

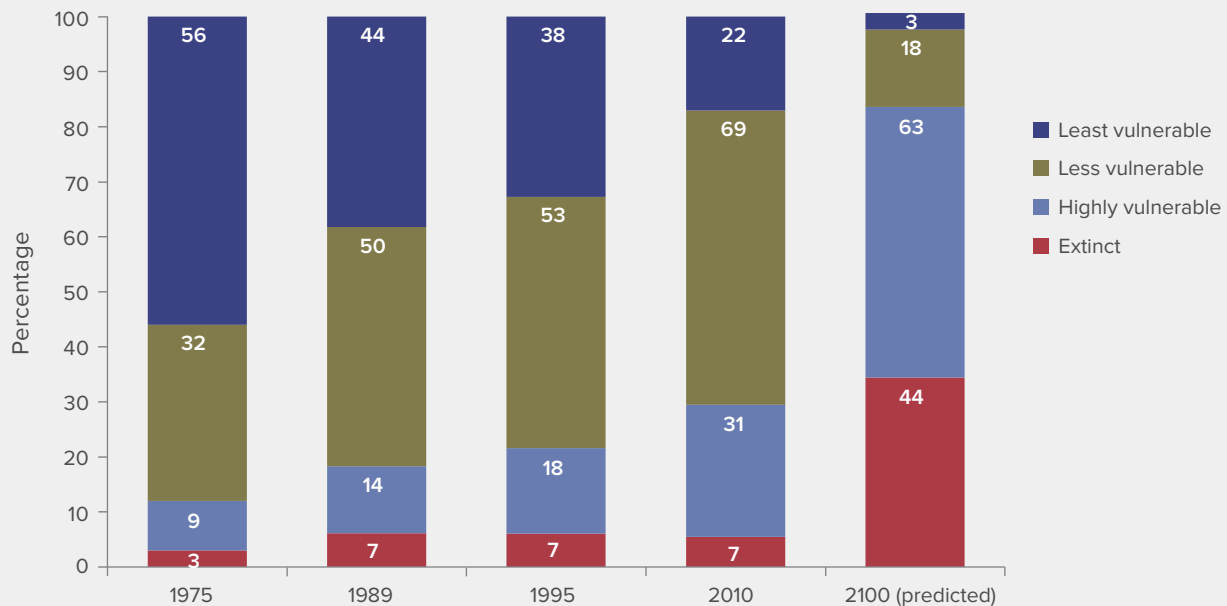
## Water is vital for California’s diverse and troubled ecosystems

With its diverse landscape and climate, California is a biodiversity hot spot—home to more endemic plants and animals than any other state. California is also an important stop on the Pacific Flyway, providing habitat for millions of migratory ducks, geese, shorebirds, and songbirds. The state’s rivers, lakes, wetlands, and estuaries support this rich biodiversity.

Dramatic changes in water and land use since statehood in 1850 have transformed California’s freshwater landscape. Today, more than 1,400 dams cut off most historical salmon and steelhead spawning habitat. Roughly 95 percent of the native vegetation that once lined Central Valley rivers and creeks has been eliminated, along with wetlands that once hosted migratory waterfowl. Farms and cities use about half of the state’s available water, while discharging harmful chemicals and other pollutants into waterways.

Four decades after the enactment of major state and federal environmental laws, California’s freshwater biodiversity is at risk. Native freshwater fishes—indicators of the health of aquatic ecosystems—have been hit hardest. A quarter of these species are listed as threatened or endangered under state or federal endangered species acts, and many more are headed toward listing. The hot, dry conditions of the latest drought have put 18 fish species at near-term risk of extinction. For both economic and social reasons, California must improve its stewardship of freshwater ecosystems. With a changing climate and a growing population, one of California’s great challenges is to strike a balance between improving ecosystem health and providing water supply, flood control, and hydropower.

### CALIFORNIA’S NATIVE FRESHWATER FISHES ARE IN TROUBLE



SOURCES: R. M. Quiñones and P. B. Moyle, “California’s Freshwater Fishes: Status and Management,” *FISHMED Fishes in Mediterranean Environments* (2015). P. B. Moyle, J. D. Kiernan, P. K. Crain, and R. M. Quiñones, “Climate Change Vulnerability of Native and Alien Freshwater Fishes of California: A Systematic Assessment Approach,” *PLoS One* 8 (5), doi:10.1371/journal.pone.0063883.

