

ISSUE BRIEF

CLIMATE CHANGE AND HEALTH IN CALIFORNIA

Climate change is altering seasonal patterns in California, making hot days hotter, and increasing the severity of extreme events such as the historic drought from late 2011 to early 2017 and fires like the devastating Camp Fire in 2018.¹ As a result, Californians face a variety of increasing health problems such as more heat-related illnesses, breathing and heart troubles, food and water contamination, traumatic injuries, mental health challenges, and exposure to infectious diseases.² These threats will only increase for Californians as long as big polluters and our buildings and transportation systems continue to pump climate-changing pollution into the air.

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Protecting the health of Californians requires tackling climate change. We can protect ourselves from these impacts by implementing cleaner and more efficient energy strategies and by preparing more effectively for future climate and health disasters.³ We must also ensure that communities and health departments have the resources they need to deal with present-day health threats.⁴

CALIFORNIA'S FIRE SEASON IS GETTING LONGER AND MORE DANGEROUS

Climate change and expanding urban development in fire-prone areas are putting more Californians in the path of dangerous wildfires over longer periods of the year.⁵ The relationship between climate trends and wildfire has not been uniform across California's many different habitats and climate zones, and projections of the future number and extent of fires are uncertain.⁶ Broadly speaking, however, high temperatures and more severe droughts in the western United States reduce water availability and dry out vegetation.⁷ These conditions create more days with extreme fire weather and can fuel larger wildfires. For example, in 2017, the combination of extremely high temperatures from May through September and delayed autumn rainfall contributed to the severity of that year's fire season.⁸ The run up to the Camp Fire was also hot and dry, with below average precipitation and above average temperatures from June through November 2018.⁹

These conditions are making California wildfire seasons worse. Four of California's worst fires on record occurred between October 2017 and November 2018 alone. The Camp Fire (November 2018) was the deadliest and the most destructive in terms of structures lost in state history, and the Tubbs Fire (October 2017) was the second most destructive.¹⁰ The Mendocino Complex (July 2018) was the largest in terms of area burned, and the Thomas Fire (December 2017) the second largest.¹¹ California wildfires killed at least 46 people in 2017 and at least 105 people in 2018, primarily in the Paradise area burned by the Camp Fire.¹² Many of those who died in the Camp Fire were elderly or had a disability or illness that prevented or dissuaded them from evacuating ahead of the fire.¹³

Wildfires create health risks that extend well beyond the direct path of the burn zone. Wildfire smoke contains contaminants, including fine particulate matter (i.e., soot). These contaminants can degrade air quality hundreds and even thousands of miles away from an actual fire.¹⁴ For instance, smoke from the Camp Fire in 2018 choked northern California for 11 days, closing schools, leading to shortages of protective face masks, and prompting emergency measures by San Francisco city officials to protect homeless people from 24-hour smoke exposure.¹⁵ However, the full health toll of the extraordinary smoke from the Camp Fire remains unclear. As one health researcher at University of California Davis put it: "This is something we've never seen before. This is unprecedented in the Bay Area. We really don't know how to respond."¹⁶



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Exposure to wildfire smoke has been linked to health problems such as respiratory infections, cardiac arrests, low birth weight, mental health conditions, and exacerbated asthma and chronic obstructive pulmonary disease.¹⁷ Long-term exposure to wildfire smoke generated an estimated \$76 billion to \$136 billion per year in health costs across the continuous United States from 2008 to 2012, with some of the most significant impacts in northern California.¹⁸

Small particles from wildfires are a particular threat to adults aged 65 and older, who made up nearly 14 percent of California's population in 2017.¹⁹ During the severe 2015 California fire season, researchers found a 22 percent increase in risk of coronary artery disease and a 42 percent increase in risk of heart attacks one day after exposure to dense smoke among adults aged 65 or over.²⁰ A study from 2004 to 2009 analyzing the number of hospital admissions for respiratory conditions among Medicare recipients in the western United States found about 7 percent more admissions on smoke-wave days (days with high concentrations of particle pollution) compared to non-smoke-wave days.²¹

California is experiencing a housing shortage, both in large cities such as San Francisco where housing costs have skyrocketed, and in less populated surrounding regions.²² The state is among the worst-ranked states in the nation for homeownership rates, housing cost burdens, and severe home overcrowding.²³ Destructive wildfires have exacerbated this problem, making it impossible for some individuals and families to find affordable housing in an already tight market.²⁴ This has increased the threat of homelessness and disrupted community and family networks that can help people bounce back from disasters.²⁵

