Climate Program Office

ADVANCING SCIENTIFIC UNDERSTANDING OF CLIMATE, IMPROVING SOCIETY'S ABILITY TO PLAN AND RESPOND

Helping Southern California's people, businesses, and environment thrive in a changing climate

Note: Southern California includes Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, and San Bernardino Counties.

Southern California Key Messages

Extreme heat is one of the most significant climate risks facing Southern California, and that risk is growing in intensity and duration.[1] In Los Angeles, heat threatens public health nearly all year long. Extreme heat disproportionately harms seniors, people of color, and people with pre-existing conditions–especially in urban heat islands. It also diminishes worker productivity.[2] High heat damages infrastructure like roads, highways, and rail lines.

According to a 2015 UCLA study, if nothing is done to control greenhouse gas emissions, parts of Los Angeles County are projected to experience triple or quadruple the number of extreme heat days by 2050.[3,4] California's Inland Deserts region is the state's hottest and driest region and it is becoming more extreme.[5] Imperial County is projected to experience days with temperatures above 90°F more than half the year by midcentury (2035–2064). Riverside County is projected to have 154 days above 90°F by midcentury, and San Bernardino County is projected to have 131 days, where the median value for the state is 79 days.[3]

Access heat health tools and products developed to help you and your community prepare for heat events and learn more about your risks to extreme heat at *Heat.gov* (https://www.heat.gov/pages/tools-information). The Climate Adaptation Programs (formerly known as Regional Integrated Sciences and Assessments) *California-Nevada Applications Program* offers temperature and precipitation maps and time series graphics, and climate outcome likelihood tools at https://cnap.ucsd.edu/climate-tools/.

A two-decade megadrought, with episodes of low precipitation and persistently high temperatures, is afflicting California and much of the West. A 2022 NOAA CPO-funded study found that this megadrought is the Southwest region's driest in at least 1,200 years and that human-driven climate change is responsible for about 42% of soil moisture loss since 2000.[6] Another NOAA-funded study, published in 2020 in the journal *Science*, projects that another megadrought of unprecedented magnitude will very likely hit the Western U.S. in the near future, and warming climate is playing a key role.[7]

California's climate is one of extremes, susceptible to rapid shifts between drought and flood.[8] Hot air, if it's not at 100 percent humidity, is like a thirsty sponge that soaks up water from whatever it touches—plants (living or dead) and soil, lakes and rivers. The hotter and drier the air, the more water vapor it absorbs. If that deficit is cranked up for a long time, soils and vegetation will parch.[9] Furthermore, a NOAA CPO-funded study found that increased atmospheric thirst due to climate warming has the potential to decrease water availability and increase wildfire risks and drought conditions in water-scarce regions including southern California.[10] Considering the increased temperatures and decreased runoff due to a thirstier atmosphere, plants, and soils, the California Department of Water Resources estimates a 10% reduction in state water supply by 2040.[11] The rapid dry-to-wet transition events, referred to as precipitation whiplash, are projected to increase first in southern California and can eventually spread to the rest of the state, becoming California's normal change in precipitation.[8,12,13]

