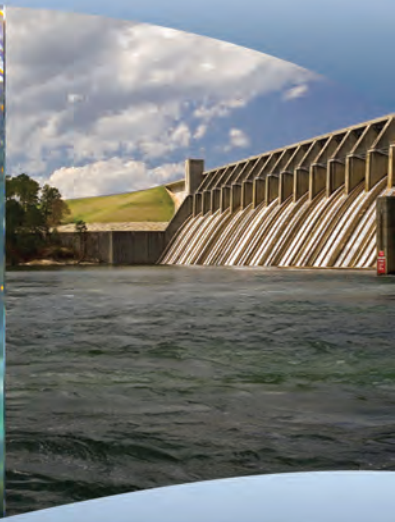
SUSTAINABLE RIVERS PROJECT



U.S. Army Corps of Engineers and The Nature Conservancy
Benefiting Rivers, Communities and the Nation

Understanding the Past ◆ Vision for the Future

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John Hickey/USACE

Beginnings

With more than 70 species of mussels, 150 species of fish, and a host of species that live in its connected cave systems, Green River features one of the richest and most unique aquatic collections in the nation. Green River Dam was built by the U.S. Army Corps of Engineers (Corps) in 1968 to help manage flood risk and provide water supply and recreation. Over time, it was realized that the water regulating effects of the dam had impacted the health of many of the river's aquatic species.

In 1998, personnel from The Nature Conservancy (Conservancy) approached the Corps' Louisville District about modifying operations at Green River Dam. Working together, the Corps and the Conservancy developed an operations plan for Green River Dam that could improve conditions for downstream ecosystems while continuing to meet human needs.

Helping Environments and Economies

Corps and Conservancy staff concluded that modifying flows on the Green River could benefit the spawning cycles of fish and freshwater mussels. At the same time, flood control benefits could be maintained and the recreation season would be extended by over a month. The new operations were implemented on an interim basis in 2002.

In 2006, following the trial period, operations at the Green River Dam were officially changed. This marked the first time that reservoir operating policies were changed at a Corps reservoir solely for ecological benefits. Scientists are now reporting increases in the number and diversity of wildlife. The longer recreation season at Green River Lake has supported jobs and generated greater visitation and increased economic activity.

Word of the successes at Green River Dam has spread. The Corps and the Conservancy are now working to apply similar strategies at three other Corps reservoirs within the watershed. The methods used and lessons learned are encouraging water managers in neighboring watersheds and on rivers across the nation to consider similar re-operations.

1998 - Conservancy approaches Corps about operations of Green River Dam.

1999 - Alternative management plans developed for Green River Dam.

2000 - Memorandum of Understanding signed by Corps and Conservancy.

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Groundbreaking Changes to Water Management

Activities at Green River Dam were the catalyst for the entire Sustainable Rivers Project (SRP). They showed that water management can be more ecologically sustainable without sacrificing other important purposes. These successes sparked the growth of SRP, which began at a nationwide level in 2002 and expanded in its first decade to include work on 36 reservoirs in eight river basins.

SRP aims to improve the health and life of rivers by modifying reservoir operations to achieve ecologically sustainable flows while maintaining or enhancing other project benefits. SRP practitioners have advanced this mission through a combination of reservoir reoperation efforts at project sites as well as through training, staff exchanges, and the development of new technologies - all designed to advance the implementation of environmental flows at Corps reservoirs.

Environmental flows are the flows of water in a river that sustain healthy ecosystems and the goods and services that humans derive from them. Environmental flows were first implemented at the Green River and then on an experimental basis at the Savannah River in Georgia and South Carolina. Following these initial efforts, SRP expanded to a diverse group of sites ranging from New England to the Arizona desert to the Pacific Northwest. Corps and Conservancy staff recognize the potential for SRP activities to positively affect operations and surrounding ecosystems at the 600-plus reservoirs managed by the Corps nationwide.