Damage to homes, forced relocation, missed work time, and the loss of loved ones can lead to severe stress, depression, and unhealthy coping behaviors like drug use.²⁶ Anyone can

experience short-term mental health issues from wildfires, but children, economically-disadvantaged people, and people who already live with mental illness are especially sensitive.²⁷ For instance, the October 2007 wildfires in San Diego destroyed or damaged 1,350 homes and forced more than half a million people to evacuate.²⁸ A survey of public mental health clinics in early November 2007 found that about 18 percent of clients who evacuated sought increased levels of mental health assistance after the fires, compared to about 2 percent in non-evacuation areas.²⁹ In wake of the Camp Fire in late 2018, school and health officials in Butte County were particularly worried about the mental health of children, many of whom had lost their homes and had gone nearly four weeks without the normalcy of school.³⁰

More severe fire seasons may also increase mental health problems among first responders, who tend to have a high prevalence of mental health conditions such as anxiety, post-traumatic stress disorder, and sleep disturbances.³¹ Nationally, wildland firefighters already seem to be at greater risk for suicide than non-wildland firefighters. As wildfire season grows longer, the mental, physical, and emotional demands placed on firefighters and other first responders will only increase, leading to adverse health outcomes for this crucial population.³²

CLIMATE CHANGE WILL WORSEN CALIFORNIA'S SMOG PROBLEM

California doesn't just face a smokier future under climate change; it also faces a smoggier one. Despite improvements in the state's air quality since the early 1990s, 34 California counties, home to 33.8 million people, experience at least one unhealthy ozone pollution (i.e., smog) day per year (Figure 1).³³ More than one-third of those counties experience at least 16 unhealthy smog days per year.³⁴ Eleven of the nation's 25 smoggiest cities from 2014 to 2016 were in California, with Los Angeles topping the list.³⁵

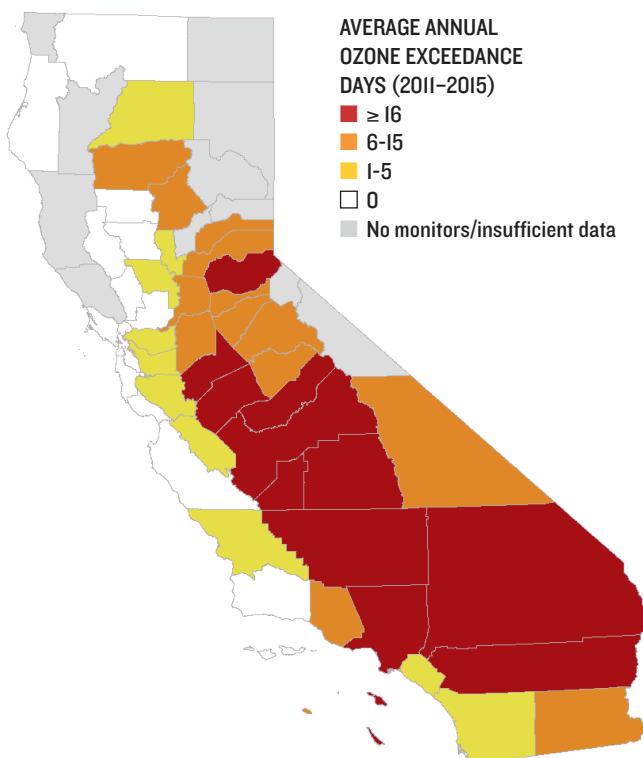
Unfortunately, climate change is likely to make the current air quality problem worse and undermine the state's future progress toward cleaner air.³⁶ Rising temperatures speed up smog-forming chemical reactions between sunlight and pollution from sources such as power plants.³⁷

In 2014, about 5.2 million Californians had asthma, a chronic lung disease that is triggered by smog.³⁸ One study of 3.7 million emergency room visits in California from 2005 to 2008 found that even small increases in smog pollution significantly increased the number of visits for asthma.³⁹ African-American, American Indian/Alaskan Native, and Puerto Rican Californians are between 28.6 and 132.5 percent more likely to be diagnosed with asthma than white Californians, leaving these populations particularly sensitive to smog.⁴⁰ This disparity in asthma prevalence may be due in part to diet, poorer quality housing, and higher exposure to air pollution.⁴¹ Smog has also been linked to other health problems, including reduced lung function, cardiac arrest, and cognitive decline.⁴²



FIGURE I: CALIFORNIA COUNTIES AVERAGING ONE OR MORE UNHEALTHY GROUND-LEVEL OZONE DAYS PER YEAR, 2011–2015

Ozone exceedances are days when an eight-hour average concentration of ozone exceeds the EPA's 2015 Ozone National Ambient Air Quality Standard of 0.070 parts per million.



