

Large-scale flood damage reduction and ecosystem restoration projects on a regulated river (California, USA)

Projets à grande échelle de réduction des dommages dus aux inondations et de restauration des écosystèmes sur une rivière aménagée (Californie, USA)

Ryan Luster

The Nature Conservancy
Chico, California, USA
rluster@tnc.org

RÉSUMÉ

La rivière Sacramento, la plus grande de Californie, a été considérablement modifiée depuis 1850 dans le but de fournir de l'eau à la fois pour l'irrigation agricole, pour l'usage urbain ainsi que pour le contrôle des inondations catastrophiques. À la suite de ces modifications, la fonctionnalité de l'écosystème a baissé et de nombreuses espèces sont menacées d'extinction. Mais la menace d'inondations catastrophiques de la rivière est encore très réelle. Le Gouvernement de l'État californien et les organismes non-gouvernementaux travaillent maintenant pour inverser certains des dommages causés à la rivière Sacramento. Deux études de cas seront présentées, chacune montrant comment la réduction des risques d'inondations et la restauration des écosystèmes peuvent être réalisées dans le même projet.

ABSTRACT

The Sacramento River, the largest in California, has been drastically altered since 1850 for the purpose of supplying water for both agricultural irrigation and urban use as well as controlling catastrophic floods. As a result of these alterations, ecosystem function has declined and many species are threatened by extinction yet there is still a very real threat of catastrophic flooding from the river. State government and not for profit organizations are now working to reverse some of the damages to the Sacramento River that result from the alterations made to the river. Two case studies will be presented, each showing how both flood damage reduction and ecosystem restoration can be achieved within the same project.

KEYWORDS

Ecosystem restoration, flood damage reduction, floodplain restoration, multiple benefit project, Sacramento River

The Sacramento River is a fundamental water source for the state of California that supplies 80% of freshwater flowing into the Bay-Delta. Historically, the river was lined by approximately 800,000 acres of riparian forest. Over 95% of this habitat has been lost, however, to selective logging, agriculture, urban development, and flood control and power generation projects. Cumulatively, these changes have greatly stressed the Sacramento River and associated species. The loss and degradation of riparian habitat has greatly diminished the river's ability to support viable wildlife populations and encouraged the invasion and proliferation of non-native invasive species. Two-thirds of the linear extent of the river's banks have been modified and confined by levees and riprap. Channelization, bank protection, and the construction of the Shasta Dam degraded riparian habitat along the Sacramento River by restricting the dynamic forces that promote natural habitat succession and regeneration.

Healthy riparian habitats contain a great number of flora and fauna due to the range of community types, overall structural diversity, availability of water and soil moisture, potential as corridors for migration, and critical breeding grounds. Additionally, riparian corridors provide two primary functions essential to maintaining water quality: 1) moderating stream temperature and 2) reducing sediments and nutrients emanating from upland agriculture. The loss of high-quality habitat and the decrease in water quality along the Sacramento River has contributed to the decline in many native species populations. Important at-risk species include the Sacramento splittail, green sturgeon, chinook salmon, steelhead trout, western yellow-billed cuckoo, Swainson's hawk, least Bell's vireo, and Valley elderberry longhorn beetle.

Although severely degraded, the Sacramento River is still the most diverse and extensive river ecosystem in California. In an effort to improve ecosystem health in the region, federal, state, and local governments, as well as non-government organizations, have begun to implement a series of ecosystem restoration programs along the river. In 1986, the California State Legislature passed Senate Bill 1086, which mandated the development of a management plan for the Sacramento River and its tributaries to protect, restore, and enhance fisheries and riparian habitat.

To address the decline of the Sacramento River, in 1988 The Nature Conservancy undertook what was then the largest riparian restoration project in the U.S. Since 1988, The Nature Conservancy has collaborated with a diverse array of partners to bring significant change to the Sacramento River. We have implemented projects that have protected and restored vast areas of riparian habitat, while simultaneously shaping policies directed at local, state, and federal levels. Through groundbreaking conservation strategies, the Sacramento River forests have resurged—with portions completely restored to their original richness. At the same time, more space has been made available for public recreation. The area is now able to support 135 species of native birds and tropical migratory songbirds on stopover flights. Recently, large mammals such as bear and lion have even begun to reappear around the Sacramento. With the effects of climate change the riparian forest will become even more crucial to a diverse range of species.

In addition to working towards project goals for biodiversity and habitat connectivity, our strategies for ecological restoration concurrently accomplish goals for human well-being. Results of a socioeconomic study focusing on local economics show that adverse impacts of implementing our restoration strategies would be minor and localized, and the resulting opportunities for employment and revenue from recreation would offset such consequences. To date, the planting of over 1 million native riparian species makes a considerable contribution to carbon sequestration and supports The Nature Conservancy's climate change goals. Functional floodplains provide ecosystem services like improved water quality and flood damage reduction, generating real and measurable benefits to our communities while promoting environmental values. Sacramento River conservation strategies engineered and engaged to support ecological targets, make significant contributions to the livelihood and wellbeing of California residents.

Climate change is expected to increase flood risk and reduce water storage in Mediterranean river systems, such as those found in California's Central Valley. River management agencies are responding to increasing flood risk and water supply uncertainty with grey infrastructure projects and

water management operation policies that severely compromise the health of natural communities, as well as the important ecosystem services that rivers provide to people. Periods of drought are expected to become more severe, and storm events, although less frequent, may be of greater intensity. In response to these challenges river management agencies are advancing grey infrastructure projects that focus on construction and refurbishment of levees and bank revetment, as well as conveyance and water storage facilities. This infrastructure, as well as the policies of the agencies that operate it, directly degrade the ecosystem, causing adverse impacts to natural species and communities, as well as the services they provide to society.

By pioneering novel multiple benefits projects that employ green infrastructure (e.g., floodplain reconnection, levee set-backs, bank revetment removal) we can demonstrate innovative solutions for making the Sacramento River's floodplain more resilient to climate change while also making significant advancements in both human wellbeing and biodiversity health. We will disseminate lessons learned on the Sacramento River to state and federal agencies charged with managing rivers throughout California. Demonstrating and documenting the success of projects on the Sacramento River will lead to similar projects being planned and constructed on rivers throughout California, and beyond.

Collaborations between The Nature Conservancy and numerous public and private partners have sparked creative conservation approaches on the Sacramento River. For example, we developed with the U.S. Army Corps of Engineers a set back levee plan for Hamilton City that would simultaneously protect residents from flooding while creating more space for wildlife. The Kopta Slough Project also seeks to reduce local flood damages while simultaneously restoring critical river processes and creating new habitat for endangered species. The Hamilton City and Kopta Slough projects will be discussed in this presentation.