of the website is also available to other states and agencies for use in their own specific applications of GIS web mapping.

A future layer that has been identified to be added to MyPlan is a dam inundation area layer based on the new map requirements that were enacted with Senate Bill 92. It is expected that the first layer will be integrated with MyPlan by the fall of 2018.

[92] National Oceanic and Atmospheric Administration (2015). Global Climate Report - Annual 2015. Retrieved from https://www.ncdc.noaa.gov/sotc/global/201513

4.4.5 PLANNING, POLICY, AND ACTION IMPLICATIONS

The following GIS multi-hazard risk exposure findings contain implications for priority setting with respect to hazard mitigation strategies.

- When comparing population growth from 2000-2012 identified in *Chapter 4* with risk exposure of socially vulnerable populations to various hazards, a substantial overlap is found among heavily populated areas, growth areas, and high risk exposure.

- Historically, mitigation priority setting has been done largely on an ad hoc basis in response to specific outcomes of particular disasters, including losses, damage locations, and scales.

- The preceding multi-hazard risk analysis, together with historical analysis of declared disasters in California since 1950, reveals that earthquakes, floods, and wildfire hazards are pervasive, primary determinants of disaster losses.

When these findings are compared with the findings on population and construction growth presented elsewhere in *Chapter 4*, additional implications are found.

4.4.6 CALIFORNIA'S ACTIONS TO ADDRESS SOCIAL VULNERABILITY AND EQUITY NEEDS

While California's communities themselves have potential capacity and resources that can be leveraged when devising and implementing adaptation strategies to address community-specific social vulnerability issues, the state has several emerging programs to support these efforts.

Legislation

Senate Bill 244 (2011)

Senate Bill (SB) 244, passed in 2011, specifically recognized that many disadvantaged unincorporated communities lacked adequate investment in infrastructure such as sidewalks, safe drinking water, and adequate waste processing. This lack of adequate investment threatens both health and safety of residents and creates inequity in terms of access to quality services. SB 244 (2011) requires general plan land use elements to include analysis of the presence of island, fringe, or legacy unincorporated communities to identify these areas of risk and update general plan policies to improve conditions. This legislation was subsequently amended by Senate Bill 1090 (2012).

Senate Bill 88 (2015)

This bill authorized the State Water Resources Control Board to order consolidation with a receiving water system where a public water system, or a state small water system within a disadvantaged community, consistently fails to provide an adequate supply of safe drinking water. This bill also authorized the State Water Resources Control Board to order the extension of service to an area that does not have access to an adequate supply of safe drinking water.

Assembly Bill 1071 (2015)

This bill requires each board, department, and office within CalEPA to establish a policy on supplemental environmental projects that benefits environmental justice communities.

Senate Bill 350 (2015)

SB 350 requires state agencies to evaluate the barriers faced by low-income customers, including those living in disadvantaged communities in gaining access to clean energy technologies and provide recommendations for how to address these barriers. Furthermore, to ensure that the full economic and societal benefits of California's clean energy transition are realized, the Energy Commission must also evaluate the barriers to contracting opportunities for local small businesses located in disadvantaged communities, along with potential solutions.

Assembly Bill 1550 (2016)

This bill modifies SB 535 (2012) regarding the Greenhouse Gas Reduction Fund (GGRF) for disadvantaged communities. The bill requires a minimum of 25 percent of GGRF funding to be allocated to projects located within and benefiting individuals living in disadvantaged communities and allocates additional funding to benefit low-income households. As of Fiscal Year 2017-2018, the California Air Resources Board (CARB) and administering agencies are in the process of implementing AB 1550 and the CARB is in the process of updating its Funding Guidelines for Agencies that Administer California Climate Investments to incorporate the legislative requirements of AB 1550.

Assembly Bill 1613 (2016) and Companion Bill, Senate Bill 859 (2016)

These bills allocate $900 million from the GGRF (proceeds from California's cap-and-trade program to limit greenhouse gas emissions) to support programs that benefit disadvantaged communities, advance clean transportation, protect the natural environment, and cut short-lived climate pollutant emissions.