Source: NRDC 2017.⁴³



EXTREME HEAT IS BAD FOR CALIFORNIANS' HEALTH—AND COULD BECOME DEADLIER

California summers are already dangerously hot, and they could become even more extreme in just a few decades. Since 1895, average annual temperatures in California have climbed 2.2 degrees Fahrenheit, and July 2018 was the state's hottest month on record.⁴⁴ The warming trend is accelerating: average summer temperatures in California rose over three times faster from 1975 to the present than from 1895 to the present (Figure 2).⁴⁵ More than 31.8 million (or 83 percent of) Californians lived in counties that experienced between 9.6 and 22.2 extreme heat days per summer from 2007 to 2016 (Figure 3).⁴⁶ In July 2018, record-breaking heat and the resulting demand for air-conditioning led to power outages for more than 90,000 customers in the Los Angeles area.⁴⁷ At least 990 residents went without electricity for more than three days while maximum daytime temperatures in downtown Los Angeles exceeded 96 degrees Fahrenheit.⁴⁸

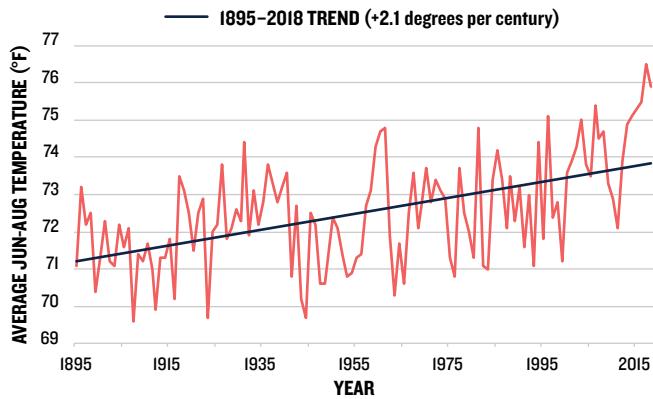
If we don't drastically cut global carbon emissions, the number of extreme heat days will continue to rise. Sacramento, for example, could see 24 days per year above 103.9 degrees Fahrenheit by the 2070s, compared to 4 days per year from 1961 to 1990.⁴⁹

Heat already poses a range of threats to California residents, from minor illnesses like heat cramps to potentially deadly conditions such as heatstroke or heat-related heart attacks.⁵¹ During the 2006 California heat wave, Sacramento, Modesto, and Woodland Hills broke records for the longest stretch of days over 100 degrees Fahrenheit. Six locations also set new records for all-time highest temperatures. Woodland Hills, for instance, hit 119 degrees Fahrenheit on July 22, 2006, exceeding its 1985 record by 3 degrees.⁵² Over the entire heat wave, there were approximately 655 premature deaths, more than 1,600 excess hospitalizations, and more than 16,000 excess visits to emergency rooms statewide related to the heat.⁵³ In total, the heat wave generated more than \$5.3 billion in health costs.⁵⁴

Anyone can get sick from extreme heat, but young children, older adults, people experiencing poverty, people with chronic diseases like diabetes, homeless people, and outdoor workers are particularly vulnerable.⁵⁵ For instance, one California study found that with every increase of 10 degrees Fahrenheit in daily apparent temperature (a measure combining heat and humidity), emergency room visits for mental health issues increased by nearly 5 percent across all ages. In addition, visits for self-injury or suicide increased by 6 percent.⁵⁶ During higher temperatures, children aged 6 through 18 specifically had a 72 percent greater increase in risk of negative mental health outcomes than adults.⁵⁷

