

A Path Forward for California's Freshwater Ecosystems

California's freshwater ecosystems are changing in response to water and land use, pollution, introduction of non-native species, and a changing climate. Native biodiversity is declining as a result, with numerous species now protected by state and federal Endangered Species Acts (ESAs) and many more likely to need protection in the future. These changes threaten biodiversity and the many benefits that healthy ecosystems provide, including clean and reliable water supplies, hydropower, recreation, and flood risk reduction.

For the past 40 years, state and federal ESAs have played a prominent role in managing the state's freshwater ecosystems. While this approach has prevented extinctions, it also places an emphasis on reducing harm to listed species, rather than improving overall ecosystem condition necessary to recover their populations. And the ESAs are not forward-looking enough to respond to change and reduce future species listings. To protect native species and the many benefits that Californians derive from freshwater ecosystems, the state needs a new approach. Ecosystem-based management emphasizes the simultaneous management of water, land, and species to improve ecosystem condition for native biodiversity and human uses. It shifts the management emphasis to the social, economic, and environmental benefits that come from healthy ecosystems, rather than narrowly focusing on mitigating harm to protected species. It is consistent with the ESAs and other state and federal laws.

Reform 1: Promote inclusive planning and governance.

Ecosystem-based management relies on collaborative planning and governance processes. These should:

- **Identify the desired ecosystem condition.** Based on extensive stakeholder and expert engagement, the desired ecosystem condition should be described along with the multiple social, economic, and environmental benefits. This narrative is the vision for the effort and the basis for setting priorities.
- **Establish metrics.** Metrics and performance measures will clarify management objectives and help secure permits for actions.
- **Provide strong scientific support.** This is essential to guide plan implementation, test hypotheses, monitor performance, and resolve technical or scientific disputes.
- **Set up transparent governance.** Because ecosystem-based management requires extensive collaboration across agencies, new governance structures will be needed to clarify responsibilities and align actions. Where possible, these structures should include stakeholder and water user groups.
- **Ensure reliable funding.** Adequate funding must be identified for all phases of implementation, including investments, ongoing maintenance, science and monitoring, and administration.

Reform 2: Employ multiple ecosystem management tools.

Ecosystem-based management requires a broad, coordinated set of actions that go beyond traditional project- or agency-specific approaches. Key actions include:

- **Establish ecosystem water budgets.** Ecosystem-based management is helped by having a predictable amount of water that can be managed flexibly. Ecosystem water budgets—similar to water rights for the environment—allow managers to allocate, trade, and store water to improve ecosystem condition. These budgets create certainty for water users and environmental managers alike, and can enhance cooperation.



- **Employ functional flows.** Ecosystem water budgets can be used to reintroduce seasonal flow variability—such as winter pulses, spring snowmelt, and summer low flows—to support important physical, chemical, and biological processes. To make the most efficient use of these “functional flows,” it will often be necessary to modify channels and their surrounding landscapes to reconnect flows to marshes, floodplains, and wetlands.
- **Manage flow and quality together.** Water quality characteristics—including temperature, salinity, nutrients, and other contaminants—change with variation in flow. There are many ways to improve water quality, including operating reservoirs to preserve cold water; improving treatment of wastewater; reducing runoff of salts, pesticides, fertilizers, and other contaminants; and re-establishing wetlands and riparian forests to receive and reduce contaminant runoff.
- **Manage native and non-native species.** California’s freshwater ecosystems support numerous non-native plants and animals that are “invasive”—those that have altered conditions to the detriment of ecosystems and human uses. Management of invasive species in conjunction with other actions will be integral to achieving the desired ecosystem condition. Native species will also require indefinite and sustained management interventions, including catch regulations, hatcheries, species relocations, and assisted migrations to avoid extinctions and recover populations.
- **Manage at the appropriate scale.** Actions taken upstream—such as species management, land use change, water diversions, storage, or water quality management—affect ecosystems downstream. For this reason, the watershed is often the optimal scale for planning and implementation. This allows for managing parts of the ecosystem for different objectives.

Reform 3: Encourage sustainable watershed management plans.

We recommend that California adopt the principles and practices of freshwater ecosystem-based management through development of sustainable watershed management plans. Such plans build on numerous efforts already underway in the state. The State Water Board, with its water quality and water right authorities, would take the lead in setting the criteria for and approving these plans. Every effort should be made to:

- **Align agency actions.** There are numerous planning and permitting agencies involved in water and species management, often with conflicting mandates. The plans should be used to align agency objectives in order to coordinate and streamline permitting and review.
- **Promote comprehensive agreements.** The plans should, where possible, be supported by binding comprehensive agreements between regulatory agencies, water users, and stakeholder communities.
- **Set timelines and backstops.** The board should set timelines for development and implementation of plans. It also should establish regulatory backstops if comprehensive agreements cannot be achieved.
- **Update water quality control plans.** If a plan meets the criteria set forth by the board, it should be adopted as the water quality control plan for a given watershed. Plans can be periodically updated to adapt to changing conditions and new information.
- **Incentivize or mandate plans.** The legislature should consider whether to incentivize or require the development of watershed plans. For the latter, the Sustainable Groundwater Management Act—with its self-organized groundwater sustainability agencies and required groundwater sustainability plans for priority basins—may serve as a model.