Sources

Header: Emily Hoehenrieder, Unsplash

Icons: High Temperature by Amir Ali, Drought by Llisole

1 http://publichealth.lacounty.gov/eh/climatechange/ExtremeHeatNClimateChange.htm
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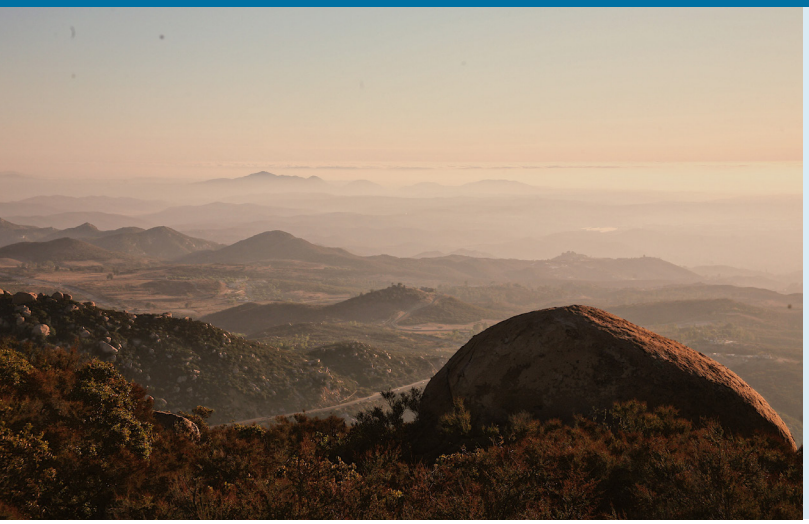

View up-to-date drought conditions down to the city and county level, including temperature, and precipitation conditions, key drought indicators, outlooks, historical conditions, and water supply, agriculture, and public health maps on *Drought.gov* (https://www.drought.gov/states/california). Then, plot maps of temperature, precipitation, and drought for any month and year dating back to 1895 at *Climate At a Glance* (https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/). Another great resource is the *Climate Explorer* which features climate maps and graphs for temperature and precipitation downscaled projections and extreme events for every county through 2100 (https://crt-climate-explorer.nemac.org/).

Photo source: Leila Bandringa, Unsplash

In the Fourth National Climate Assessment, a review of the most up-to-date science found strong links between drought, tree mortality and an increase of fire on the landscape with much research pointing to human-caused climate change.[14] California's Fourth Climate Change Assessment found that human activities account for the cause of 60% of large fires, and they are likely to have a large effect on future fire activity.[5]

Toward the end of the summer season, downslope winds, such as the Santa Ana winds of Southern California that can gust to 80 mph, are often associated with the most destructive wildfires.[15] The San Gabriel Mountains, largely covered by the Angeles National Forest, have the highest degree of wildfire risk. On average, the San Gabriel Mountains are projected to experience an increase in wildfire burn area of approximately 40 percent and 50 percent in 2050 and 2080, respectively, under the high emissions scenario.[16] In addition to the potential loss of life and property, wildfires may result in erosion and landslides, reduced air and water quality, and loss of native biodiversity.[17] In fact, air quality in southern California is expected to worsen with climate change due to higher ground-level ozone concentrations, and increased particulate matter resulting from more frequent wildfires.[18] By the end of the 21st century (2070–2099), climate change under a high greenhouse gas (GHG) emissions scenario will likely increase the annual large (greater than 40 hectares) wildfire days from ~36 days in 1970–1999 to ~71 days, while moderate GHG emissions scenario will increase it to ~58 days in Southern California.[19]

Explore drought, wildfire, inland and coastal flooding on past, present, and future climate conditions at the county and community level with the Climate Mapping for Resilience and Adaptation tool (https://resilience.climate.gov/). The *State Climate Summary* for California provides long-term trends and extreme weather events including wildfire events. You can also explore observed and projected climate change information (https://statesummaries.ncics.org/chapter/ca/).

Agriculture is paramount for California's economy; the state has the largest agriculture sector in the U.S., yielding $49 billion in cash receipts in 2020. Agriculture employs 420,000 people statewide.[20] Southern California contributes significantly to the state's agriculture sector. In 2020, Imperial County was the 9th ranked county in agricultural production value statewide, thanks to its cattle, vegetables, alfalfa hay, and leafy greens production. Ventura County ranked 10th on the strength of its strawberries, lemons, avocados, and raspberries.[21]

Water is essential for both crops and livestock. California's climate is known for its rapid shifts between drought and flood, but climate change is projected to intensify these precipitation fluctuations, challenging water resources infrastructure.[22] Climate change is worsening the current megadrought affecting California and much of the West.