Heat vulnerabilities associated with age, occupation, and socioeconomic factors are especially pronounced in cities due to the urban heat island effect, which is produced by tall buildings that block airflow, an abundance of heat-absorbing surfaces like asphalt, and a lack of tree cover and other green space.⁵⁸ During summers, most of California's larger cities are up to 9 degrees Fahrenheit warmer on average than surrounding suburban and rural areas.⁵⁹ In the Riverside-San Bernardino area, where multiple heat islands form an "urban heat archipelago," there can be a difference of up to 19 degrees Fahrenheit in average temperatures between urban and non-urban areas.⁶⁰

FIGURE 2: AVERAGE JUNE–AUGUST TEMPERATURES IN CALIFORNIA, 1895–2018



Source: NOAA.⁵⁰

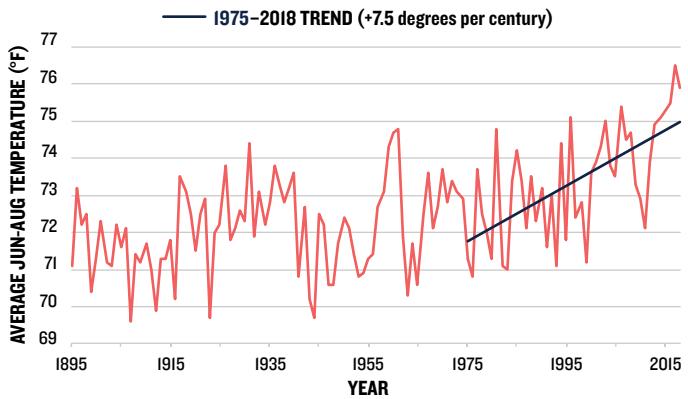
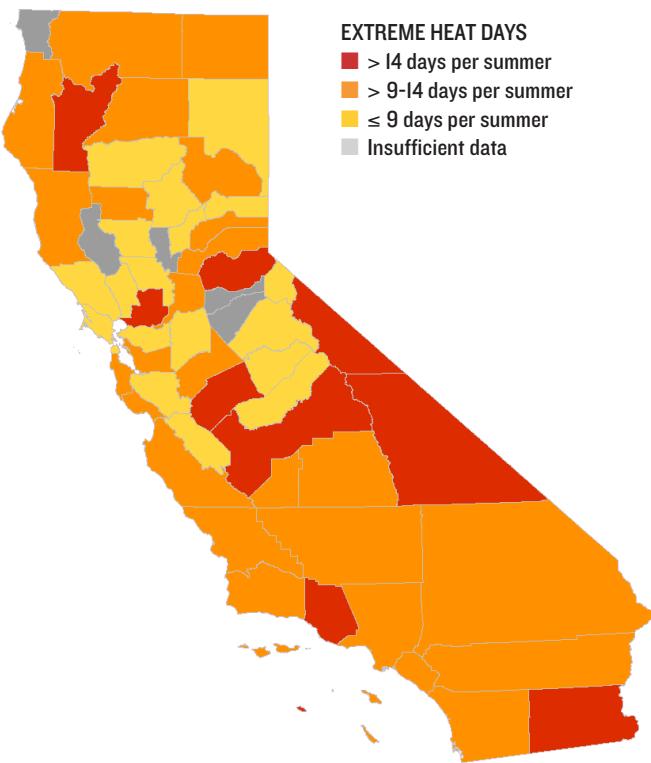


FIGURE 3: AVERAGE NUMBER OF EXTREME SUMMER HEAT DAYS EACH YEAR IN CALIFORNIA COUNTIES, 2007-2016

"Extreme heat days" are defined here as days from June 1 to August 31 on which the maximum temperature at a given station was as hot as (or hotter than) the top 10 percent of maximum readings at that station from 1961 to 1990. We used the June, July, and August days from 1961 to 1990 to calculate the top 10 percent of temperature readings. Nine of these extreme heat days per summer, on average, would be expected if temperatures remain stable. County-level values represent the average of station-level data within a given county.



