California's Latest Drought

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California has been in a major drought.

Droughts are a recurring feature of California's climate, and the four-year period between fall 2011 and fall 2015 was the driest since record keeping began in 1895. High temperatures worsened its effects, with 2014 and 2015 being the two hottest years in the state's recorded history. Precipitation in 2016 was average in northern California—where most of the state's water supply originates—but this was not enough to eliminate the severe water deficit. Governor Brown declared a statewide drought emergency in January 2014, establishing an interagency drought response team. The legislature has allocated more than $3 billion—mostly from voter-approved bonds—to provide drought relief and improve water management.

Effects of the drought are being felt differently in urban and rural communities.

Households and non-farm businesses account for about 20% of all human water use in California. Most urban and suburban areas were relatively well prepared for drought, thanks to significant investments to diversify their water supplies and build infrastructure that allows communities to share water during emergencies. In response to voluntary local programs and a statewide conservation mandate announced in April 2015, urban areas cut water use by nearly 25% between 2013 and early 2016. In 2016, urban agencies were given more flexibility, and some have relaxed restrictions in response to local supply conditions. But in some rural areas—particularly in the San Joaquin Valley and the Sierra Nevada—small communities without diverse water sources have faced shortages, and more than 2,000 domestic wells have run dry. The state has provided emergency supplies, and has begun investing in longer-term solutions.

The drought has been particularly hard on the agricultural sector.

Most farming in California depends on irrigation, which accounts for about 80% of the state's human water use. In 2015 growers received nearly 50% less surface water because of the drought. They made up for much of that loss by pumping additional groundwater, but still had 10% less water than in normal years. Farm-to-farm water sales helped keep valuable orchards and vineyards alive. But farmers also reduced acreage by 6% statewide. Land fallowing and higher costs for water and feed led to nearly $2 billion in farm sector losses, along with some 10,000 seasonal, part-time, and full-time farm jobs. Although farming is a relatively small share of California's economy (1–2% of gross state product), water cutbacks also cause hardship in sectors that support farming, such as fertilizer sales, transportation, and industries that process farm products. Continued drought will worsen these effects.

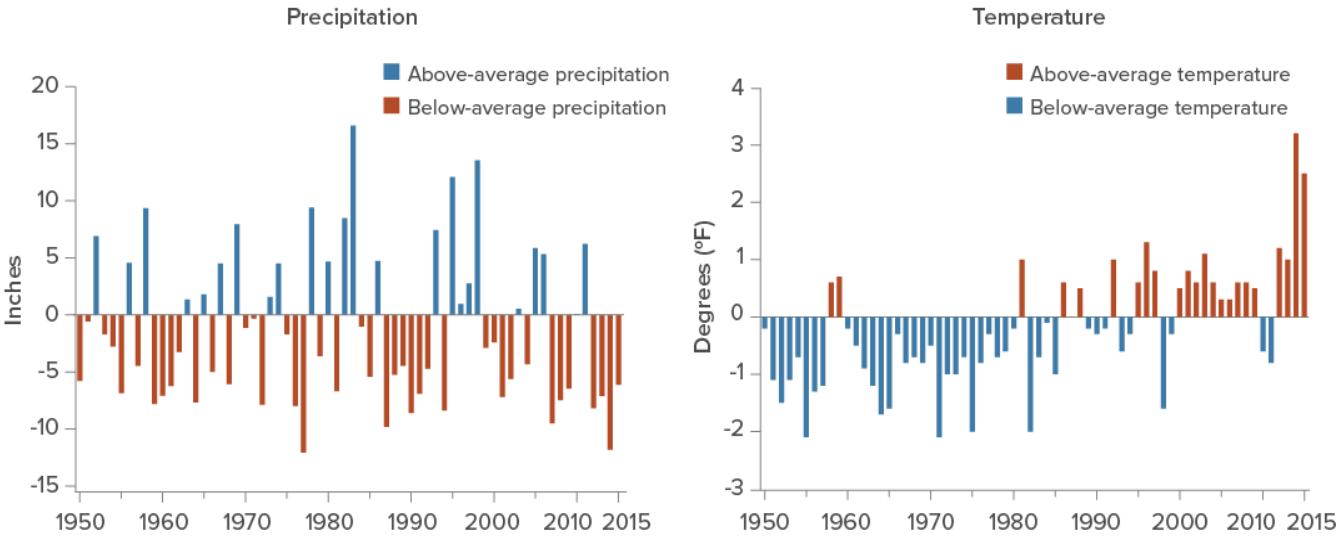
The environment is also being hit hard.

