



AUGUST 2015

Key Findings: What If California’s Drought Continues?

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The ongoing drought has served as a stress test for California’s water management systems, and continuing drought will test them further. Here we summarize likely impacts if the drought continues for two or three more years, and provide some key recommendations for maintaining resiliency.

Likely impacts and management challenges if the drought continues

Water availability	
Runoff and storage	Reduced runoff (25–40% of average) due to low rainfall and snowpack. Fall reservoir storage at 50% of historic average. Impacts vary regionally depending on precipitation patterns.
Deliveries and curtailments	Supply reduced for farms (8.5–9.0 million acre-feet/year) and cities (2.0–2.5 million acre-feet/year) compared to normal years. Central Valley Project and State Water Project allocations remain at 2015 levels. Surface water shortages require extensive curtailment of water rights, including many senior pre-1914 and riparian rights. Hydropower generation remains at half of recent average, increasing energy costs (\$500 million/year or ~2%).
Groundwater	Central Valley continues heavy reliance on groundwater. Excess pumping of 6 million acre-feet/year (with \$650+ million additional energy cost for pumping). Increase in dry wells; acceleration of widespread land subsidence and damage to infrastructure.
Water quality	Low flows and high air temperatures cause widespread decline in water quality in rivers and streams. Low reservoirs make managing Delta salinity increasingly difficult.
Cities and suburbs	
Large metropolitan areas have reasonably secure supplies, but require continued conservation efforts and some new supply investments. Isolated communities with a single water source face shortages and require alternative supplies. Some water- and snow-sensitive industries that rely heavily on water (e.g., boating, skiing) face financial hardships, but not enough to dampen statewide economic growth.	
Farms	
Net water shortfall of 2.5–3.0 million acre-feet/year results in roughly 550,000 acres fallowed annually; economy-wide economic losses of more than \$2.8 billion, loss of more than 10,000 full-time, part-time, and seasonal farm jobs, and more than 21,000 jobs economy-wide.	
Rural communities	
Number of rural water districts and homes that rely on shallow wells need emergency assistance increases as wells go dry. Fallowing of farmland exacerbates poor air quality in some parts of the Central Valley and increases economic hardship in farmworker communities.	
Ecosystems	
Native fishes	Record-low flows and high temperatures continue to degrade habitat for native fishes. As many as 18 native fishes face likelihood of near-term extinction, including delta smelt, most salmon runs, and several species of trout. Economic losses for commercial and recreational fisheries.
Waterbirds	Fall and winter habitat for waterbirds of the Pacific Flyway decline dramatically from reduced water for wetlands and flooded farmland. Bird populations reduced by limited food supplies and disease from overcrowding.
Forests	Extreme wildfire hazard due to high temperatures, dry conditions, and increased tree mortality in California’s forests. Severe wildfires (comparable to the 2013 Rim Fire) occur, impacting local communities, watersheds, wildlife, infrastructure, and air quality. Risks of permanent loss of conifer forest ecosystems in burned areas.

SOURCE: See *What If California’s Drought Continues?* technical appendix Table A10 for details.

NOTES: Assumes two to three more years of 2014 conditions. Reductions in water availability are relative to a normal rainfall year.

Recommendations for Building Drought Resilience

WHAT'S WORKING

Diversified water portfolios: Historic investments in diversifying water supply sources and managing demand have yielded great benefits. Further investments could be aided by streamlined permitting.

Regional infrastructure: Coordinated infrastructure development among multiple agencies has built regional diversity in water supplies and reduced vulnerability.

Coordinated emergency response: Unprecedented coordination among state, federal, and local agencies has improved emergency response and reduced the economic costs of the drought.

WORKS IN PROGRESS

Mandatory conservation: Although highly successful at reducing urban use, statewide conservation mandates can have unintended consequences if implemented inflexibly. They can reduce local financial capacity and appetite for new supply investments, and cost jobs if not considerate of business water use.

Water pricing: Many urban utilities have used tiered water pricing to encourage conservation but now face uncertainty about the legality of these rates. Low-income households are vulnerable if utilities make up for lost revenues by increasing fixed monthly fees. Legal reforms to Proposition 218 may be needed.

Rural community supplies: Emergency response has improved. But the mechanisms to report dry wells should be strengthened and response times for getting water to affected residents should be shortened. Continued progress is also needed to provide long-term safe water solutions to rural communities.

Groundwater management: Groundwater is a vital drought reserve, and extra pumping has reduced economic costs of drought. State and federal support for groundwater models and well metering can ease implementation of the new groundwater law. Addressing impacts of excess pumping, such as infrastructure harm from sinking lands, may require charging pumping fees or limiting new wells in some areas.

Water trading: Trading has helped reduce economic costs of the drought so far, and will be vital if the drought continues. But the market is not sufficiently transparent or flexible. Processes for approving trades are complex and often opaque. Little information is publicly available about trading rules, volumes, or prices.

Waterbird management: Risks to waterbirds can be reduced by coordinating management of water on refuge wetlands and flooded farm fields. State and federal investment in creative approaches, such as programs that pay farmers to flood fields, can yield great benefits with limited water and funds.

DIFFICULT WORK AHEAD

Improving the curtailment process: In principle, California's seniority-based water-rights system is designed to handle droughts. But making it work well will require better information on water availability and use, clearer state authority, and more effective enforcement.

Modernizing water information: To improve water management—including trading, curtailments, and environmental flows—the state will need to invest in the collection, analysis, and reporting of water information, and updated models to consider extreme temperature and flow conditions of modern droughts.

Managing wildfire: Suppressing fires during drought may work in the short-term, but a long-term strategy of improved forestry and fire management—with strong federal participation—is needed.

Managing surface water trade-offs: The state and federal governments must define and prioritize objectives among competing uses of scarce supplies. The difficulties of managing Shasta Reservoir to protect wild salmon shows the need for better forecasting and margins of safety for environmental flows.

Avoiding fish extinctions: Continued drought will likely lead to multiple extinctions of native fish species in the wild, and California lacks a plan to address this. In addition to acquiring water for fish in strategic places, it may also be prudent to make immediate investments in conservation hatcheries.

Building environmental resilience: California needs to invest in improving the capacity of native biodiversity to weather droughts and a changing climate. This requires a plan and the funding to put it into action.