Source: NRDC.⁶¹

Low-income households and communities of color are often concentrated in the hottest urban neighborhoods.⁶² A 2010 study analyzed areas in Los Angeles with little plant cover, a high density of urban development, and high land surface temperatures. The research found those areas tended to have more people of color, more disabled people, fewer high school graduates, fewer owner-occupied homes, and lower household incomes.⁶³

Low-income households may be unable to afford life-saving air-conditioning; they also may lack access to cooling centers.⁶⁴ In 2015, just nine of Los Angeles County's 94 official cooling centers were located in the most heat-vulnerable census tracts. These areas had high percentages of renters, foreign-born residents, people below the poverty level, and households with no vehicles and no health insurance.⁶⁵ In San Diego County, from 1999 to 2013, people from households in ZIP codes where central air-

conditioning is uncommon were hospitalized significantly more often for heat-related causes on days with a maximum temperature of 89 degrees Fahrenheit or higher, compared to days cooler than 75 degrees Fahrenheit.⁶⁶ Hospitalizations did not significantly increase on hot days in ZIP codes with high ownership of air-conditioning.⁶⁷

In early 2017, a quarter of the nation's homeless population lived in California and 68 percent of homeless people in the state lived on the street, with no refuge from extreme heat.⁶⁸ African-Americans comprised nearly one-third of the state's unsheltered people in 2017.⁶⁹ Homeless people also are more likely to have high rates of chronic disease, mental health conditions, and drug and alcohol dependencies—all of which can increase sensitivity to extreme heat.⁷⁰

California's estimated 423,700 farmworkers and 854,000 construction workers are especially vulnerable to heat-related illnesses and death.⁷¹ From 2000 to 2010, the risk of heat-related deaths was 35 times higher among U.S. farmworkers and 13 times higher among construction workers than workers in other industries.⁷² Researchers in Los Angeles found that from 2005 to 2010, there was an estimated 8 to 11 percent increase in heat-related emergency room visits for every 1 percent increase in the number of residents working in agriculture, forestry, fishing and hunting, and mining.⁷³ Foreign-born farmworkers, who make up about 90 percent of California's agricultural workforce, may be particularly at risk for heat-related illnesses on the job. Language barriers or concerns about their immigration status could potentially hinder their access to heat-safety information and their willingness to report illness to employers or submit workplace safety complaints to California's Division of Occupational Safety and Health.⁷⁴ Furthermore, many foreign-born farmworkers are paid by the amount they harvest, which can dissuade them from taking breaks for shade or water.⁷⁵ As one worker said in a 2013 focus group, "Yes, we continue working because we want to advance to earn what we are supposed to for the day ... we have to continue working, until we can't handle it anymore."⁷⁶

SEVERE DROUGHTS THREATEN FOOD AND WATER SECURITY IN RURAL CALIFORNIA

From late 2011 to early 2017, California endured its worst drought in at least 1,200 years.⁷⁷ The drought caused \$5 billion or more in damage to the state's agriculture industry and affected water supplies, fisheries, and infrastructure.⁷⁸ In 2015, spring and summer runoff was at less than half of normal values at 14 points on major Central Valley rivers. And from spring 2011 to spring 2016, groundwater levels at nearly half of California wells declined by more than 10 feet.⁷⁹

There is increasing evidence that record-high temperatures in 2014, 2015, and 2016 contributed to the historic drought.⁸⁰ First, extreme heat increased water loss



from plants and soils, which exacerbated dry conditions associated with low precipitation.⁸¹ Second, warm winter weather increased snowmelt and decreased the amount of precipitation falling as snow, which dramatically reduced the amount of water stored in California's mountain snowpack.⁸² From late 2011 to early 2015, warmer weather reduced snowpack levels in the Sierra Nevada Mountains—which supply about 60 percent of California's fresh water—by an average of 25 percent.⁸³ If global carbon emissions continue to climb, the snowpack could be reduced by up to 85 percent by the end of this century.⁸⁴

Nearly 4,000 California households—mostly in the agricultural, majority-Hispanic southern San Joaquin Valley—experienced dry or failing water supplies from January 2014 to early August 2016.⁸⁵ Two-thirds of the water shortages in the San Joaquin Valley's Tulare County were in very low-income communities.⁸⁶ Many families relied on bottled water or emergency water tanks provided by state and local governments, corporate donations, or nonprofit organizations, but still had to ration for daily hygiene, drinking, and cooking needs.⁸⁷ In some communities, the emergency tanks stayed empty over the weekends when water trucks failed to arrive on time.⁸⁸ Some residents reported injuries and worsening arthritis symptoms associated with hauling water bottles and walking long distances to public water supplies.⁸⁹ As of early June 2018, 320 San Joaquin Valley households still did not have access to well water.⁹⁰