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"The Sustainable Rivers Project is fundamentally about conservationists and water managers working together to find ways to meet human needs while restoring and protecting some of our nation's most imperiled and important natural habitats."
— Steve McCormick, as President of The Nature Conservancy (2004)

"The SRP is not only demonstrating how sustainability can be incorporated into project planning and operations, it is also bringing to light new opportunities for collaboration in areas such as training and software development. Sustainable Rivers is a shining example of how our Environmental Operating Principles are being put into practice."
— Lt. Gen. Carl A. Strock, as Director of Civil Works, U.S. Army Corps of Engineers (2004)

2002

- Sustainable Rivers Project begins.
- Experimental flows on Green River.

2003

- New process for defining environmental flows applied at Savannah River.
- First joint Corps-Conservancy training course.

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SRP and the Evolution of Water Management

The Corps began building dams and reservoirs on a large scale starting in the 1930s in response to a string of devastating floods and the economic hardship of the Great Depression. The country's rapid post-war growth in the 1940s and 1950s required not only flood control but also reliable water supplies and increased electrical output for prospering communities. The Corps was thus called upon to construct reservoirs around the country that achieved multiple purposes.

The environmental effects of dams, reservoirs and other water control structures were poorly understood when many of these projects were built. By the 1960s and 1970s, government agencies, conservation groups and citizens nationwide began to evaluate the ecological impacts of development. The Corps has since worked to understand the effects of human influences on water resources and, when possible, mitigate impacts and improve the environment.

SRP continues this work by exploring reservoir re-operations to benefit wildlife as well as humans. Using state-of-the-art technology and scientific expertise, the Corps and Conservancy are working to ensure that dams and reservoirs continue to provide the services people rely on while implementing environmental flows designed to improve conditions for the natural communities that also depend on our nation's rivers.

Early stages of construction (top photo) and installation of hydropower equipment (below) at Hartwell Dam on the Savannah River. *USACE*

- Corps staff member assigned to Conservancy.
- First experimental flows on Savannah River.
- Second joint training course.

2004

- Environmental flows developed for Big Cypress Bayou.
- Environmental flows developed for Bill Williams River.

2005

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Value of Natural Systems

Healthy and sustainable ecosystems provide a wide array of services to human communities, including improved water quality, protection from floods and storms, and provision of the food and fiber that we rely on as part of our everyday lives. Over time, human influences have degraded ecosystems to the point where it is difficult to appreciate how productive they can be. Freshwater ecosystems, including rivers, floodplains and estuaries, are among the most altered in the United States today. In fact, 98% of all rivers in the U.S. are now regulated by human interventions.

Ecosystems respond to changes in the patterns of river flows and water quality. Reservoir operations play a role in this because the presence of reservoirs and the management decisions made at dams affect aquatic conditions for long stretches of river and connected wetlands. The fact that reservoirs affect ecosystems is also very powerful. It implies that reservoirs can be used as vital tools in the restoration and management of ecosystems.

Scientists and water managers have discovered and continue to refine our understanding of connections between river flows and healthy ecosystems. Periodic flooding and seasonal dry spells are now known to benefit the plants and animals that live in rivers, floodplains and estuaries because they nurture different parts of organisms' life cycles. In turn, healthy populations of fish and other aquatic organisms support recreation activities, and vibrant river ecosystems provide cleaner water supplies for human communities.

Photos provide glimpses of the productivity of ecosystems and historical human use (harvests of mussels, timber, and sturgeon).

- First experimental flows on Bill Williams River.
- Partnered software development begins.

2005

- Official operating procedures modified at Green River Dam.
- Initial public release of partnered software.

2006

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Photos top to bottom: Clifton Adams, National Geographic Society; Forest History Society; OR DFW

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Learning Through Actions

The Corps and Conservancy are making progress at SRP sites around the nation. To date, environmental flows have been defined at six of the eight SRP sites. Experimental releases of water based on environmental flow recommendations have taken place at five sites and serve as a way to validate the recommendations.

Monitoring the plants, animals and geologic characteristics of rivers - both before and after environmental flows are released from reservoirs - is helping scientists and water managers evaluate the effects of re-operations and determine if ecological goals are being achieved. Partners from universities, non-governmental organizations, and Federal, state and local agencies continue to make invaluable contributions to these efforts.

