PPIC | PUBLIC POLICY INSTITUTE OF CALIFORNIA

PPIC WATER POLICY CENTER

PRIORITIES FOR CALIFORNIA'S WATER

OCTOBER 2019

CONTRIBUTORS

Ellen Hanak, Caitrin Chappelle, Alvar Escriva-Bou, Brian Gray, Jelena Jezdimirovic, Henry McCann, Jeffrey Mount, Gokce Sencan

ACKNOWLEDGMENTS

Thanks to Celeste Cantú, Doug Kenney, Dave Puglia, Nancy Vogel, and Jay Ziegler for very helpful reviews of a draft of this report, and to Lori Pottinger and Lynette Ubois for expert editorial guidance. Any remaining errors or omissions are the responsibility of the authors alone.

The PPIC Water Policy Center spurs innovative water management solutions that support a healthy economy, environment, and society—now and for future generations.

INTRODUCTION

CONTENTS

Sources for this document are available at ppic.org/water-priorities-sources

Has California finally reached the point where we stop labeling especially wet or dry periods as "extreme" and instead start treating them as events to prepare for as a matter of course? After years of responding to severe drought, the state's water management systems were pushed to the breaking point last year by heavy rains that flooded towns and farmland, damaged infrastructure, and caused landslides. Along with this came heat waves and massive wildfires that destroyed water systems and polluted supplies.

Leaders across the state have been taking steps to address the challenges that a more volatile climate brings to the water sector. Governor Newsom's administration is planning to adapt all aspects of water management to the "new normal" with a water resilience portfolio.

This brief highlights top priorities for improving water management and preparing California's water systems and natural environment for a changing climate. Key elements include:

- **Modernizing the water grid:** Addressing infrastructure weaknesses and gaps—coupled with more flexible management—is essential for reducing the costs of future droughts and floods.
- **Preparing for changing supply and demand:** Developing a portfolio of cost-effective supply and demand tools can help California weather droughts, accommodate population growth, and bring groundwater basins into balance.
- **Providing safe drinking water:** More stable funding has been secured to improve quality and reliability in small, mainly rural poor communities, but more work is needed to tackle this challenge.

- **Reducing fire risk in headwater forests:** The state's mountain forests—a major source of water—are in poor health. Active management can reduce the risk of extreme wildfires and maintain the benefits that forests provide.
- **Improving the health of freshwater ecosystems:** A new approach to managing water for freshwater ecosystems and species can help them adapt to a warming climate.

We also explore how these issues come together in two key watersheds: the Colorado and the Sacramento–San Joaquin basins.

Four key principles are essential to ensuring the success of these efforts:

- **Flexibility** of institutions, rules, and infrastructure to help manage increased volatility and build resilience to changing conditions.
- **Incentives** to encourage and enable local agencies and individuals to implement smarter, more flexible management systems.
- **Alignment** of objectives and regulatory approaches across agencies to make it easier to trade water, recharge aquifers, and restore forests and freshwater ecosystems.
- **Multiple-benefit approaches** that tackle several issues together—such as flood protection, recharge, and habitat—to broaden cooperation and leverage more sources of funding.

We hope you find this compendium a helpful guide to water issues that affect all Californians in one way or another—and that you're inspired to engage in efforts to develop lasting solutions.

Ellen Hanak

A CHANGING WATER LANDSCAPE

Changes are coming to California that will affect water management in multiple ways. Here we summarize several major issues:

Climate change: Five climate pressures will seriously impact the state's water management—and they are already underway: warming temperatures, shrinking snowpack, shorter and more intense wet seasons, more volatile precipitation, and rising seas. These pressures will make it harder to simultaneously store water for long droughts, manage flood risk, and protect freshwater ecosystems.

Population growth: By 2050, California's population is projected to reach nearly 50 million (up from 40 million today). Inland areas are expected to grow the fastest, which will bring additional pressure to manage groundwater supplies sustainably. The recent past offers some hope, however: urban water use fell over the past two decades, despite population growth.

Technological and regulatory changes: California has long been a leader in water system innovation. Agencies are investing in new tools to manage groundwater, develop supplies, and clean up contamination, to name a few. And continued innovation will create new possibilities for the water sector. Regulatory changes can limit urban and farm access to some water supplies, but can also present opportunities, such as allowing broader uses of recycled water and more streamlined permitting.

Evolving relationships between state, federal, and local governments: California's relationship with the federal government is an ongoing factor in managing forests, water supply, dams, ecosystem health, and many other issues. The state can encourage improved cooperation and alignment among local jurisdictions, which make most frontline management decisions and are often leading innovation.

Mandated groundwater sustainability: Major changes in water and land management will be needed to comply with the Sustainable Groundwater Management Act (SGMA), the state law requiring local water users to bring groundwater use to sustainable levels by the early 2040s. The biggest impacts will be on California agriculture, and significant permanent idling of farmland in the San Joaquin Valley is likely.

"Change is like a river: nothing is the same, even for an instant."

—WU WEI

LEARN MORE

Managing Drought in a Changing Climate: Four Essential Reforms. Mount et al., PPIC, 2018.

California's Future: Population. Johnson et al., PPIC, 2019.

Water Use in California. Mount and Hanak, PPIC, 2018.

Water and the Future of the San Joaquin Valley. Hanak et al., PPIC, 2019.