The 2011 to 2017 California drought also harmed water

quality in the San Joaquin Valley. Groundwater withdrawals by industrial farming operations exacerbated decades-old pollution problems by decreasing the volume of well water, thus increasing the concentration of nitrates and arsenic.⁹¹ Nitrate contamination, which in rural areas largely comes from fertilizers and animal feedlots, can be deadly to infants.⁹² Researchers have linked arsenic exposure to chronic illnesses including diabetes and multiple forms of cancer.⁹³

Finally, the drought made it hard for the poorest residents of the San Joaquin Valley to get enough food. In 2016, 13.4 percent of people (61,452 individuals) in the San Joaquin Valley's nine counties experienced food insecurity, compared to 11.7 percent of California as a whole.⁹⁴ In 2015 alone, there were more than 10,000 seasonal farm jobs lost across California.⁹⁵ The combination of seasonal job losses and rising household water bills during the drought increased food bank usage by farming families.⁹⁶ One food bank in Tulare County, for example, served 5,000 more people in May 2014 than in typical months.⁹⁷ A resident of Cantua Creek, in Fresno County, said at a community meeting, "We have to decide now if we bathe with water or if we eat!"⁹⁸



SOUTHERN CALIFORNIANS FACE MORE VALLEY FEVER UNDER CLIMATE CHANGE

In Southern California, increases in temperature and changes in rainfall patterns fueled by climate change may be contributing to more cases of Valley fever.⁹⁹ Valley fever is an airborne fungal infection that can cause fatigue, shortness of breath, and, in rare cases, serious infections of the lungs, brain, skin, or bones.¹⁰⁰ Approximately 40 percent of people infected with Valley fever need hospitalization.¹⁰¹ California accounted for about 45 percent of the 11,829 cases of Valley fever across the United States in 2016.¹⁰² The number of Valley fever cases increased about fivefold from 1998 to 2016 in California and four other southwestern states.¹⁰³

Additionally, Valley fever can worsen asthma symptoms, leading to more medication and trips to the doctor.¹⁰⁴ The San Joaquin Valley is a hotspot in California for both asthma and Valley fever.¹⁰⁵ Fifty-seven percent of the state's Valley fever cases from 2000 to 2015 were in the San Joaquin Valley, and 11.4 percent of adults in the San Joaquin Valley had active asthma in 2015 and 2016, compared to 8.3 percent of adults across the state.¹⁰⁶

Construction workers, military personnel, oil and gas workers, and others who use heavy machinery outdoors are also vulnerable to Valley fever, because the fungus that causes the infection lives in soil.¹⁰⁷ Occupational exposures accounted for more than half of the Valley fever cases during 47 worldwide outbreaks from 1940 to 2015.¹⁰⁸

STORMS AND SEA LEVEL RISE THREATEN CALIFORNIA'S DRINKING WATER AND COULD DISRUPT TRANSIT AND EMERGENCY SERVICES

Coastal California, which is home to more than 70 percent of California residents, faces significant risks from the combination of rising sea levels and more damaging rainstorms.¹⁰⁹

The average sea level at San Francisco's tide gauge has increased by about 7 inches since 1900, consistent with the global average of 7 to 8 inches since 1890.¹¹⁰ In Northern California's Humboldt Bay, the relative sea level rise is more than double the global rate.¹¹¹ That's because dikes have long prevented natural land-building processes in what used to be tidal wetlands, leading to local land settling and sinking.¹¹²

As a result, parts of California are experiencing an increase in the number of high tide floods (also called "nuisance" or "sunny day" floods) that can block roads and damage infrastructure.¹¹³ From 2000 to 2015, San Diego, La Jolla, Los Angeles, and Humboldt Bay saw a 25 to 50 percent increase in high tide floods. San Diego had 13 high tide flood days in 2017, a new record for the city.¹¹⁴ Under an intermediate sea level rise scenario (about 3 feet by 2100), the coast from Arena Cove in Mendocino County to San Diego could see high tide flooding increase from an average of 1.4 days per year in 2015 to 35 days per year in 2050.¹¹⁵

California also faces a future of stronger rainstorms like the series of severe storms that hammered the state from November 2016 through March 2017.¹¹⁶ If high levels of global carbon emissions continue, the frequency of extremely wet winter/spring seasons along California's coast could increase by an estimated 150 percent by the 2070s, compared to 1850.¹¹⁷ From 2018 to 2060, San Francisco and Los Angeles may even face at least one wet season similar to the devastating winter of 1861 to 1862, in which 45 days of rain forced the temporary relocation of the state legislature from Sacramento to San Francisco and "destroyed almost one-third of the taxable land of California."¹¹⁸

