

## California must keep improving its ability to weather droughts

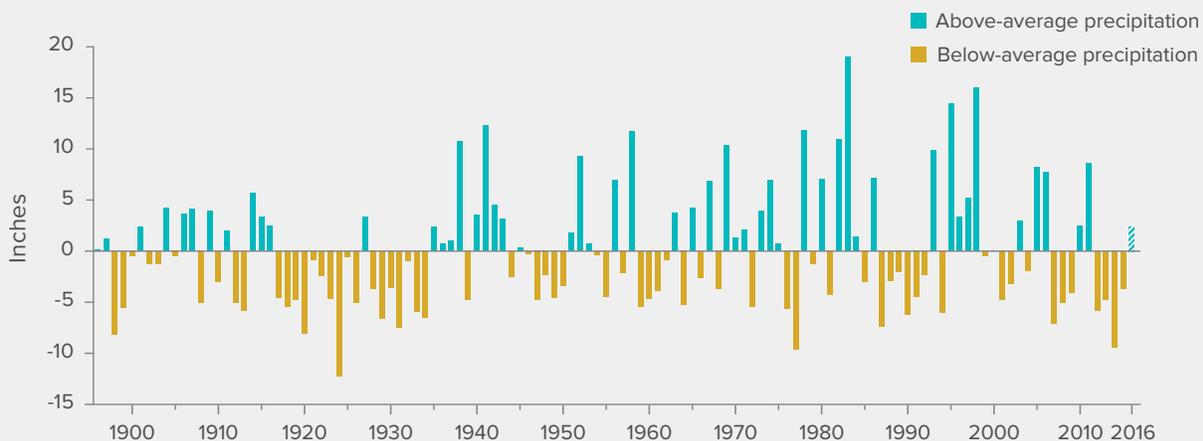
Droughts are a regular feature of California’s variable, semiarid climate. The laws that govern the allocation and use of water—as well as the operation of reservoirs, groundwater basins, canals, and aqueducts—were created in part to manage water scarcity during dry periods.

California has weathered many droughts, including four in the past four decades. These ranged from a short, severe drought from 1976 to 1977 to a prolonged six-year drought from 1987 to 1992. The latest drought began in 2012, and it includes the driest four-year stretch in 120 years of record keeping. This drought has been more widespread than most, covering the entire state. The years 2014 and 2015 were also the two hottest on record, which made conditions even drier. Rains in Northern California in early 2016 provided some relief, but this drought is not over. It is not unusual for one or two wetter years to fall within a series of dry years.

It is difficult to specifically link the latest dry period—or any individual weather event—to climate change caused by human activity. Nonetheless, climate change models suggest that the current drought may be a “dry run” for a drier and warmer future. This poses major challenges for managing water to support a growing population and economy, while also sustaining a healthy environment.

Droughts test California’s water management systems and expose their weaknesses. They also provide opportunities to improve the state’s ability to weather future droughts. California needs to learn from the latest drought and begin preparing for the next one.

### DROUGHTS ARE A RECURRING FEATURE OF CALIFORNIA’S CLIMATE



SOURCE: Western Regional Climate Center.

NOTES: Bars show the number of inches above and below the long-term California statewide average precipitation level of 21.45 inches, based on water years (October–September) since 1896. The dashed 2016 bar is based on data through June and author estimates for the remaining three months based on 2015 values.

## Urban and rural areas have fared differently in the latest drought

California’s diverse sectors and regions have experienced this drought in different ways.

- **Large urban areas have fared reasonably well.**

Most large metropolitan utilities were better prepared to handle this drought than past ones, despite population increases. Those that have performed well—mainly in Southern California and the San Francisco Bay Area—invested extensively to diversify their water supply portfolios following the 1987–92 drought. Utilities built interconnections with neighboring systems that drew on different supply sources, reduced per capita water use,

stored conserved water in new reservoirs and groundwater storage facilities, and purchased water from farmers. From 2013 to 2015, urban residents further reduced water use by nearly 25 percent in response to voluntary local programs and a statewide conservation mandate. On the downside, this rapid decline in water sales caused financial problems for some utilities.

- **Some communities were vulnerable.**

Some communities faced extreme shortages, reflecting their high dependence on a single source and their lack of connections with other water utilities. By late 2015, more than 100 small water systems faced shortages and more than 2,000 domestic wells went dry in some small, poor, rural communities—particularly in the Central Valley and the Sierra Nevada foothills. The state provided emergency aid for replacement water.