Sources:

Icons: Forest Fire by Nikita Kozen, Cow by Laymik, Agriculture by Made

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The *Western Regional Climate Center* offers historical precipitation, temperature, and snow summaries, maps, and tables as well as current monitoring of climatic conditions of states in the western region. This tool also provides speciality climate information including impacts to agriculture (https://wrcc.dri.edu/). To further address questions related to climate monitoring, forecasts, and projections, explore the *Climate Toolbox*, developed in partnership with NOAA (https://climatetoolbox.org/climate).

Unusually warm temperatures in 2021—nearly 3.5 degrees Fahrenheit above the 20th-century average of 58.5°F—created an estimated additional 3–4 inches of evaporative demand, or about an 8 percent increase in crop water demands.[20,23] A study using projections from a NOAA climate global climate model found that while warmer temperatures can increase crop water demand, they can simultaneously reduce water supply for agriculture.[24,25]

Visual Resources for Southern California

Case Study: January 2018 Montecito Debris Flows

The Montecito debris flows that occurred in January 2018 were the result of a rare confluence of two uncommonly extreme events converging: the Thomas Fire which was the largest wildfire in California history at that time and which for weeks burned through Ventura and Santa Barbara counties; and the intense winter storm, at one point dumping half an inch of rain in a five-minute period on the newly charred mountainside.[26] California Geological Survey scientists estimated the Montecito debris flow as having speeds of 10-15 mph, being up to 25-30 feet deep, and capable of carrying boulders as large as a tow truck.[27] The event killed 21 people and resulted in at least 167 injuries and 436 damaged or destroyed homes.[28,30] Overall, insurance claims for the event were over $421 million.[29] In addition to the tragic loss of life and property, the debris flows caused tremendous business and transportation interruptions. Highway 101, an iconic arterial of California, was blocked for many days, as was the adjacent Surfrider railroad line. The communities of Santa Barbara, Montecito, and others in the region are heavily influenced by tourism that relies on connectivity.[30]

Looking ahead, the likelihood of post-fire debris and mud flow is likely to increase, in large part because climate change is already leading to intensity of more fires and extreme precipitation.[26,31] When the ground is parched, fire-charred soil can become hydrophobic and repel water. The California Department of Conservation advises that residents of fire-struck areas be prepared for potential debris flows for as long as two to five years after major fires.[31]

First responders performing search and rescue after damage from the debris and mud flow. More damage to homes from the debris and mud flow. Source: California Department of Conservation

Sources:
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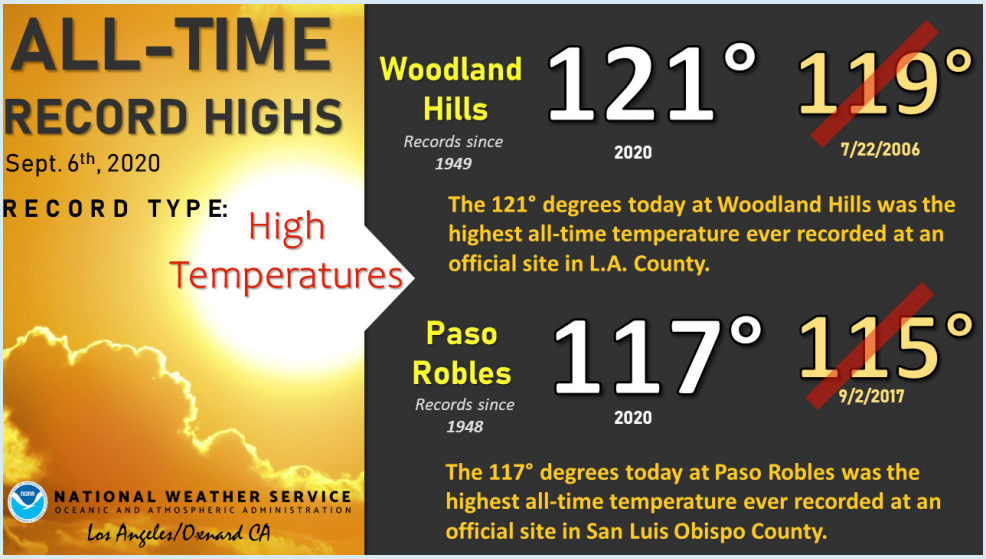
Case study: Sept. 2020 Dangerously Hot Heat Wave