MODERNIZE THE WATER GRID

California relies on a vast network of above- and below-ground storage and conveyance systems managed by diverse local, regional, state, and federal entities. This grid—one of the most complex in the world—provides many services: it stores and delivers water for dry summers and frequent droughts, reduces flood risk, generates electricity, helps maintain downstream ecosystems, and provides recreation.

But various factors are stressing this system. As the 2017 Oroville Dam crisis showed, the state's above-ground infrastructure is aging; much of it was built more than 50 years ago, using hydrology that doesn't reflect the changing climate. And in many areas, groundwater basins are being depleted, making wells go dry, raising pumping costs, harming ecosystems, and causing lands to sink, which damages vital infrastructure—such as the California Aqueduct, Delta-Mendota Canal, and Friant-Kern Canal. The wet winters of 2017 and 2019 also revealed that California has shortcomings in infrastructure and institutions that prevent the capture of enough floodwaters to adequately recharge aquifers. And climate pressures—warming temperatures, shrinking snowpack, shorter and more intense wet seasons, more frequent extreme wet and dry years, and rising seas—are already greatly increasing challenges for managing the grid. Yet this grid is also the state's most valuable asset for adapting to the changes in store.

43 MILLION ACRE-FEET
STORAGE SPACE IN CALIFORNIA'S RESERVOIRS

⅓
PORTION OF STATE'S ANNUAL WATER SUPPLY FROM SNOWPACK

~40%
AVERAGE SHARE OF GROUNDWATER IN URBAN AND FARM WATER SUPPLY

Flooding on the Sacramento River in 2019 overtopped the Tisdale Weir.

The state has initiated efforts to tackle many of these problems. In July 2018, the California Water Commission approved nearly $2.6 billion for eight surface and groundwater storage projects that collectively would boost water storage capacity by 4.3 million acre-feet. And to restore groundwater levels in overdrawn basins, local groundwater agencies are now finishing state-mandated sustainability plans, the first of which will go into effect in early 2020. The Oroville crisis also prompted broader safety reviews and policy changes to improve emergency preparedness—and highlighted the need to better fund dam safety and flood management.

But much more is required to prepare California's water system for these mounting pressures. Making the grid more robust, better integrated, and technologically state-of-the-art will require investments to modernize not only the infrastructure, but also the way the system is managed.

PRIORITIES

Prepare the grid for changing conditions.

Addressing infrastructure weaknesses and gaps is essential to ensure adequate flood protection and water supply in a warming climate. Top priorities include modernizing dams and spillways to accommodate more volatile precipitation and bigger floods, and investing in conveyance system repairs and upgrades to support groundwater recharge and manage floodwaters. Conveyance improvements will also facilitate water trading, an important tool for increasing the flexibility of water supply and reducing the costs of scarcity during droughts. Also needed: technology investments to provide more real-time data on surface- and groundwater conditions.

Enhance groundwater storage.

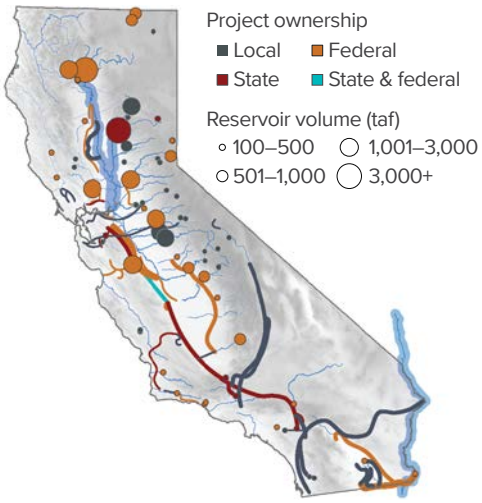
Although efforts to increase groundwater recharge intensified in 2017 and 2019, there are still many barriers to taking full advantage of this important strategy. Regulatory and management flexibility are key to capturing available water during high flows, which requires quick action. Obstacles include infrastructure constraints, challenges with permits, uncertainty over who has rights to recharge water from large storms, and a lack of incentive programs to encourage farmers to recharge shared aquifers. The state has begun to look into addressing these barriers, but a coordinated plan of action remains a high priority.

Rethink infrastructure operations.

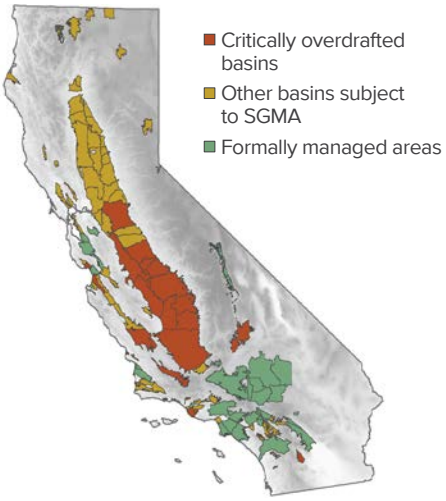
California will be able to store more water if it manages surface- and groundwater storage as one system to increase their combined potential. For instance, moving more water out of surface reservoirs and into aquifers in fall can free up room in reservoirs to capture winter and spring storms. And promising efforts are underway in some watersheds—including the Russian, American, Santa Ana, Tuolumne, and Yuba Rivers—to update dam operations using advanced weather forecasting technology. Under rapidly changing conditions, more accurate forecasts can help managers decide the best course of action, such as when to release water to protect downstream areas from flooding, move water to groundwater basins, or keep water in reservoirs for later use. So far, these efforts have been based on reoperating one dam at a time; the next step is using these approaches in a regional, integrated manner.