Sea level rise and more frequent storms could lead to more contaminated runoff and more failures of wastewater treatment facilities along California's coast.¹¹⁹ Wastewater treatment plant failures can lead to outbreaks of gastrointestinal infections such as norovirus, crypto, and giardia.¹²⁰ One foot of sea level rise beyond 1988 levels could flood eight wastewater treatment plants that serve more than 1 million Californians.¹²¹ Six feet of sea level rise could flood 36 plants serving nearly 5.6 million people. Thirty of those vulnerable wastewater treatment plants are in the San Francisco Bay area.¹²² In small communities like Marin County's Stinson Beach, sea level rise will push groundwater and waste from septic fields upward into yards, streets, and homes.¹²³ Groundwater flooding associated with 3 feet of sea level rise could inundate about 11 percent of Stinson Beach.¹²⁴

San Francisco is the only city along California's coast with a combined sewer system.¹²⁵ This outdated system, which carries sewage and stormwater in the same pipe, was designed to overflow during heavy rain.¹²⁶ During intense rainstorms, sewage from the combined system can leak into streets and flow into the San Francisco Bay.¹²⁷ Based on sewer overflow data from 2009 to 2014, the San Francisco neighborhoods most likely to flood during heavy rain are Haight Ashbury, Hayes Valley, Mission, Outer Mission, and South of Market (SOMA).¹²⁸ Mission, Hayes Valley, and SOMA have higher percentages of residents living below 100 and 200 percent of the Census Poverty Threshold than the city as a whole.¹²⁹ Outer Mission and SOMA also have higher percentages of people of color than the city as a whole. People in lower-income communities may not have the money to repair flood damage to their homes or to relocate to safer, less flood-prone areas.¹³⁰

Coastal flooding associated with sea level rise and heavy rainstorms can also cause serious and long-lasting damage to health and safety facilities such as emergency shelters and hospitals.¹³¹ Currently, about 25 critical state-owned facilities on California's coast could be flooded by a 100-year event (severe floods with a 1 percent chance of occurring in a given year) and another 29 could be operationally disrupted.¹³² By the 2080s and 2090s, 100-year floods could damage 30 facilities and disrupt the operations of 38 others. More than one-third of the facilities expected to flood at

the end of the century are in communities disadvantaged by pollution exposure, existing health challenges, and socioeconomic factors.¹³³

Sea level rise will also disrupt public transit services, resulting in travel delays and loss of service. According to a national-level survey in 2016, 68 percent of recent tidal flooding and storm surge events had minor to moderate impacts on transit service.¹³⁴ In December 2014, for example, a storm that produced 18 inches of storm surge resulted in several Bay Area Rapid Transit (BART) and Municipal Railway (MUNI) delays and closures in the San Francisco area.¹³⁵

Recurring losses of emergency and public transit services will be especially serious for people who require regular care for chronic illnesses and those who can't drive to medical appointments or emergency rooms.¹³⁶ From 2006 to 2010, an estimated 10.7 percent of African-American households in California's coastal counties lacked access to a vehicle, compared to 6.5 percent of white households.¹³⁷ In San Francisco, interviews in 2014 with 50 elderly residents who received home care services revealed that 41 percent had health issues or disabilities that kept them trapped at home.¹³⁸

ACTING ON CLIMATE CAN PROTECT OUR HEALTH

The good news is that cutting back on fossil fuels and switching to cleaner energy will help limit the dangerous effects of climate change and protect our health.

California's greenhouse gas emissions have declined by 10 percent since 2004, thanks to a wide range of state clean energy and energy efficiency policies including the California Global Warming Solutions Act of 2006.¹³⁹ From 2007 to 2015 alone, California's wind and solar power plants averted the production of nearly 74.6 million metric tons of carbon dioxide.¹⁴⁰ That's the equivalent of what 183 billion passenger vehicle miles, or more than 73 million trips around the Earth, would produce. These renewable energy sources also averted 326 metric tons of sulfur dioxide and more than 19,000 metric tons of nitrogen oxides (the building blocks of smog and particle pollution).¹⁴¹ California has ambitious goals to reduce the state's economy-wide greenhouse gas emissions by 40 percent from 1990 levels by 2030, and to achieve carbon neutrality by 2045.¹⁴² But achieving these targets will require a lot more work.¹⁴³