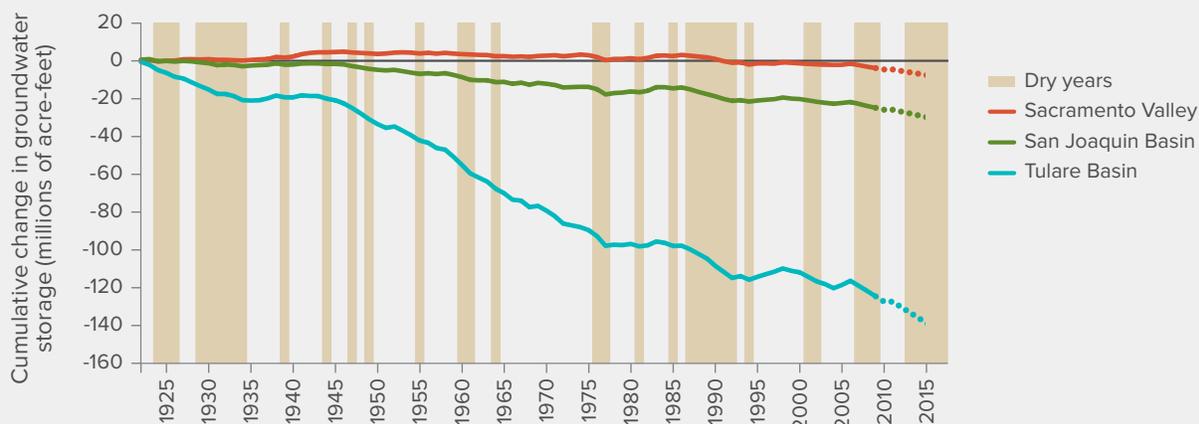
- **Agriculture faced major problems.**

In 2014, deliveries of surface water to Central Valley farms were just 63 percent of average; in 2015 they dropped to 52 percent. Farmers with the oldest and highest-priority water rights were better served, but many received little or nothing. Farmers offset most of the missing surface water by pumping additional groundwater. Some purchased water from other farmers to keep tree crops alive. But they also had to fallow some land—more than 500,000 acres, or 6 percent of irrigated acreage in 2015. Increased groundwater pumping and land fallowing led to increased costs and lost revenues and jobs. Strong commodity prices partially offset production losses. The state provided financial and food assistance to hard-hit farmworker communities.

- **The drought exposed weaknesses in groundwater management.**

Although farmers in most areas were able to pump more groundwater, decades of unsustainable pumping have made this resource more costly and less reliable. High pumping volumes—both before and during the drought—have lowered groundwater tables. This has boosted pumping costs, degraded water quality, and caused land to sink, damaging aqueducts and other infrastructure. Legislation enacted in 2014 requires local agencies with the most stressed basins to adopt sustainable groundwater management plans by 2020. These plans can improve drought resilience over the long term, but their implementation may limit farm water supplies.

### UNSUSTAINABLE GROUNDWATER PUMPING IS DEPLETING RESERVES IN THE CENTRAL VALLEY



SOURCE: Ellen Hanak et al., *What If California's Drought Continues?* (PPIC, 2015), Figure 3, using data through 2009 from the California Department of Water Resources and author estimates thereafter.

NOTES: Lines show cumulative change in groundwater storage based on water years (October–September). Projections since 2009 may underestimate depletions since the onset of the latest drought in 2012. Dry years are those classified as critical or dry in the Sacramento Valley based on the California Cooperative Snow Survey.

## The latest drought has hit ecosystems hard

Water and habitat management during droughts can have lasting impacts on migratory birds, fish, and other species.

- **Wetland and river ecosystems have suffered.**

Rivers throughout California have experienced record-low flows and poor water quality. Many coastal and mountain streams have dried up, harming salmon, steelhead, and other native fishes. Conditions have further deteriorated

for fish in rivers below Central Valley dams, and some hatcheries have lacked adequate cold water. Water supplies also fell dramatically in wildlife refuges in the Central Valley and Klamath Basin—key habitats for migratory birds and other species. This forced birds to gather in smaller areas, increasing their vulnerability to disease outbreaks and predation.

