

Could California's Drought Last 200 Years?

Clues from the past suggest the ocean's temperature may be a driver.



The cracked-dry bed of the Almaden Reservoir near San Jose shows the strain of California's megadrought. The governor has declared a drought "state of emergency."

PHOTOGRAPH BY MARCIO JOSE SANCHEZ, AP

Thomas M. Kostigen
for [National Geographic](#)

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Two years into California's drought, Donald Galleano's grapevines are scorched shrubs, their charcoal-colored stems and gnarled roots displaying not a lick of life. "I've never seen anything like this," says Galleano, 61, the third-generation owner of a 300-acre [vineyard in Mira Loma](#), California, that bears his name. "It's so dry ... There's been no measurable amount of rain."

California is experiencing its worst drought since record-keeping began in the mid 19th century, and scientists say this may be just the beginning. [B. Lynn Ingram](#), a paleoclimatologist at the University of California at Berkeley, thinks that California needs to brace itself for a megadrought—one that could last for 200 years or more.

As a paleoclimatologist, Ingram takes the long view, examining tree rings and microorganisms in ocean sediment to identify temperatures and dry periods of the past millennium. Her work suggests that droughts are nothing new to California.



PHOTOGRAPH BY GEORGE ROSE, GETTY

Lake Mendocino, a major water storage lake near Ukiah, California, is nearly dry.

"During the medieval period, there was over a century of drought in the Southwest and California. The past repeats itself," says Ingram, who is co-author of *The West Without Water: What Past Floods, Droughts, and Other Climate Clues Tell Us About Tomorrow*. Indeed, Ingram believes the 20th century may have been a wet anomaly.

"None of this should be a surprise to anybody," agrees Celeste Cantu, general manager for the [Santa Ana Watershed Project Authority](#). "California is acting like California, and most of California is arid."

Unfortunately, she notes, most of the state's infrastructure was designed and built during the 20th century, when the climate was unusually wet compared to previous centuries. That hasn't set water management on the right course to deal with long periods of dryness in the future.

Given that California is one of the largest agricultural regions in the world, the effects of any drought, never mind one that could last for centuries, are huge. About 80 percent of California's freshwater supply is used for agriculture. The cost of fruits and vegetables could soar, says Cantu. "There will be cataclysmic impacts."



PHOTOGRAPH BY DAVID MCNEW, GETTY

Farms, like this one near Bakersfield, California, have been unable to sustain crops or livestock due to the driest conditions in decades.

What's causing the current drought?