CALIFORNIA'S WATER GRID

Main above-ground storage and conveyance



Main groundwater basins



SOURCE: Developed by authors using data from the Department of Water Resources. For details see Escriva-Bou et al., *California's Water Grid* (PPIC, 2019).

LEARN MORE

California's Water: Storing Water. Escriva-Bou et al., PPIC, 2018.

Replenishing Groundwater in the San Joaquin Valley. Hanak et al., PPIC, 2018.

"How Oroville Is Changing Dam Safety in California." Pottinger, *PPIC Blog*, 2018.

SUPPLY

PREPARE FOR CHANGING SUPPLY AND DEMAND

Modernizing the water grid is not enough to ensure adequate supply to support California's economy and environment. Investing in supplies, managing demand, and trading water are essential tools for building resilience. In recent decades, California's cities and farms have been making strides in using all of these approaches, which helped them weather the 2012–16 drought much better than past droughts.

But the latest drought—with its record-low snowpack and high heat—also prompted many agencies to begin planning for greater climate volatility. On the supply side, agencies are investing in surface- and groundwater storage, recycled water, stormwater capture, and desalination. Tighter management of urban demand is a statewide priority, with laws to reduce per-capita water use passed in 2018. And under SGMA, the farming sector must prepare for future droughts while also bringing groundwater basins into balance, which will require cost-effective supply investments along with judicious demand management.

Water trading has been a constructive way for California to flexibly manage demand by sharing supplies within and across regions. During drought, temporary trades help farmers keep their orchards alive and allow cities to avoid acute water shortages. Long-term trades have boosted the supplies of growing communities and are increasingly sought by farmers who need more reliable water for irrigation. Trading has also supported habitat for California's native wildlife. SGMA increases the incentives to trade, because trading can lessen the cost of bringing basins into balance.

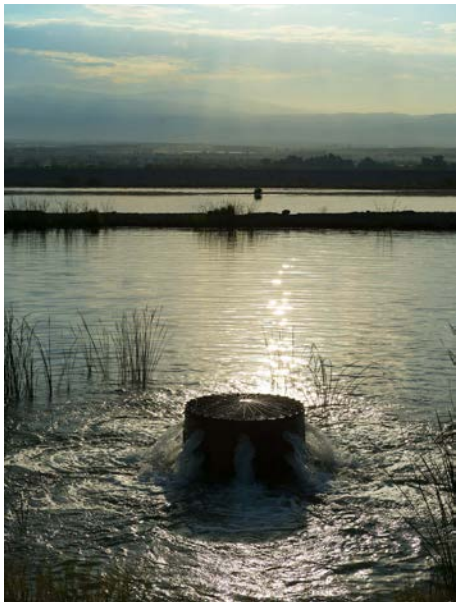
93%
SHARE OF CALIFORNIANS SERVED BY LARGE URBAN WATER SUPPLIERS

4%
SHARE OF WATER USE THAT COMES FROM SURFACE WATER TRADES

>500,000
ACRES OF SAN JOAQUIN VALLEY IRRIGATED CROPLAND LIKELY TO GO OUT OF PRODUCTION UNDER SGMA

New technology can help manage agricultural water use.

As California's cities and farms adopt new supply and demand strategies to accommodate growth, bring groundwater basins into balance, and adapt to a changing climate, they will need to emphasize cost-conscious and affordable approaches. They will need to better understand and mitigate impacts that trading can have on the environment and disadvantaged communities. And they will need to consider the interplay between land use decisions and water management. Although most investments will be locally driven, the state can promote sound approaches to building resilience in the system.



Replenishing groundwater in Coachella.

PRIORITIES

Emphasize regional portfolios to manage supply and demand.

State agencies should encourage and incentivize local water agencies and other stakeholders to develop portfolios to manage supply and demand at the regional scale. Regional plans can improve how local systems work together and identify opportunities where joint investments in the regional grid—including storage, interconnected conveyance systems, and new supplies—would benefit the region as a whole. Coordinated investments can also maximize benefits and reduce costs. And regional plans can identify watershed-level impacts and avoid unintended consequences of new management strategies. For example, increased use of recycled wastewater or stormwater can reduce available supplies for downstream users and the environment.

Connect water and land use planning.

Under SGMA, many farming areas must eliminate excess groundwater pumping by the early 2040s. This will entail some reduction in irrigated cropland, especially in the San Joaquin Valley. Careful planning is critical. It can reduce negative effects from dust, pests, and weeds that could arise from piecemeal land fallowing. Planning can also seek to align regulations and funding programs to get the most value from fallowed lands—for example, to incentivize recharge, solar energy, flood protection, healthy soils, habitat, and recreation. And in growing communities around the state, the connection between water and land should be more fully considered. Incentivizing land use decisions that protect important areas for groundwater recharge, stormwater drainage, and ecosystem restoration—and avoiding development in areas at growing risk of flooding and wildfires—will be crucial to prepare for coming changes.

Make it easier to trade water.

Trading water can significantly reduce the costs of complying with SGMA by allowing farmers to maintain the crops that generate the most revenue and jobs. In the San Joaquin Valley, trading within local basins can cut the costs of ending groundwater overdraft by nearly half. But the approval process for trading surface water is often overly complex. While it is important to ensure that trading does not harm other water users or the environment, simplifying the process—and aligning the requirements of various federal, state, and local agencies—can help. SGMA also makes it possible to develop local trading of groundwater shares, another important flexibility tool. This will require good accounting systems and protections for local communities and the environment. Such trading already occurs in the Mojave basin and is being tested in some other areas. More accurate, transparent data on water availability and use can help build confidence in water trading systems.