- **Regulators have been forced to make trade-offs on the fly.**

With little advance planning for managing fish and wildlife during severe droughts, regulators had to make difficult decisions in 2014 and 2015 based on limited knowledge and almost no scientific or public review. Environmental flow protections in Central Valley rivers were reduced to send water to cities and farms. Most eggs of endangered winter-run Chinook salmon died because of poor management of cold water releases from Shasta Reservoir. Fish and wildlife agencies carried out many fish rescue efforts. In some cases, they had to make difficult choices between competing environmental needs—such as water for salmon versus smelt, or for fish versus waterbirds.

- **Species declines usually increase future costs.**

As many as 18 native fish species—including most salmon runs—are at near-term risk of extinction with continued drought. The failure to protect native biodiversity during drought can have long-term consequences. These can include greater risk of extinction for some species, as well as increased future regulatory costs and water supply reductions for cities and farms if actions taken during drought cause some species to move into threatened or endangered status.

## The latest drought has tested state water allocation policies

Water is a scarce resource in California even in normal years. The state government oversees water rights and must be prepared to manage cutbacks during droughts to balance competing needs fairly. In 2014 and 2015, California's inter-agency drought task force managed many aspects of the emergency in an effective and coordinated manner. But the drought also exposed weaknesses in the water allocation system.

- **California's fragmented water rights system creates unnecessary problems.**

The State Water Board's efforts to allocate scarce water supplies were made more difficult by an archaic water rights system. Some senior water-right holders successfully challenged the board's authority to curtail their water use.

- **The state lacks a comprehensive policy on water allocation priorities.**

In addition to overseeing urban and agricultural users' water rights, the state must consider the water needed to protect public health and aquatic ecosystems. It did not have clear and comprehensive policies on how to prioritize these vital interests.

- **Drought water allocations have not fully followed two important legal doctrines.**

The state constitutional "reasonable use" requirement mandates that all water uses must be reasonable under current hydrologic conditions. The "public trust" doctrine requires the state to consider the effects of its water allocation decisions on aquatic ecosystems, water quality, and fisheries, and to protect such uses to the extent feasible under the circumstances. The state has not followed these doctrines sufficiently when allocating water, instead relying principally on the priority of water rights.

- **The state's information systems are inadequate.**

Water use reporting has advanced in recent years. Still, state agencies lack sufficient information on water rights, surface water flows, and water use to manage droughts more effectively. As a result, recent curtailment decisions have been based on rough estimates and may unfairly harm some water users and the environment.

## Looking ahead

Now is the time to plan for the next drought, while experience gained in this latest drought is still fresh. Better preparation will also help California adapt to a warming climate and an increasingly variable hydrology.

**Build on progress in urban drought management.** Some cities still need to diversify water supply sources and reach sharing agreements with neighboring communities. Many utilities must improve their drought pricing policies to give customers incentives to conserve, while generating adequate revenue to remain financially healthy when water sales decline. The state needs to refine its conservation policy to encourage continued local investments in drought resilience.

**Build resilience for disadvantaged rural communities.** Proposition 1—a water bond approved by voters in November 2014—provides funds to improve drinking water systems in communities now at risk. Where feasible, these communities should be connected to larger water systems. Legislation passed in 2015 will make this easier.

**Implement sustainable groundwater management.** The new groundwater legislation should be implemented rapidly to improve agriculture’s drought resilience. Proposition 1 provides \$100 million to support local planning efforts in this area, and legislation passed in 2015 makes it easier for groundwater users to clarify pumping rights.

**Modernize management of cutbacks.** The sources and uses of water should be tracked better, the State Water Board’s direct regulatory authority should be extended to all surface water rights, the reasonable use and public trust doctrines should be applied in allocation decisions, and priorities for protecting environmental flows and public health should be explicitly defined and comprehensively implemented.

**Develop an environmental stewardship strategy.** State leaders should commission an aquatic biodiversity task force to develop recommendations for action—and related funding—for managing riverine and wetland areas during droughts and prioritizing conservation actions. Some ecosystem-oriented funds from Proposition 1 could be directed toward restoring aquatic habitats to improve their drought resilience.

**Conduct periodic dry runs for drought emergencies.** California regularly assesses preparedness for floods, wildfires, earthquakes, and other emergencies. The state should also carry out simulations to test agency performance and evaluate impacts to water users and the environment during drought emergencies.

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