Assembly Bill 2722 (2016)

This bill establishes the Transformative Climate Communities program to be administered by the Strategic Growth Council. The bill would require the council to award grants to programs that advance development and implementation of multiple climate and clean energy efforts in a community-wide approach, such as by providing for affordable housing near transit, energy efficiency, clean transportation, and other local economic, environmental, and health benefits to disadvantaged communities.

Senate Bill 1000 (2016): Land Use: General Plans: Safety and Environmental Justice

This bill requires that a jurisdiction's general plan either include an environmental justice element or integrate goals, objectives, and policies addressing environmental justice into other elements of the general plan.

As part of this requirement, jurisdictions must:

- Identify objectives and policies to reduce the unique or compounded health risks in disadvantaged communities, including:
  - Reducing pollution exposure, including improving air quality
  - Promoting public facilities
  - Promoting food access
  - Promoting safe and sanitary homes
  - Promoting physical activity
- Identify objectives and policies to promote civil engagement in the public decision-making process
- Identify objectives and policies that prioritize improvements and programs that address the needs of disadvantaged communities.

There is a strong linkage between a jurisdiction's environmental justice actions and a community's climate change adaptation efforts. The requirements of SB 1000 (2016) are cross-linked with new requirements that climate change adaptation be addressed in safety elements. As part of climate change adaptation updates to their safety elements, jurisdictions will assess community vulnerability.

General Plan Guidelines

The Governor's Office of Planning and Research (OPR) is responsible for preparation and updates of the General Plan Guidelines. The General Plan Guidelines includes resources, data, tools, and model policies to help cities and counties update their general plans.

As required by AB 1553 (2001), the General Plan Guidelines have provided guidance on environmental justice considerations for local jurisdictions since 2003. As noted above, legislation adopted in 2016, Senate Bill 1000, now requires both cities and counties that have disadvantaged communities to incorporate environmental justice policies

into their general plans, either in a separate environmental justice element or by integrating related goals, policies, and objectives throughout the other elements. The 2017 General Plan Guidelines update provides detailed guidance for an environmental justice element within the "Required Elements" chapter (Chapter 4).

The environmental justice element section within Chapter 4 of the 2017 General Plan Guidelines includes an evaluation of the required timeline to address environmental justice under Senate Bill 1000, linkage to other elements, required contents, and a completeness checklist that describes each requirement of the statute. The detailed description of each statutory requirement includes considerations of the requirement, OPR-recommended data for element analysis, best practice examples of jurisdiction projects or programs that address environmental justice, and sample policies.

OPR notes that "the General Plan Guidelines [GPG] contains the statutory requirements for SB 1000 (2016), but since the legislation passed after the public comment concluded for the GPG, the Governor's Office of Planning and Research will be soliciting more focused feedback with related state and local agencies as well as local jurisdictions and partners to learn more about the process to do these new updates, discuss data use, promising policies, and case examples to share with other jurisdictions across California. This new guidance will be made available on the OPR website." An update to the General Plan Guidelines to further address SB 1000 is planned for late 2018.

Further guidance and information related to environmental justice is also offered in the 2017 General Plan Guidelines chapters on "Equitable and Resilient Communities" and "Healthy Communities." These chapters include definitions of terms in reference to equity, examples, strategies for incorporating social equity and health considerations into planning, and recommended policies. Many of these strategies and planning opportunities align with existing planning practice and state legislation addressing climate change and resiliency, which also correlate closely with issues addressed in the circulation, housing, and open space elements. The General Plan Guidelines nots the linkages between climate change and increased risks to public health, especially to vulnerable populations, and the necessity of land use planning and policy to benefit the most vulnerable segments of the community. For a comprehensive listing of addition health-related data resources, see Chapter 8 of the 2017 General Plan Guidelines.