In early September 2020, an intense heatwave broke temperature records in several locations in Southern California. The dry, hot conditions helped fuel new and existing fires, which have consumed tens of thousands of acres of land.[32]

The extreme heat resulted in hundreds of hospitalizations and emergency responses in San Diego County. The intense heat was accompanied by unusually strong early season Santa Ana winds which contributed to explosive wildfire growth. Two large wildfires (El Dorado and Valley) burned over 45,000 acres and resulted in long duration evacuations and firefighting efforts to suppress the fires.[33]

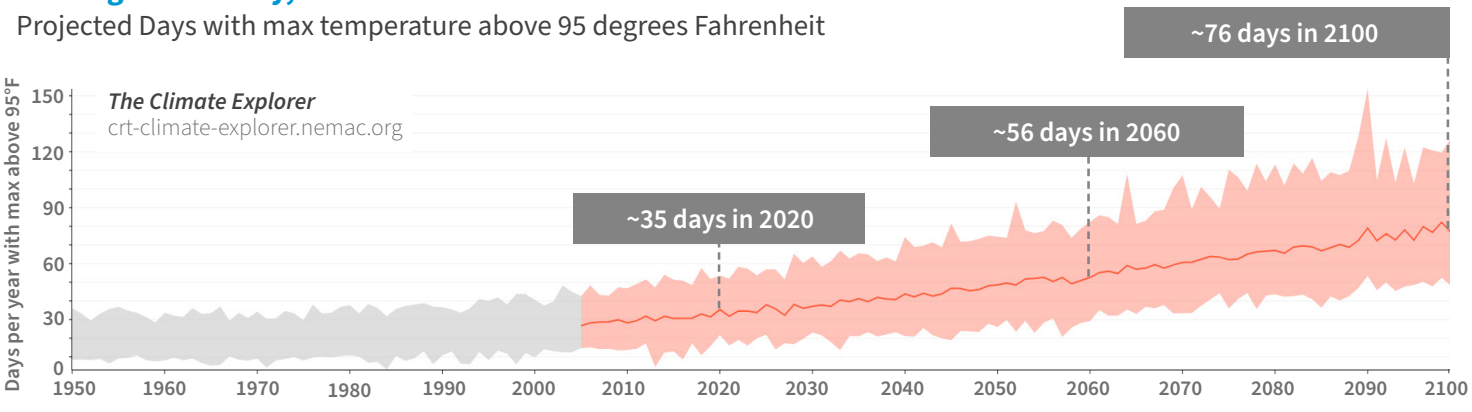


The 121 degrees at Woodland Hills and 117 degrees at Paso Robles broke climatological records as the highest all-time temperature ever recorded in an official site in Los Angeles County and San Luis Obispo County respectively. Source: NWS Los Angeles/Oxnard

In Los Angeles County, the observing station at Pierce College (Woodland Hills) in the San Fernando Valley recorded an all-time record high of 120°F (49°C) on Sept. 6.[34] On September 6, 2020, around 1:30 p.m., Los Angeles County recorded its highest temperature ever at 121°F at Woodland Hills. Several other cities, like Paso Robles and Palmdale, also hit record highs. A major reason for increased heatwaves is warmer nighttime temperatures in Southern California, which increased approximately 0.41°C per decade. This trend more than doubles when humidity (i.e., heat index) is taken into account. According to recently published research, these extremes fit a long-term trend toward longer and more intense heatwaves in Southern California.[32]

Los Angeles County, California

Projected Days with max temperature above 95 degrees Fahrenheit



Days in Los Angeles County with maximum temperature greater than 95°F where red is a high emission scenario and gray is modeled history. (**https://crt-climate-explorer.nemac.org/**)

Sources:
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