Reductions in fossil fuel-related air pollution have already improved the health of California's children. For example, air quality improvements in eight Southern California communities significantly reduced the probability of coughing, chest congestion, and other bronchitic symptoms from 1993 to 2012.¹⁴⁴ Among 10-year-old children with asthma, the prevalence of bronchitic symptoms declined 16.3 percent per median decrease in ozone and 15.4 percent per median decrease in fine particle pollution.¹⁴⁵



California has taken strong steps to reduce the carbon pollution causing climate change, but can continue to improve. The transportation sector is California's largest source of climate-changing pollution and one of the main causes of the state's current air quality problem, even though transportation emissions have declined since 2007.¹⁴⁶ Transportation electrification is a critical part of continued climate and clean air progress in California and the rest of the country.¹⁴⁷ This process involves switching from vehicles powered by dirty fossil fuels to ones powered by low- or zero-carbon sources of clean energy.

California metropolitan planning organizations (regional committees of city and county officials) should also increase the ambition of their long-term transportation plans.¹⁴⁸ The existing plans, which include carbon pollution reduction targets and increased alternatives to car travel (e.g., public transportation and infrastructure to increase cycling), can deliver numerous health benefits, including less traffic jam-induced stress and improved response times by paramedics.¹⁴⁹ However, making these plans more ambitious in California's five largest planning regions can further reduce air pollution and increase physical activity. By 2040, these efforts could help California avoid more than 900 deaths each year and the equivalent of more than 16,000 years lost to disability or poor health.¹⁵⁰

Buildings account for about a quarter of California's carbon emissions. Building electrification and increased energy efficiency can improve the health of Californians and help them save money on heat and hot water bills.¹⁵¹ Measures like increasing insulation and installing better windows can make buildings more efficient and help keep them dry and comfortable. These efforts also help protect occupants from extreme heat and indoor asthma triggers such as mold.¹⁵² Using clean electricity generated from pollution-free renewable resources like wind and solar to power high-efficiency electric heating and water heaters can produce immediate health benefits by reducing air pollution from fossil fuel combustion.¹⁵³

More energy savings from efficiency would also benefit the health of low-income Californians who may need to choose between paying for utility bills and other necessities like food or medicine. A recent survey of 750 low-income families in Southern California found that 2 in 3 households had their electricity shut off in the previous three years.¹⁵⁴ In 2016, power disconnections affected more than 884,000 California households across Pacific Gas and Electric's service territory. Eighty percent of the residents in the 20 ZIP codes with the highest shutoff rates in 2016 were people of color.¹⁵⁵ Rising temperatures and population growth only fuel more demand for air-conditioning, which will increase the importance of energy efficiency.¹⁵⁶ Without smarter energy use in Los Angeles County, for example, electricity demand could increase up to 87 percent by 2060.¹⁵⁷

Finally, California needs to continue to refine its plan to address the harmful health impacts of climate change that are already being felt today. The 2018 update to the California Natural Resources Agency's *Safeguarding California Plan* is one of the most comprehensive climate resilience roadmaps in the country.¹⁵⁸ Policy recommendations in the health chapter include improving emergency preparedness in local health departments and transit agencies, promoting strategies that reduce carbon pollution and help keep heat-sensitive neighborhoods cool, and developing data analyses and tools to guide health interventions. The plan also addresses socioeconomic inequities that make people more vulnerable to the health impacts of climate change.¹⁵⁹ For example, measures to make California's agricultural system less energy intensive and more resilient to climate change could improve the financial and food security of farmworkers and increase access to fresh, healthy foods in urban areas.¹⁶⁰

However, as the plan's authors point out, the recommendations "do not serve as comprehensive guidance for how to adapt to climate change." For instance, one of the action items is to "encourage agencies to make resources available to support people suffering mental health consequences." There are no details about how to actually implement this action item—which is perhaps not surprising, given California's complex funding mechanism for mental health services.¹⁶¹ California must continue to work with both internal and external stakeholders to turn many of the next steps in *Safeguarding California* into detailed, implementable projects and programs.¹⁶²

The bottom line is that California residents have much to gain from climate action—and lives to lose if we fail to clean up climate-changing pollution and build resilience to the present-day harms of climate change.

ENDNOTES

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