OPR has also created technical advisories related to environmental justice and disadvantaged communities, such as the SB 244 (2011) Technical Advisory. Information about OPR's technical advisories can be found on the OPR website.

2018 Safeguarding California Plan: Climate Justice

While climate justice is addressed throughout the Safeguarding California Plan: 2018 Update, the plan also includes a specific chapter dedicated to climate justice. The 2018 Safeguarding California Plan defines climate justice as "ensuring that the people and communities who are least culpable in the warming of the planet, and most vulnerable to the impacts of climate change, do not suffer disproportionately as a result of historical injustice and disinvestment." The draft 2018 Safeguarding California Plan identifies five climate justice goals for Safeguarding California and highlights next steps that state agencies are taking to realize the state's vision of an equitable and resilient California.

To download the *Safeguarding California Plan: 2018 Update*, visit: http://resources.ca.gov/climate/safeguarding/.

OPR Defining Vulnerable Communities Guide

As part of the efforts undertaken by the Integrated Climate Adaptation and Resiliency Program (ICARP), established by Senate Bill 246, the ICARP Technical Advisory Council determined that is was necessary to define the term "vulnerable communities". Through a series of working groups a definition was adopted in April 2018. With input from the ICARP Technical Advisory Council, the Governor's Office of Planning and Research (OPR) developed a resource guide to assist local planners in defining vulnerable communities in the climate adaptation planning context. The guide is available on OPR's website.

To download the guide, visit: http://opr.ca.gov/planning/icarp/vulnerable-communities.html.

CalEPA Environmental Justice Program

California was one of the first states in the nation to codify environmental justice in statute. Beyond the fair treatment called for in code, leaders in the environmental justice movement work to include individuals disproportionately affected by pollution in decision-making processes. The aim is to lift the unfair burden of pollution from those most vulnerable to its effects.

The CalEPA Environmental Justice Task Force operates under CalEPA's Enforcement Program. It coordinates the compliance and enforcement work of CalEPA's boards, departments, and office in areas of California that are burdened by multiple sources of pollution and are disproportionately vulnerable to its effects. The Environmental Justice Task Force develops new initiatives in communities where increased compliance has the potential to have the greatest impact.

Initiative: Los Angeles

In 2015-2016, the Task Force conducted an initiative focused on the Los Angeles communities of Boyle Heights and Pacoima. Both communities are among the top five percent of disadvantaged communities in California, according to CalEnviroScreen. For an overview of this pilot initiative, download the report at: https://calepa.ca.gov/wp-content/uploads/sites/62/2017/02/LAReport.pdf.

Initiative: Fresno

In 2013-2014, the Task Force selected a portion of the city of Fresno and its surrounding unincorporated area for its first initiative, with the goal of increasing compliance with environmental laws in this area. For an overview of this pilot initiative, download the report at: https://calepa.ca.gov/wp-content/uploads/sites/62/2016/10/Enforcement-Publications-2015yr-FresnoReport.pdf.

OEHHA Environmental Justice Program and CalEnviroScreen 3.0

The Office Environmental Health Hazard Assessment (OEHHA) Environmental Justice program assists CalEPA in its environmental justice efforts. OEHHA developed and maintains the CalEnviroScreen mapping tool as a screening methodology that can be used to help identify California communities that are disproportionately burdened by multiple sources of pollution.

CalEnviroScreen 3.0 uses environmental, health, and socioeconomic information to produce scores for every census tract in the state. The scores are mapped so that different communities can be compared. An area with a high score is one that experiences a much higher pollution burden than areas with low scores. CalEnviroScreen ranks communities based on data that are available from state and federal government sources.

For more information about CalEnviroScreen, see the program website: https://oehha.ca.gov/calenviroscreen.

California Healthy Places Index

The California Healthy Places Index (HPI) is an interactive data and mapping tool developed by the Public Health Alliance of Southern California that provides a detailed snapshot of the social and environmental conditions that contribute to health, at the census tract level. The HPI includes maps and indicators, including the Climate Change and Health Vulnerability Indicators for California created by the California Department of Public Health.