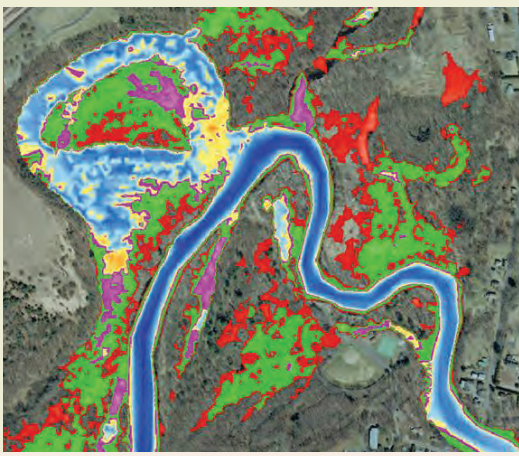
Technologies for simulating reservoirs and ecosystems are being developed and applied at SRP sites in concert with changes in operations and advances in scientific understanding. These tools allow scientists and water managers to better understand the tradeoffs between different uses of water and explore management scenarios that are not easily tested through implementation. SRP has also advanced water resources modeling through development of a new computer program to help define environmental flows. This program, named HEC-RPT, makes it easier for water managers and scientists to formulate different ways to manage rivers.

Using Technology to Improve Water Management

Computer programs allow scientists, engineers and stakeholders to evaluate potential water management scenarios. These tools help Corps and Conservancy staff to better understand and communicate tradeoffs between different water release plans:

- IHA: Indicators of Hydrologic Alteration
- HEC-EFM: Ecosystem Functions Model
- HEC-RAS: River Analysis System
- HEC-RPT: Regime Prescription Tool (developed jointly by Corps and Conservancy)
- HEC-ResSim and Riverware: Reservoir Simulation Models
- MDSWMS: Multidimensional Surface Water Modeling System

Simulated forest and plant communities.



- Experimental releases on Big Cypress Bayou.
- Partnered software used at Willamette River environmental flows workshop.

- Environmental flows developed for proposed dams on Yangtze River, China.
- Water managers from Zambezi River in Africa hosted.
- National reservoir survey initiated by Corps.

2007 2008

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Photos top to bottom: John Hickey/USACE; SC DNR; Katherine Maher/USACE

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Innovation for the Future of River Management

The Corps and Conservancy are developing and applying new approaches to improve river management today and into the future. Collaborative methods to define environmental flows, cooperative experiments, and new technologies are being used to involve stakeholders in water and ecosystem management at our nation's rivers. By implementing environmental flows at reservoirs, SRP is connecting science and management to increase the productivity and sustainability of our natural systems.

SRP activities increasingly involve multiple river tributaries and reservoirs in a watershed. The greater complexity of a basin-wide effort is both a challenge and an opportunity. These efforts require extensive coordination and technical support, but at the same time enable holistic management practices that benefit rivers and surrounding communities.

Corps and Conservancy personnel are seeking to extend these types of efforts to existing and future SRP sites. Reservoir re-operations at the watershed level can reconnect and enhance ecosystems along rivers, their tributaries and their floodplains. A nationwide survey of reservoirs is helping accelerate the growth of ecologically sustainable reservoir management at rivers around the country.

These efforts are not confined to rivers in the United States. SRP participants assisted in developing environmental flow recommendations for part of the Yangtze River in China, and lessons learned through SRP have the potential to support ecosystem health worldwide.

SRP activities are inspiring changes within the Corps and with national and international partners. In 1998, the Sustainable Rivers Project was an idea shared between a few innovative Corps and Conservancy staff. A decade later it encompassed eight river basins and 36 dams and now aims to build upon its successes and take on new challenges to improve river management in the United States and beyond.

Jeff Opperman/TNC

- Stakeholder analysis completed for Connecticut River.
- National funding for SRP.
- Environmental flows developed for the McKenzie River (Willamette).