LEARN MORE

California's Water: Water for Cities. Hanak et al., PPIC, 2018.

California's Water Market. Hanak et al., PPIC, 2019.

"A Winning Approach for Managing Groundwater in the San Joaquin Valley." Escriva-Bou et al. *PPIC Blog*, 2019.

"California's Growing Demand for Wastewater Has Ripple Effects." McCann and Chappelle. *PPIC Blog*, 2019.

PROVIDE SAFE AND AFFORDABLE DRINKING WATER

Several hundred mostly small, rural water systems across the state—along with thousands of domestic wells—do not provide safe drinking water. Common problems include nitrate from farm runoff and other groundwater contaminants, such as naturally occurring arsenic. Treating these pollutants can be very expensive, and many small, poor communities lack the resources and economies of scale to address them. During the latest drought, falling groundwater levels also caused some wells to go dry.

Although most cities have safe water supplies, rising water bills are affecting affordability for low-income urban residents. Publicly owned water utilities are restricted in their ability to provide relief for these customers because of Proposition 218, a constitutional amendment that requires tight connections between water rates and the cost of service. This limits options for funding lifeline rate programs such as those used for electricity and gas.

California has begun to address these issues. State water quality programs were merged under the State Water Board to streamline oversight. A special office was created to focus on disadvantaged communities, and a new law authorizes consolidation of water systems where that is the best way to provide access to safe drinking water. In 2019 the Safe and Affordable Drinking Water Fund was created to help water suppliers in disadvantaged communities cover ongoing operations and management costs; the fund will provide $130 million annually over 10 years. The board has also been tasked with creating a plan to fund and implement a low-income water rate assistance program.

Despite these strides, hundreds of water systems are still out of compliance with drinking water standards—and many more small systems are on the brink of failing. Greater climate volatility brings new risks, and will test the ability of water providers across the state to deliver safe and affordable drinking water.

300
APPROXIMATE NUMBER OF WATER SYSTEMS IN CALIFORNIA WITHOUT SAFE DRINKING WATER

2,060
APPROXIMATE NUMBER OF WATER SYSTEMS SERVING FEWER THAN 500 HOUSEHOLDS

$130 MILLION
ANNUAL FUNDS ALLOCATED FOR POOR COMMUNITIES UNDER NEW SAFE AND AFFORDABLE DRINKING WATER FUND

PRIORITIES

Implement cost-effective solutions for safe drinking water in poor communities.

The Safe and Affordable Drinking Water Fund promises to close an important funding gap to ensuring safe water in poor communities. The State Water Board now needs a comprehensive implementation plan to prioritize support for communities that are regularly exposed to unsafe drinking water and to identify at-risk water systems that may also need help. The board should continue to promote cost-effective approaches, such as physical or administrative consolidation between small and large systems. To enable policymakers and the public to easily monitor California's progress in addressing the safe drinking water crisis, the board should create a tool that tracks performance of water systems over time and flags when problems are addressed. It should also summarize key indicators of state action.

Build drought resilience for small systems and domestic wells.

Drinking water vulnerabilities in rural communities arise in every major drought and could worsen with climate change. Declining groundwater levels can dry up shallow drinking water wells. But during drought, extra pumping can be important to make up for surface water cuts. In the latest drought, the state worked with counties and community groups to provide emergency supplies to affected communities. Going forward, better planning is needed to anticipate problems. At the local level, groundwater sustainability agencies should develop programs to promptly mitigate wells affected by drought-related pumping. This model is already used effectively in Yuba County and parts of Kern County. State leadership is also key. Under 2018 legislation, the Department of Water Resources (DWR) is coordinating an effort to identify small water systems at risk of water shortages and develop recommendations to improve their drought planning.

Align state efforts on water quality and reliability.

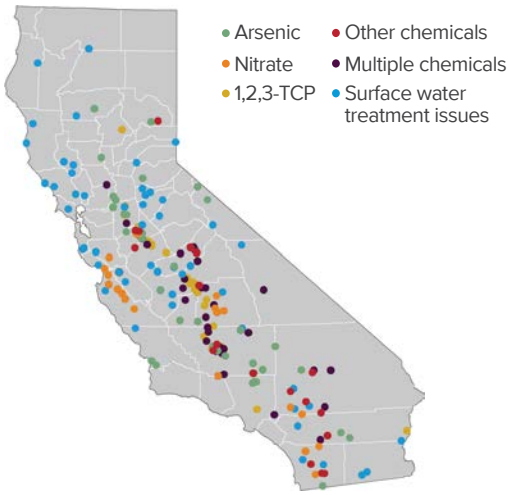
Since drought-related vulnerabilities often occur in places that also face water quality challenges, state efforts to support at-risk communities will be most effective if State Water Board-led water quality planning and DWR-led drought planning are closely aligned.

Collaborate on affordability solutions for the urban poor.