NOTES: The figure shows freshwater native fish status based on field surveys. Bars display the number of fish species for which adequate information for evaluation was available in the specified time period. Predicted status in 2100 assumes continuation of current trends, with added stress from climate change. Extinct means no longer found in California; highly vulnerable means highly vulnerable to extinction by 2100; less vulnerable means less vulnerable to extinction than the previous group; least vulnerable means very low vulnerability to extinction.

## Environmental water use is not well understood

Water counted by the state as “environmental” serves a variety of purposes. Although much of this water is not in direct competition with other uses, a growing volume of water is being dedicated to protecting endangered species or water quality. This causes controversy because it can reduce water available for other uses. A better understanding of environmental water use can help inform future decisions about water management.

- **Water that stays in rivers, streams, and wetlands is assigned to the environment.**  
There are four broad types of environmental water: water that flows in rivers protected as “wild and scenic” under federal and state laws, water needed to maintain aquatic habitat within streams, water that supports wetlands for migratory birds, and water needed to maintain water quality. Water categorized as environmental accounts for half of state use; farms (40%) and cities (10%) make up the other half.
- **Most environmental water does not affect other uses.**  
Most environmental water occurs in remote North Coast rivers where there is little competition for use. In the rest of California, where water is shared by all three sectors, environmental water represents 33 percent of all uses (versus 53% for farms and 14% for cities). In these regions, water dedicated to the environment may reduce water available for other uses.
- **Environmental water often achieves multiple benefits.**  
In the Central Valley, most flows in wild and scenic rivers are captured by reservoirs and reused downstream. In many rivers, minimum flow standards that help fish and other species are set to maintain water quality for drinking water and irrigation. For instance, in the Sacramento–San Joaquin Delta, freshwater outflows (viewed by some as water “wasted to the sea”) also protect Delta water quality for farms and cities. In addition, environmental water that goes to wetlands and floodplains recharges groundwater basins.
- **Droughts heighten conflicts over environmental water allocations.**  
Because the environment relies principally on surface water, it experiences larger cutbacks during droughts than farms and cities, which can often pump extra groundwater when rivers are low. In some places, this extra pumping further reduces streamflows and harms fish. Droughts also put pressure on regulators to relax environmental standards in order to boost supplies. In 2014 and 2015, the state approved requests to reduce environmental flows and relax salinity standards in the Delta so that water exports for farms and cities could be increased.

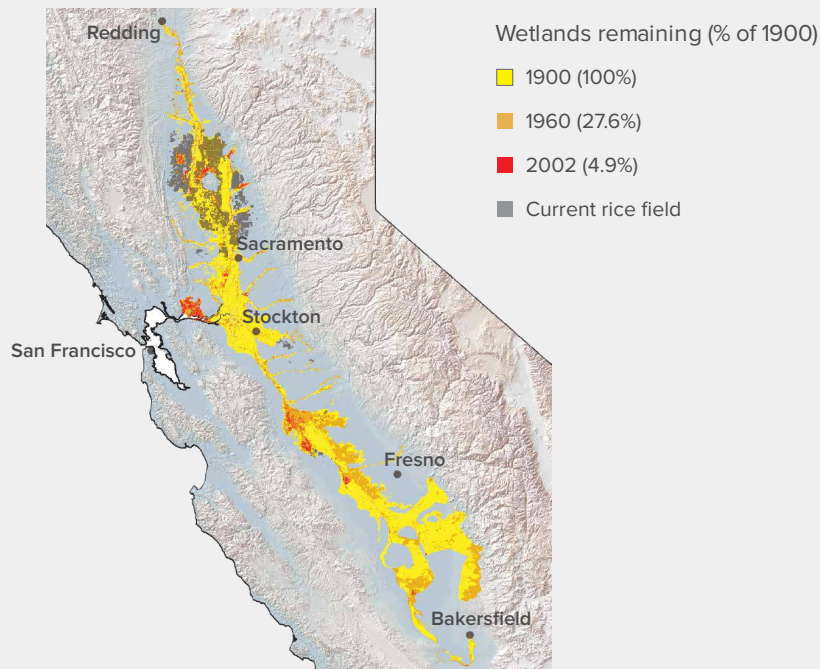
## California needs to make environmental water use more efficient

Although more freshwater flows will likely be required to improve ecosystem conditions in some regions, new approaches to ecosystem management are also needed.