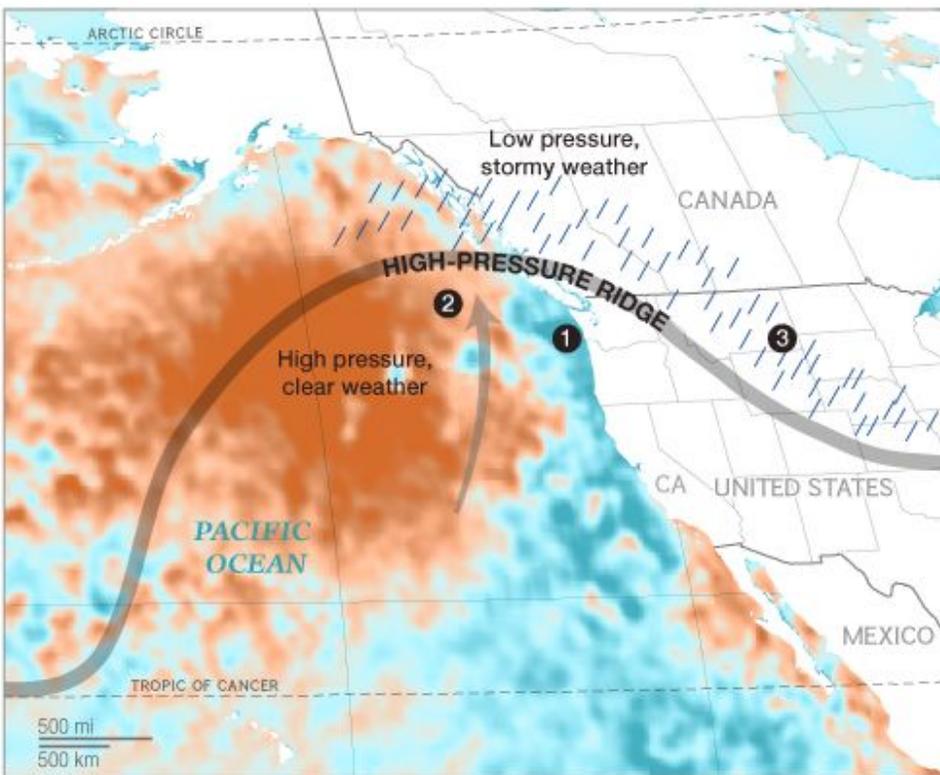
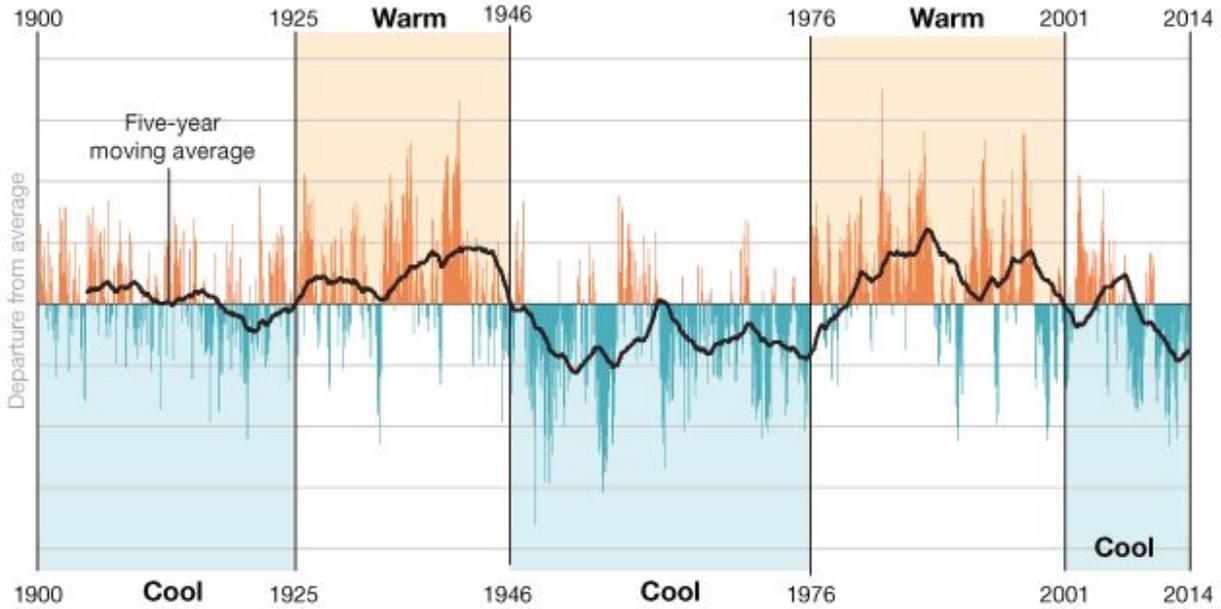
Ingram and other paleoclimatologists have correlated several historic megadroughts with a shift in the surface temperature of the Pacific Ocean that occurs every 20 to 30 years—something called the Pacific Decadal Oscillation (PDO). The PDO is similar to an El Niño event except it lasts for decades—as its name implies—whereas an El Niño event lasts 6 to 18 months. Cool phases of the PDO result in less precipitation because cooler sea temperatures bump the jet stream north, which in turn pushes off storms that would otherwise provide rain and snow to California. Ingram says entire lakes dried up in California following a cool phase of the PDO several thousand years ago. Warm phases have been linked to numerous storms along the California coast.

"We have been in a fairly cold phase of PDO since the early 2000s," says Brian Fuchs, a climatologist at the [National Drought Mitigation Center](#), "so the drought we are seeing now makes sense."

That said, scientists caution against pinning the current drought on the PDO alone. Certainly ocean temperatures, wind, and the weather pattern in the Pacific have contributed to the drought, says [Nate Mantua](#), of NOAA's National Marine Fisheries Service in Santa Cruz, California, where the PDO pattern was first discovered and named. "But it's more nuanced than saying the PDO did this." After all, as its name suggests, the PDO is decades in the making.

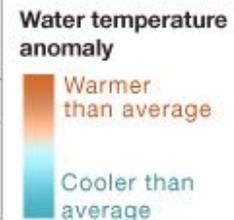
Measuring Ocean Trends

This Pacific Decadal Oscillation (PDO) index represents a monthly pattern of anomalies in sea surface temperature. The PDO waxes and wanes approximately every 20 to 30 years. Scientists think we are now in a cool phase.



Pacific Decadal Oscillation, February 2014

- 1 Cooler than average water along the coast wraps around a core of warmer than average water.
- 2 This creates a high-pressure ridge that pushes north.
- 3 Rain falls north of the ridge, leaving the southwest U.S. dry.



What can Californians expect?

Yet it's only natural to want hints of what's to come. "Water managers need to know how much water they can expect in their lakes and reservoirs," says Fuchs.

Ultimately, how long the current California drought will last is anyone's guess. Cantu says the Santa Ana Watershed Project Authority is stymied by that uncertainty. "We need to import water, and we need to know how much we can move around," she says. Some 4.5 million people rely on that southern California water supply, including ranchers and farmers like Galleano.

He says it would be nice to know if he is going to be able to grow any grapes at all in 2014. Asked how he would deal with a long bout of dryness, Galleano says he'd just have to "drink the wine."