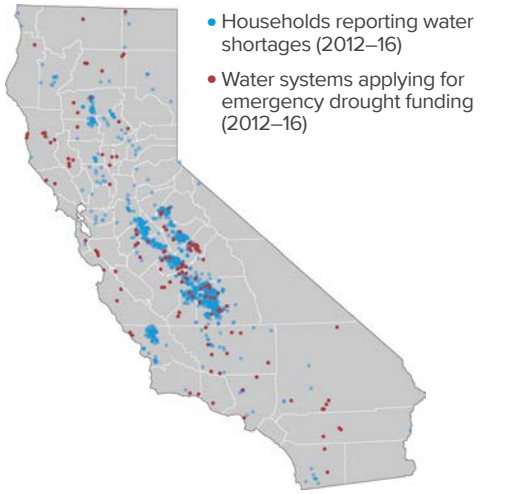
The state is developing a program to address affordability for low-income households, but this challenge could be better handled at the local level. Constitutional relief from Proposition 218 restrictions on using water rates to fund lifeline programs would give utilities more flexibility to offer these programs where they are needed. Utilities can also minimize the need for rate increases with more attention to cost control.

DRINKING WATER SAFETY AND RELIABILITY CHALLENGES

Communities with unsafe water



Communities facing shortages



SOURCES: Systems with unsafe water (as of June 2019) and systems needing emergency drought funding: State Water Board; household water shortages: Department of Water Resources.

LEARN MORE

California's Water: Providing Safe Drinking Water. Hanak et al., PPIC, 2018.

"Connecting Water Systems for Safe Drinking Water." Bostic and Chappelle, *PPIC Blog*, 2018.

"The High Cost of Drought for Low-Income Californians." Hanak, *PPIC Blog*, 2015.

"Information Gaps Hinder Progress on Safe Drinking Water." Jezdimirovic et al., *PPIC Blog*, 2018.

REDUCE WILDFIRE RISK IN HEADWATER FORESTS

California's mountainous forests are a critical part of the state's natural infrastructure. Headwater forests capture and release large quantities of high-quality water that flows into California's rivers and its water grid. They also provide outdoor recreation, timber and forage, and habitat for plants and animals. The exceptionally hot and dry drought of 2012–16 resulted in widespread tree die-off and high-intensity wildfires in the western slope of the Sierra Nevada and Southern Cascades. Past forest and fire management practices have made these forests overly dense, increasing their susceptibility to drought, insect attacks, and extreme wildfires. The changing climate will amplify these threats and put vulnerable forests at even higher risk of mass mortality.

The strategic use of fire and mechanical thinning is critical to improving forest health in a changing climate. But implementing these practices is complicated by three critical issues: the massive scale of the problem; the difficulty in building social acceptance for such a major intervention; and the patchwork of public, industrial, and family landowners. State and federal funding for management is inadequate to the task and vastly outweighed by emergency fire suppression funds. That's starting to change: in 2018, the legislature passed a five-year, $1 billion commitment of state Greenhouse Gas Reduction Fund money for improving forest health. That same year, Congress passed a law making it easier for the US Forest Service (USFS) to actively manage federal forests.

It's not just the headwaters region that needs better fire-proofing. Many different landscape types are at greater risk as the fire season grows longer, fall precipitation becomes

2X

FACTOR BY WHICH THE DENSITY OF SMALL TREES HAS INCREASED IN HEADWATER FORESTS SINCE THE 1930s

147 MILLION

NUMBER OF DEAD TREES ACROSS CALIFORNIA'S FORESTS, MOSTLY IN THE HEADWATERS REGION

$1 BILLION

AMOUNT APPROPRIATED BY CALIFORNIA LEGISLATURE IN 2018 FOR FOREST HEALTH, FIRE PREVENTION, AND FUEL REDUCTION OVER FIVE YEARS

Tree die-off is widespread in California's headwater forests.

more variable, and the climate warms—all of which are making wildfires more extreme. For example, the Tubbs (October 2017) and Camp (November 2018) fires—the two most destructive fires in state history—cumulatively resulted in more than 100 deaths and destroyed entire neighborhoods in Santa Rosa and most of the community of Paradise, respectively. Innovative funding, governance, and policies are needed to reduce fire risk across the state and improve forest health in the headwaters.

Mechanical thinning removes trees from overly dense forests.

Strategic use of fire reduces the risk of extreme fires.

PRIORITIES

Accelerate the pace and scale of forest management on federal lands.

About two-thirds of headwater forests are owned by the federal government, mostly by USFS. The task of managing nearly 8 million acres is impractical for one agency alone. Accelerating forest management on these lands will require USFS to take full advantage of partnerships with state, nonprofit, and private stakeholders. In recent years, USFS has promoted leveraging external resources for forest management, especially when the benefits extend beyond ownership lines. New collaborative tools are being used in California, and there is significant opportunity to expand their use. For example, the Good Neighbor Authority makes it easier to share funding and personnel between state agencies and USFS—an important way to align state and local efforts. "Stewardship contracting" allows USFS to better implement forest management projects and offset their cost with revenues from harvesting commercially valuable wood.

Utilize new tools for managing forests on private lands.

The high cost of forest management is particularly challenging for many people who own family forests (parcels less than 5,000 acres in size), which make up about a quarter of the Sierra Nevada headwater forests. Private forest owners should consider forming forest health improvement districts to develop common management objectives, pool resources, and make costly forestry activities more feasible. Aggregating family forest management can help owners take advantage of new policies that increase state assistance funds and relax regulation to make it easier to reduce wildfire risk. A joint approach may also promote investment in mills and other wood-processing infrastructure—a key gap in headwater areas.

Define multiple benefits and beneficiaries, and make the most of available funds.