Low flows and high water temperatures are threatening California's native fish. As many as 18 species—including most salmon and steelhead runs—are at risk of extinction if the drought continues. Wildlife refuges that provide vital habitat for migratory birds and other species have also faced shortfalls. And dry, dense forests are at increased risk of extreme wildfire. More generally, the state is facing difficult tradeoffs, such as whether to retain cold water in reservoirs to maintain endangered salmon or release this water to protect smelt in the Delta or to support wildlife refuges. The state has already relaxed environmental flow standards to reserve some water supplies for farms and cities and is under pressure to do more of this.

Droughts generate opportunities to improve water policies.

Droughts encourage better water management, including more efficient water use and investments in new supplies—such as wastewater recycling, groundwater storage, and stormwater capture. In 2014, California enacted the Sustainable Groundwater Management Act, which will facilitate better management of groundwater, an especially valuable resource during droughts. There are many opportunities to make progress in these and other areas. This drought is also a useful warning about future conditions—climate change simulations indicate that droughts are likely to increase in severity and more frequently resemble this drought.

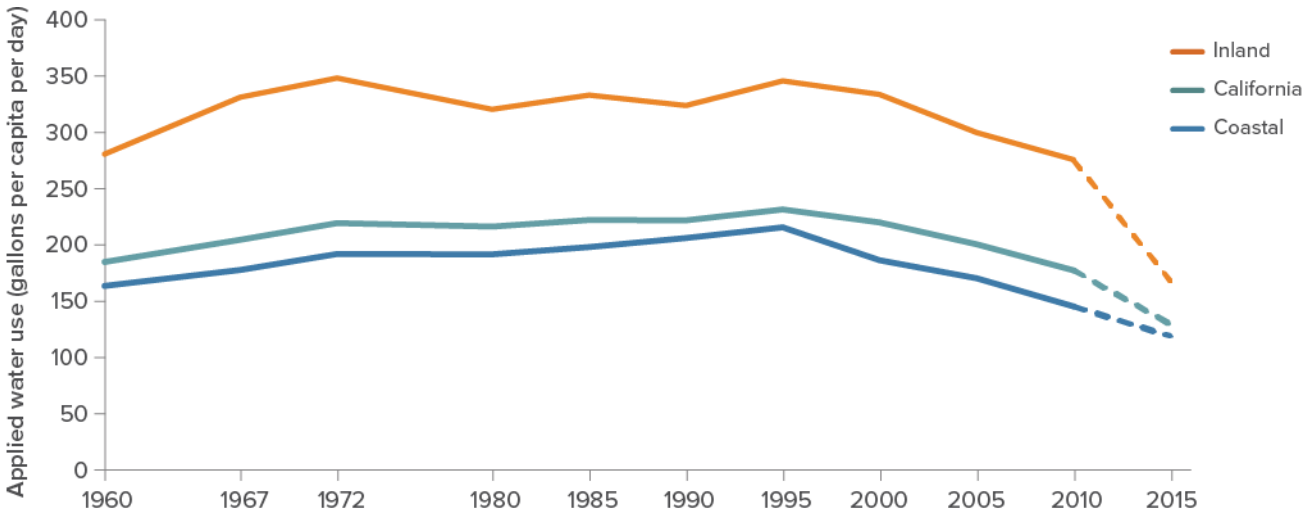
This drought has combined low precipitation and record-high temperatures



Source: Precipitation: Western Regional Climate Center. Temperature: National Oceanic and Atmospheric Administration.

Note: Averages are calculated for 1981–2000. Average statewide precipitation is 23.8 inches, and average temperature is 58.3°F.

Per capita water use in urban areas has fallen sharply during this drought



Source: Author calculations (1960–2010) using data from California Water Plan Update (California Department of Water Resources, various years) and urban water conservation reports from the State Water Resources Control Board (for 2015).

Note: The figure shows applied water use—the amount delivered to homes and businesses—and excludes energy use, conveyance losses, and active groundwater recharge. Except for 2015 (a severe drought year), the figure reports estimates for normal rainfall years. (Pre-2000 estimates are adjusted to levels that would have been used in a year of normal rainfall.) Estimates are for water years (October to September), except for 2015, which is for the calendar year. Inland per capita use in 2015 was 168 gallons per capita per day (gpcd) and coastal use was 119 gpcd. Inland areas tend to have higher per capita use because of higher temperatures and larger landscaped areas.

Sources: Drought impacts: E. Hanak et al. *What If California's Drought Continues?* (PPIC 2015). Water use data: California Department of Water Resources and State Water Resources Control Board. Gross state product data: US Bureau of Economic Analysis. Precipitation data: Western Regional Climate Center. Temperature data: National Oceanic and Atmospheric Administration.

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