

Making the Most of Water for the Environment

In California, water and land management activities have substantially altered river flows. This has harmed native fish and wildlife and limited the many benefits healthy river ecosystems provide to people. Effective management of environmental flows—the quantity, quality, and timing of water necessary to sustain ecosystem health—is needed to prevent further ecosystem degradation and to arrest the decline in native species. However, the most common approach to environmental water management involves setting minimum flow standards, which do not account for the natural variability in flow that is necessary to support the ecosystem functions upon which native freshwater species depend.

- **We recommend moving away from minimum flow standards to a “functional flows” approach.** Functional flows mimic key components of a river’s flow that support critical biological, chemical, and physical functions. This includes flows that move sediment, maintain water quality, and provide environmental cues for species migration and reproduction. Functional flows maintain essential flow variability in rivers—both seasonally and between wet and dry years. The approach also requires physical habitat improvements—such as barrier removal, channel restoration, and floodplain reconnection projects—to restore critical interactions between flowing water and land. By coupling physical habitat improvements with flow variability, functional flows offer a more effective means of improving ecosystem health than conventional approaches.
- **A functional flows approach should be used to improve environmental flow standards.** This involves setting goals for ecosystem condition and determining the functional flows necessary to achieve those goals. In most rivers, it will be necessary to balance ecosystem needs with competing objectives, such as water supply and flood management. But a structured approach to developing functional flows can help minimize conflict among objectives, while bringing greater regulatory certainty and other public benefits derived from healthy ecosystems.

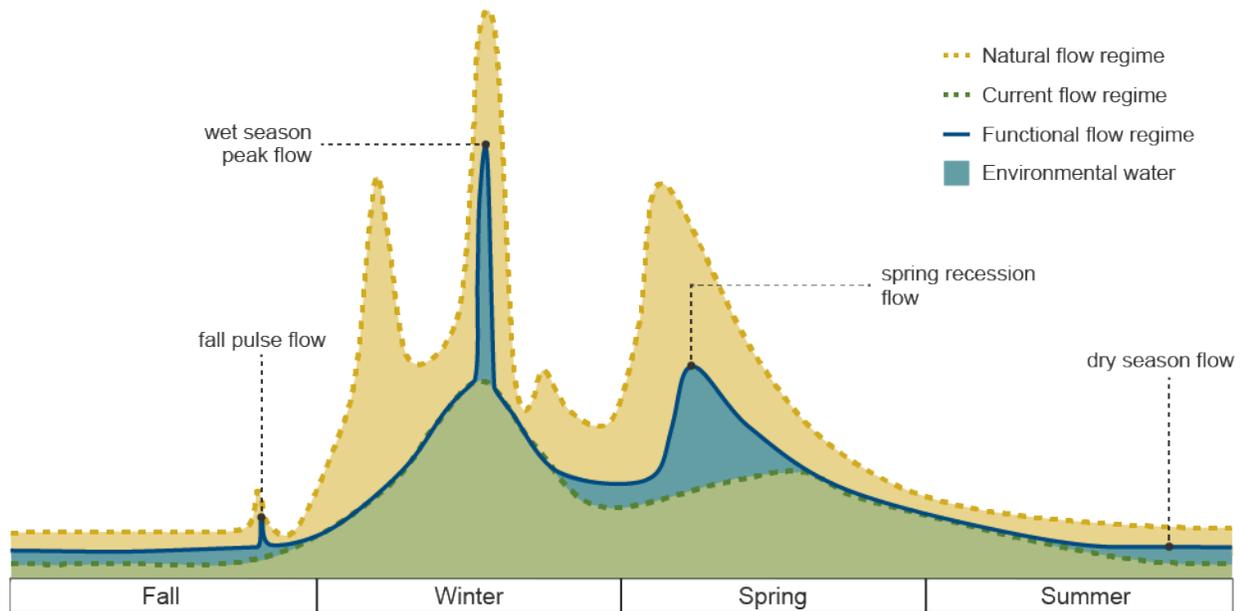
Functional Flows in Practice

Although California has a remarkable diversity of river types and uses of rivers, a functional flows approach can guide environmental water management throughout the state. For example, on the many rivers where flows are controlled by dams, changing the timing and magnitude of reservoir releases is an effective way to establish functional flows. The figure below shows how this would work. Stored environmental water would be released to augment existing flows and restore functional flows at key times. A fall pulse flow would cue fish migration. A winter flood pulse would move sediment and connect floodplain habitat. A spring release would mimic snowmelt runoff to improve dispersal and germination of plants and spawning of fish and amphibians. Summer releases would protect water quality and riparian habitat.

A functional flows approach can also be used in other contexts. For rivers with no major dams, the timing, volume, and location of diversions would be managed to maintain functional flows. This includes limiting groundwater pumping that affects springs and river flows. And in highly altered rivers in urbanized watersheds, treated wastewater and urban runoff can be managed to maintain suitable dry season flows, while improved stormwater retention structures can help reduce the impacts of winter storms.



How functional flows would work in dammed rivers



SOURCE: Modified from Mount et al. (2017, 2019).

NOTES: This figure illustrates a hydrograph typical of a dammed river in California's Central Valley. The current managed flow regime has reduced flow throughout the year relative to the natural flow regime, as a result of water storage and consumptive use. Higher flows in winter and spring reflect uncaptured flow and managed flow releases to satisfy downstream water users and existing regulations. Environmental water would be released at key times of year to create functional flows.

Governance Is Key to Implementation

Putting functional flows into practice requires good governance.

- We recommend the use of ecosystem water budgets to manage functional flows. An ecosystem water budget functions like a high-priority water right, and can be used to define a fixed volume of environmental water that can be flexibly managed. In dammed rivers, this would be water set aside in storage. On undammed rivers, it would be the volume available for restricting diversions. In urbanized watersheds, the budget could include stored water, diversion restrictions, and water discharged from wastewater treatment facilities. An independent trustee should oversee management of the ecosystem water budget to achieve the objectives of functional flows and ensure that environmental water is used effectively.
- The approach should be adopted through existing planning and regulatory proceedings. There are no legal barriers to implementing functional flows. The approach may be particularly useful in establishing environmental flow standards in water quality and water rights proceedings of the State Water Board and Regional Water Boards. Functional flows can also be used to help set standards under provisions of the state and federal Endangered Species Acts.

By improving overall ecosystem health, the functional flows approach can address the needs of protected species, reduce the likelihood of vulnerable species requiring protections in the future, and serve as a valuable tool for building the resilience of California's water management system.