California needs to foster more durable forest stewardship arrangements. Developing a clear understanding of the multiple benefits gained from increasing forest management will be instrumental in motivating new financial resources and governance solutions for ongoing stewardship. But to expand this approach, California needs better field-level information about the benefits that forest management can bring, including in air and water quality, runoff for water supply, fire risk reduction, and carbon sequestration. To make the most of available funding and reduce the net costs of management, parties should consider including revenue-generating opportunities in their projects. For example, bundling ecologically responsible mechanical harvesting (which brings in revenue from harvested timber) with prescribed fire can help stretch available funds while providing jobs and incomes to rural communities.

LEARN MORE

Improving the Health of California's Headwater Forests. Butsic et al., PPIC, 2017.

California's Water: Protecting Headwaters. Mount et al., PPIC, 2018.

Watch the 3-minute video "Headwaters." PPIC, 2019.

IMPROVE THE HEALTH OF FRESHWATER ECOSYSTEMS

California's freshwater ecosystems support rich biodiversity, but these systems are in trouble. The ecology of most of the state's rivers, lakes, estuaries, and wetlands have been permanently altered by water and land use practices, water management infrastructure, and the arrival of numerous non-native species that are well-adapted to these conditions. Climate change will alter ecosystems even further and make it harder to manage habitat for many native species—particularly salmon and steelhead, which depend on cold water.

California has relied heavily on state and federal endangered species acts (ESAs) to protect biodiversity. But this focus on endangered species—rather than the ecosystems that support all species—has proven costly and controversial. And recent studies have shown that the number of species vulnerable to changing conditions is significantly greater than those currently protected. California needs a new approach.

Improving the health of freshwater ecosystems would not only help vulnerable species adapt to changing conditions—it could be done in a way that brings broad social and economic benefits. The state should plot a course to prepare ecosystems and species in critical watersheds for rapidly changing conditions while emphasizing projects that bring multiple benefits. This "healthy ecosystem" approach would reduce conflict—and reduce cost and uncertainty for water users—while also creating a higher return on resources allocated to manage the environment.

25%
SHARE OF NATIVE FISHES THAT ARE THREATENED OR ENDANGERED

5 MILLION
NUMBER OF MIGRATORY WATERBIRDS THAT USE CALIFORNIA'S WETLANDS

50%
SHARE OF ENVIRONMENTALLY SENSITIVE WATERSHEDS LACKING GAGES TO MEASURE FLOW

PRIORITIES

Focus actions on watersheds and ecosystems.

Current management efforts focus too narrowly on supporting species protected by the ESAs, and too little on improving overall ecosystem conditions. California should shift emphasis from single-species management to ecosystem-based management at the watershed scale. This approach seeks to improve ecosystem health for a wide range of benefits, including the multiple uses of freshwater ecosystems by people. It is also the

most effective way to support protected species while keeping many more vulnerable species from becoming listed under the ESAs. This shift could be accomplished without altering laws on water quality and endangered species.

Promote sustainable watershed management.

To support this shift, the state should promote broad-based watershed planning. The goal of these plans should be to improve ecosystem health while bringing multiple social, economic, and environmental benefits. Watershed plans could be incorporated into water quality control plans already required under state and federal law. To benefit the water user community, these plans could align and streamline permitting by state and federal regulators, set priority actions to improve ecosystem conditions, and prescribe responsibilities and funding. The state should encourage self-organization within watersheds—agencies, water users, landowners, and other stakeholders would develop a course of action to meet sustainability goals through voluntary agreements. Some watersheds—such as the Upper Santa Ana River—are already taking this approach.

Use new tools to manage ecosystems.

The traditional approach to ecosystem and species management is to set minimum standards for flow and water quality. This approach is not very flexible, making it difficult to adapt to changing environmental conditions and new science. An alternative is to adopt ecosystem water budgets—preferably negotiated by key stakeholders in each watershed—that define a quantity of water available to maintain healthy ecosystems. Ecosystem managers could flexibly deploy this water to improve ecosystem conditions or store or trade it to prepare for future droughts. These "functional flows" could also be used to reconnect rivers with the land, improving habitat for a wide range of species and human uses. Better measurement of river flows will be essential to implement this approach. Integrating flood programs into other areas of water management can bring multiple benefits—for example, giving rivers and streams more room to spread out can improve ecosystem health while decreasing flood risk and increasing groundwater recharge.

Anticipate and prepare for change.

Ecosystem-based watershed plans should be forward-looking and identify actions needed to improve ecosystem health and the many benefits ecosystems provide. This means identifying how coming changes will affect ecosystem management and setting priorities and responsibilities to improve resilience. For example, the state is seeing a steady increase in the occurrence of harmful algae blooms in rivers, estuaries, and lakes—a trend likely to be hastened by a warmer climate—which will need to be mitigated. It will also be necessary to prepare for the decline or loss of critical habitat for some species, along with the possible listing of new species. New approaches will be needed, including protecting strongholds for species, establishing new populations outside of historical habitat ranges, preparing for emergency actions during drought, and other conservation actions.

Many native fishes are at risk.

Shasta Dam operations affect salmon migration.

LEARN MORE

California's Water: Water for the Environment. Mount et al., PPIC, 2018.

"A Water Budget for the Environment." Mount, *PPIC Blog*, 2018.

Managing California's Freshwater Ecosystems: Lessons from the 2012–16 Drought. Mount et al. PPIC, 2017.