This tool will enable users to assess an area's health risks due to wildfire, heat, drought, sea-level rise, or air quality, while simultaneously assessing social vulnerabilities or adaptive capacities, such as living in poverty; having a disability; lacking access to transportation, air conditioning, or tree canopy; and much more. Jurisdictions can use the tool to identify actionable policies that would improve health in their communities, and that would increase resilience to climate change impacts.

For access to the Healthy Places Index, visit http://healthyplacesindex.org.

California Department of Public Health Products and Programs

California Environmental Health Tracking Program

The California Environmental Health Tracking Program (CEHTP) is a program of the Public Health Institute, in partnership with the California Department of Public Health. CEHTP is primarily funded by the Centers for Disease Control (CDC) National Environmental Public Health Tracking Program. CEHTP works to make environmental health data and information publicly available through the development of a web-based data query system, state-of-the-art data displays, and innovative web tools and services. CEHTP aims to make these data and information accessible and useful to a variety of stakeholders including communities, governments, academia, and private partners. Strategic Directions 2017-2020 include:

- Track environmental and public health data for California
- Enhance data and information on the portal
- Develop policy-relevant products
- Participate in community-engaged research
- Facilitate use of water boundary and quality data
- Support environmental justice communities and identify health inequities

Office of Health Equity's Climate Change and Health Equity Program and the CalBRACE Project

The Office of Health Equity (OHE) was established, as authorized by Section 131019.5 of the California Health and Safety Code, to promote equitable social, economic, and environmental conditions to achieve optimal health, mental health, and well-being for all. The Climate Change and Health Equity Program (CCHEP) is located within the Office of Health Equity. CCHEP embeds health and equity in California climate change policy and planning, and embeds climate change and equity in public health policy and planning.

California Building Resilience Against Climate Effects (CalBRACE) is a project of the CCHEP. CalBRACE project goals are to enhance the California Department of Public Health's capability to plan for and reduce health risks associated with climate change. As part of the CalBRACE project, Climate Change and Health Profile Reports have been published to help counties in California to prepare for the health impacts related to climate change through adaptation planning. These reports are tools to address vulnerability to climate change from a public health and health equity perspective for every county in California.

For more information about CCEHP and the CalBRACE project, see *Section 4.3.6.4* or visit: https://www.cdph.ca.gov/Programs/OHE/Pages/CalBRACE.aspx.

Climate Change & Health Vulnerability Indicators for California

CCHVIz is the interactive data visualization platform for the Climate Change & Health Vulnerability Indicators for California (CCHVIs). It is produced by the California Department of Public Health Office of Health Equity. The CalBRACE Project produced Climate Change and Health Vulnerability Indicators to help stakeholders better understand the people and places that are more susceptible to adverse health impacts associated with climate change. They are a suite of 21 indicators (18 available here) of climate exposure, population sensitivity, and adaptive capacity to the impacts of climate change. These indicators are being used by local and state programs to plan to meet the needs of the communities most at risk of harm from climate change.

For more information about CCHVIz visit: https://discovery.cdph.ca.gov/ohe/CCHVIz/.

Best Practices Highlight 4.B: "OutsideIn" Program

PILOT PROJECT

OutsideIn SLO: We Take Health and Climate Change Personally was a pilot program led by a partnership between the San Luis Obispo County Public Health Department and the California Department of Public Health (CDPH). The purpose of the pilot program was to increase awareness of the health effects of climate change in San Luis Obispo County (SLO), as part of CDPH's effort to increase state and local capacity to prevent and prepare for those effects.

Existing Efforts

San Luis Obispo County emerged as a state leader on climate change through its early efforts to develop climate action plans and reduce greenhouse gas (GHG) emissions. The San Luis Obispo County Public Health Department brings a public health perspective into these planning processes.