2009

- Environmental flows developed for Connecticut River.
- Flow recommendations revised for Savannah River.
- National reservoir survey completed.

2011

2010

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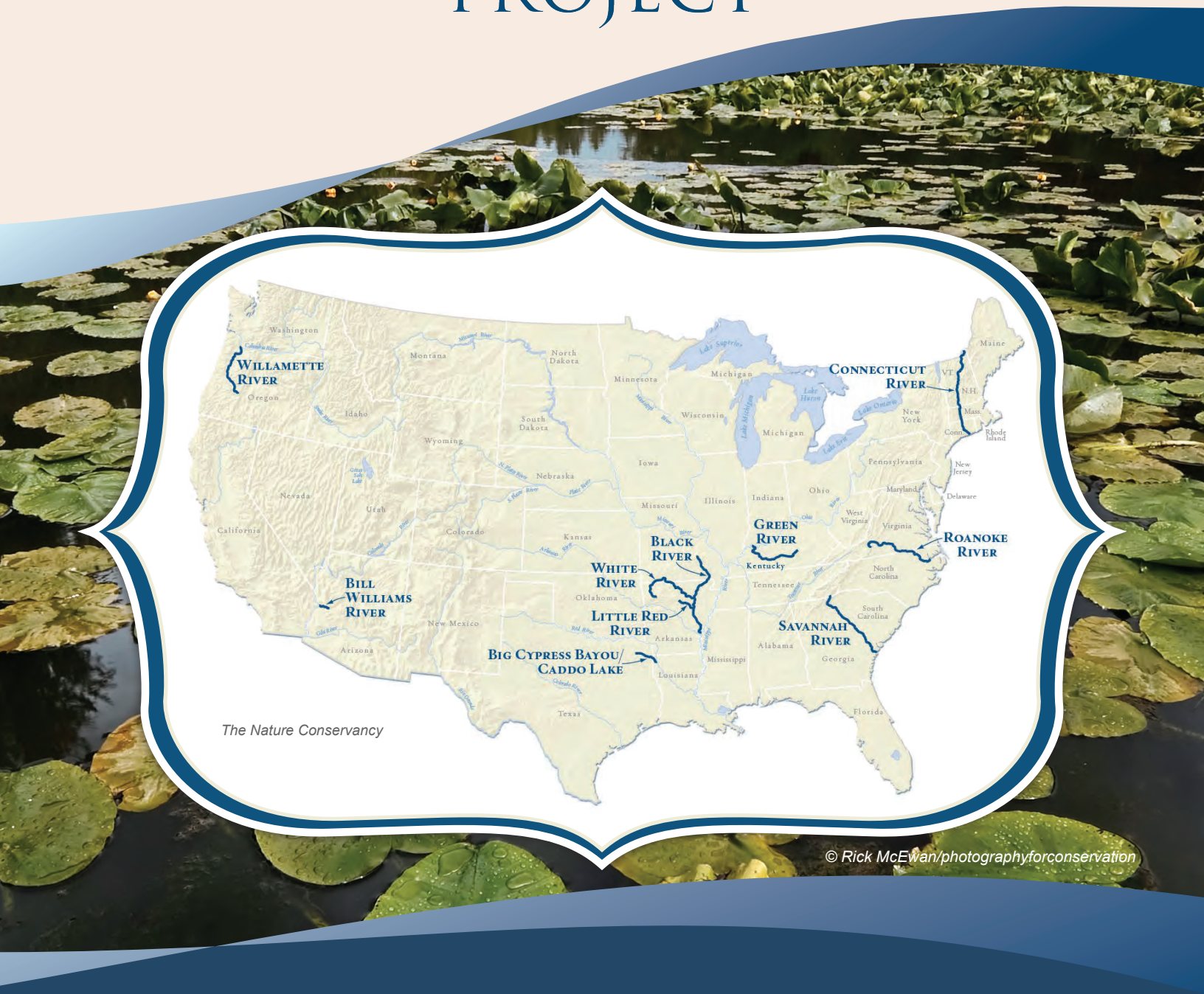

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