THE COLORADO RIVER

The Colorado River is a major source of water for California, six other western states, and Mexico. California is the largest single user of this water, which helps supply close to 20 million residents in Southern California and roughly 600,000 acres of irrigated farmland in Imperial and Riverside Counties. Current laws allocate 15 million acre-feet (maf) of Colorado River water to the United States and 1.5 maf to Mexico per year—amounts that exceed average annual supplies.

Water levels in major reservoirs have been in decline for two decades due to over-allocation, prolonged drought, and climate warming in the basin. Because urban Southern California relies on both the Colorado River and the water that flows through the Sacramento–San Joaquin Delta, shortages in the Colorado increase pressure on Delta supplies.

In 2019, after several years of difficult negotiations, the seven basin states adopted a Drought Contingency Plan (DCP), which Congress ratified. This plan enables the use of flexible water management tools—water trading, conservation programs, and "carryover storage" (allowing unused water to be stored for later use)—and imposes mandatory cuts to avoid shortages. The passage of the DCP also enables all elements of an agreement with Mexico—Minute 323—to take effect. Building on an earlier agreement, Minute 323 obligates Mexico to share shortages on the river and empowers it to store saved water in Lake Mead. This agreement also extends a program to provide ecological flows for the Colorado River's delta in Mexico.

27%
PORTION OF COLORADO RIVER WATER ALLOCATED TO CALIFORNIA

⅓
PORTION OF SOUTHERN CALIFORNIA URBAN WATER SUPPLY THAT COMES FROM THE COLORADO RIVER

>70%
PORTION OF COLORADO RIVER SUPPLIES USED BY AGRICULTURE IN THE SEVEN BASIN STATES

Flexible water management tools have already proven helpful in addressing some of the basin's tough water scarcity challenges. For instance, in the early 2000s, California was required to reduce its use of the river as other states began to take a larger share of their allocations. Under the Quantification Settlement Agreement (QSA), parties employed a variety of water-use reduction tools—including lining earthen canals, improving irrigation efficiency, and fallowing some land. This made water available for long-term transfer to Southern California cities, which were most vulnerable to cutbacks of California's allocation. Unfortunately, some of these programs are now causing environmental problems by reducing inflows to the Salton Sea.

Although water use in the basin has declined in recent years, population growth creates demand pressures. Meanwhile, rising temperatures and drier conditions are

already worsening the basin's water deficit. Addressing these issues will require water users to keep reducing consumption in ways that cause the least economic and social disruption. Continued collaboration is essential to manage the river most effectively.

PRIORITIES

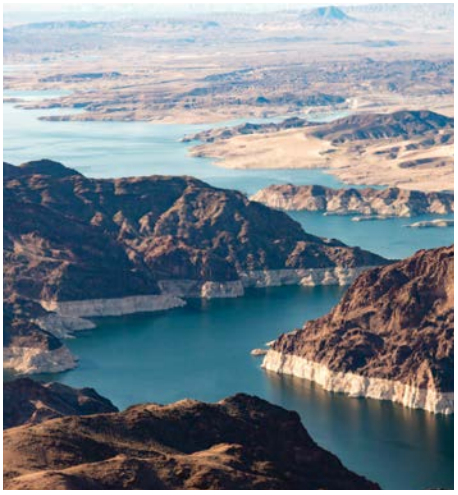
Accelerate restoration of the Salton Sea.

The shrinking water level in the sea—whose principal water supply is irrigation runoff from the Imperial Irrigation District (IID)—is a major concern. Declining water levels are resulting in increased dust pollution, which harms public health in a region where asthma rates are already very high; and higher water salinity, which reduces food sources for birds using the Pacific Flyway. Inflows to the sea began declining in 2018, when IID was no longer required to provide mitigation flows under the QSA. The state is now responsible for mitigation, and its focus is on restoration activities rather than flows. A 10-year restoration plan provides an initial road map, but regulatory setbacks have delayed implementation, and funding is only secured for the first five years. Options that go beyond this plan—including purchases of water for the sea—should also be considered.

Develop a 2026 vision to help delay or minimize mandatory water cuts.

To slow Lake Mead's decline, California, Arizona, and Nevada negotiated the Lower Basin DCP, which includes voluntary conservation and mandatory cuts. Despite the above-average snowpack in 2019, the lake is projected to reach levels requiring cuts in 2020—initially affecting Arizona and Nevada, as well as Mexico. While the DCP was an important step in helping all parties manage supplies, it does not address longer-term challenges facing the basin. In 2020, parties must begin planning beyond 2026, when both Minute 323 and the Interim Guidelines governing the operations of Lakes Powell and Mead expire. California parties will need to promote approaches that make it possible to use less river water, with additional investments in alternative water supplies, water use efficiency, and water trading. Maintaining a focus on improving the river's ecological health and considering Salton Sea impacts will also be important.

The Salton Sea is a key stopover on the Pacific Flyway.



Lake Mead's "bathtub ring" reflects years of dropping water levels.

LEARN MORE

California's Water: The Colorado River. Hanak et al., PPIC, 2018.

"A Path to Progress for the Salton Sea." Pottinger, *PPIC Blog*, 2017

"Planning for a Drier Future in the Colorado River Basin." Pottinger, *PPIC Blog*, 2019.

THE SACRAMENTO–SAN JOAQUIN BASIN

The Sacramento and San Joaquin Rivers and Delta form California's most important watershed, which helps supply water for 36 million people and more than 6 million acres of irrigated farmland. More than a million people within the watershed rely on thousands of miles of levees and large, multipurpose dams to reduce the risk of flooding. And the basin's ecosystems are home to multiple at-risk salmon and steelhead runs, as well as the remnants of once-vast wetlands that support extensive populations of waterbirds and other species. All of these attributes—water supply, flood control, and aquatic ecosystems—are in constant tension, which is why this watershed is also the source of the state's most enduring water conflicts.