Interagency Collaboration and Community Partnerships

In January 2014, the CDPH proposed the partnership to the San Luis Obispo County Public Health Department. Soon after the project was approved, the San Luis Obispo County Public Health Department invited community partners to participate and help advise the project. Organizations and individuals involved in the pilot project include but are not limited to the following: the Planning and Building Department; the Environmental Health Director; Woman, Infants, and Children (WIC) staff; the Air Pollution Control District; the San Luis Obispo Council of Governments; the Sierra Club; local private planning firms; several local non-profits; and faculty of Cal Polytechnic State University San Luis Obispo.

Progress

Through formal presentations, social media, radio, local news, and other media, the program reached thousands of people, including 1,100 WIC families (about 5,000 people). Formal presentations alone reached over 700 people, including 130 public health staff. As San Luis Obispo County is an agricultural community, farmers and farmworkers were also important stakeholders. The CDPH and OutsideIn SLO collaborated with the local university to secure a Resilient Food Systems Conference that included a keynote presentation by the California Department of Food and Agriculture Secretary Karen Ross.

Lessons Learned

- *Framing the message:* The message was well received by most people, regardless of political affiliation; however, it is still important to understand the audience and provide a narrative that is most relevant to them.
- *Grassroots organizing:* Education campaigns need to take a community organizing approach to develop strong personal relationships with community members. Involving community and local partners early in the campaign planning creates a shared mission to promote climate and health awareness and activities.
- *Interagency collaboration:* Local public health departments need to have both internal and external relationships to effectively address emerging issues like climate change.
- *Utilizing existing resources:* With limited funding, climate and health activities can leverage existing resources and enhance existing public health programs.

For more information about OutsideIn SLO, visit: http://www.healslo.com/outsidein-slo/.

EXPANDING THE PROGRAM ACROSS THE STATE

In 2017, the Kings County Public Health Department and the Capital Region Climate Readiness Collaborative (CRC) developed OutsideIn campaigns tailored to increase awareness of the health impacts of climate change and actions people can take to be prepared, improve health, and build community resilience. CRCs campaign can be viewed at http://climatereadiness.info/outsidein-capital-region/. A recorded webinar on OutsideIn and other campaigns can be found at the Communicating Climate Change as a Public Health Issue webinar series, at: http://www.healslo.com/webinar/.

Linkage to SHMP Goals and Objectives

The OutsideIn program accomplishes implementation of State Hazard Mitigation Plan (SHMP) Objective 2 of Goal 1 which is to "ensure that hazard mitigation measures and allocation of mitigation funds are protective of the state's low-income, underserved, linguistically isolated, minority, access and functional needs, and other highly vulnerable populations so that hazards do not have a disproportionately negative impact on those populations, and improve coordination with those populations to ensure that hazard, risks, and preparedness options are well understood."

Source: Kathleen Karle, San Luis Obispo County Public Health Department and the California Public Health Department, Office of Health Equity's Climate Change and Health Equity Program.

State of California's Sea-Level Rise Guidance and Social Equity

The Ocean Protection Council's 2018 update to the State's Sea-level Rise Guidance includes recommendations for preferred sea-level rise planning and adaptation approaches. The first recommendation in the 2018 Guidance is: *Adaptation planning and strategies should prioritize social equity, environmental justice and the needs of vulnerable communities*. The Guidance discussion on this recommendation emphasizes that engaging communities early in the planning process helps to ensure accurate vulnerability assessments and development of adaptation strategies that adequately address needs and priorities.

The Guidance recommends the following steps be included in incorporating social equity and environmental justice into sea-level rise planning and adaptation strategies:

- Address environmental contamination risks for coastal communities adjacent to industry or toxic sites
- Preserve access to and along the beach
- Prevent displacement by ensuring that investments in coastal resilience protect local jobs and housing costs
- Address economic impacts on agriculture
- Address emergency services and response to natural disasters
- Evaluate the social and economic implications of various adaptation strategies

For more information about this and other recommendations, download the Guidance: http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf.

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