- **Reduced flows are not the only source of ecosystem stress.**  
Habitat loss, water pollution, invasive species, and fishery and wildlife management practices also need to be addressed. It is not possible to undo all the ecological changes that have occurred over decades of human water and land use. Environmental managers and regulators need to find strategies that adapt to changing conditions.
- **Environmental water can get more “pop per drop.”**  
Significant environmental improvements can come from managing water in ways that mimic natural flow variability, even with smaller flow volumes. Also, a drop of water may have very different environmental benefits depending on where it is used. In some places, a little water—applied in the right place at the right time—can go a long way toward protecting species.
- **Restoring habitat requires water *and* land.**  
Riparian zones, floodplains, and wetlands require periodic flooding to provide high-quality habitat. This can be accomplished by changing the timing of releases from reservoirs and removing or setting back levees. Selective removal of dams can also restore fish access to high-quality upstream habitat. Some dams are no longer useful for water supply, flood control, or hydropower purposes because of silt buildup or other factors. To improve habitat, a large dam was just removed on the Carmel River, and four more are planned to come down on the Klamath River.

- **Farming can be wildlife friendly.**  
Sacramento Valley rice farms now provide essential habitat for migratory waterfowl. Corn and alfalfa fields support many other types of birds. The Yolo Bypass offers habitat to birds and juvenile salmon, while supporting rice farms and protecting Sacramento from flooding. Farmers face economic pressure to shift to crops that have low habitat value but earn higher revenues and profits, such as fruits, nuts, and vegetables. They may require financial incentives to keep practicing wildlife-friendly agriculture.
- **Reliable funding for environmental management is a key hurdle.**  
Bond funds, while helpful, are short-lived and project-based. The state needs a new approach to funding public-trust resources (including fish and wildlife), such as a small surcharge on water use.

## CENTRAL VALLEY RICE FIELDS NOW PROVIDE WILDLIFE HABITAT IN PLACE OF NATIVE WETLANDS



SOURCE: Ellen Hanak et al., *Managing California's Water: From Conflict to Reconciliation* (PPIC, 2011), Figure 1.2.

NOTES: Wetlands in 1900 include yellow, orange, and red areas; the 1960 wetlands include orange and red areas. Sacramento Valley rice fields perform some seasonal wetland functions for migrating birds and terrestrial and riparian species such as the giant garter snake.

## Looking ahead

California has a long-term economic and social interest in supporting native biodiversity in freshwater ecosystems. But new approaches are needed to make environmental water allocations more effective.

**Prepare for droughts and climate change.** California should commission a biodiversity task force to develop a strategy to make species and ecosystems less vulnerable to drought and a changing climate. Promising approaches include identifying and prioritizing environmental strongholds that can support species during droughts and warm periods (such as streams fed by cold water springs) and developing mechanisms to purchase or lease water for environmental uses.

**Prioritize watersheds for conservation management.** The state should also develop a freshwater ecosystem conservation plan that identifies high-priority watersheds for conservation management. A systematic approach—which goes beyond single-species management—would greatly improve the chances of survival for the state’s native fishes and other species dependent on fresh water.

**Identify environmental water needs.** For many rivers and wetlands, the state has not identified the quantity, quality, and timing of water required to sustain ecosystem health. Establishing clear environmental water targets is critical for prioritizing conservation actions and providing guidance to agencies responsible for balancing human and ecosystem water needs.

**Acquire water rights for the environment.** To increase management flexibility, the state should purchase existing water rights (or provide incentives for private parties to acquire them) and dedicate those rights to environmental uses. Environmental managers should be authorized to lease these rights to raise funds for other restoration projects. Such practices are working well in Australia, which faces similar water management challenges. **Proposition 1, the water bond approved in November 2014, makes available up to \$200 million for this purpose.** While helpful, the sum is insufficient.

**Reform environmental permitting.** Environmental water is most effective when paired with habitat restoration. However, obtaining permits for restoration is unnecessarily difficult because of multiple, often conflicting, agency reviews. The Habitat Restoration and Enhancement Act of 2014, which reduces permitting hurdles for private land owners seeking to improve habitat, is a model worth expanding.

**Promote projects with multiple benefits.** Water can simultaneously provide benefits to people and nature. For example, wildlife-friendly farming can support ecosystems while maintaining the economic viability of farms. Cooperation on storing and releasing water from reservoirs can benefit fish while meeting downstream users' needs. Investing in healthy watersheds can help protect drinking water supplies and provide recreational opportunities.

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