Climate pressures are amplifying these challenges, making it harder to meet water demands for cities, farms, and the many native species protected by federal and state laws. Shorter, more intense wet seasons are testing the watershed's aging infrastructure, designed and built for a different climate. In addition, the Sustainable Groundwater Management Act is increasing demand for surface water, as farmers in the San Joaquin Valley face significant reductions in groundwater pumping.

To improve water supply reliability, the state has been exploring building tunnels underneath the Delta to move water from the Sacramento River to water users in the

33%
AVERAGE PORTION OF WATER CONSUMED UPSTREAM OF THE DELTA

17%
AVERAGE PORTION OF DELTA WATER THAT IS EXPORTED

5%
AVERAGE PORTION OF DELTA WATER USED BY LOCAL FARMS AND CITIES

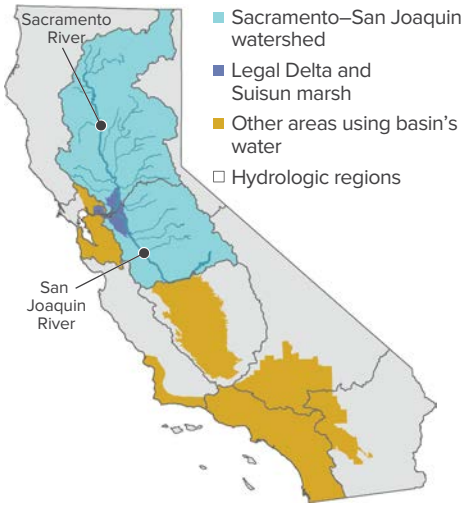
A Delta levee being repaired.

San Joaquin Valley, Bay Area, and Southern California. This proposal—scaled back from two tunnels to one by the Newsom administration—remains highly controversial.

In 2017 the state updated the Central Valley Flood Protection Plan, an innovative approach to reduce flood risk while seeking to improve ecosystem conditions. But costs are high and funding is not secured. It also is not fully integrated with water supply planning and does not adequately address fragile levees within the Delta.

Despite decades of effort, native biodiversity in the watershed continues to decline, with multiple species of fish teetering on the edge of extinction, and no workable plan to restore their populations or to avoid new listings. The coming year will be critical. To update the water quality control plan for the watershed, stakeholders are developing voluntary agreements for new environmental flow standards and habitat investments. Lengthy litigation is possible if the parties fail to agree. In addition, federal wildlife agencies are revising regulations governing water exports from the Delta.

THE SACRAMENTO–SAN JOAQUIN BASIN AND AREAS THAT RELY ON ITS WATERS



PRIORITIES

Change course on ecosystem management.

Current approaches to managing this ecosystem—with an emphasis on endangered fishes—are not working, and fail to address other threats arising from climate change (for example, an increase in harmful toxic algae blooms). The key to addressing climate and water demand pressures and growing flood risk is to create the capacity to be nimble and responsive—using tools like ecosystem water budgets that allocate water to the environment for flexible use. Investing in multi-benefit projects can improve ecosystem health and benefit other users. This is the essence of the ecosystem-based management approach described in the section on freshwater ecosystems. The voluntary agreements now under negotiation could be the cornerstone of a comprehensive, integrated program to improve ecosystem health. These agreements will need to set broad objectives for the ecosystem (rather than focusing on single species), define metrics and responsibilities, develop robust science support, establish transparent governance, and secure reliable funding.

Modernize storage and conveyance infrastructure.

California urgently needs a comprehensive plan to make its water grid more resilient to climate pressures. This includes upgrading facilities and operations of the large storage reservoirs—essential for meeting water supply, flood risk, and ecosystem needs—and improving conveyance to promote water trading and groundwater recharge. The state must also decide on whether to invest in new Delta conveyance, which is a major bottleneck to moving water where it's needed.

Accelerate implementation of the Central Valley flood plan.

This will require gathering additional input on the merits of specific local projects, setting investment priorities, and securing funding. It also means developing a viable long-term plan for the 1,100 miles of fragile Delta levees that are under pressure from sea level rise and climate volatility. The Delta Stewardship Council has established priorities for spending existing bond funds on Delta levee improvements, but this will address only a fraction of them.

The Delta provides important habitat for water birds and aquatic species.

LEARN MORE

California's Water: The Sacramento–San Joaquin Delta. Mount et al., PPIC, 2018.

Stress Relief: Prescriptions for a Healthier Delta Ecosystem. Hanak et al., PPIC, 2013.

"Commentary: Delta Interests Should Seize the Opportunity to Cease Water Fights." Mount and Hanak, *PPIC Blog*, 2019.

THANK YOU TO THE ANNUAL SPONSORS OF THE PPIC WATER POLICY CENTER

PPIC PUBLIC POLICY INSTITUTE OF CALIFORNIA

Public Policy Institute of California
500 Washington Street, Suite 600
San Francisco, CA 94111
T 415.291.4400 F 415.291.4401

PPIC Sacramento Center
Senator Office Building
1121 L Street, Suite 801
Sacramento, CA 95814
T 916.440.1120 F 916.440.1121

ppic.org/water

This publication is printed on post-consumer recycled paper. ♻