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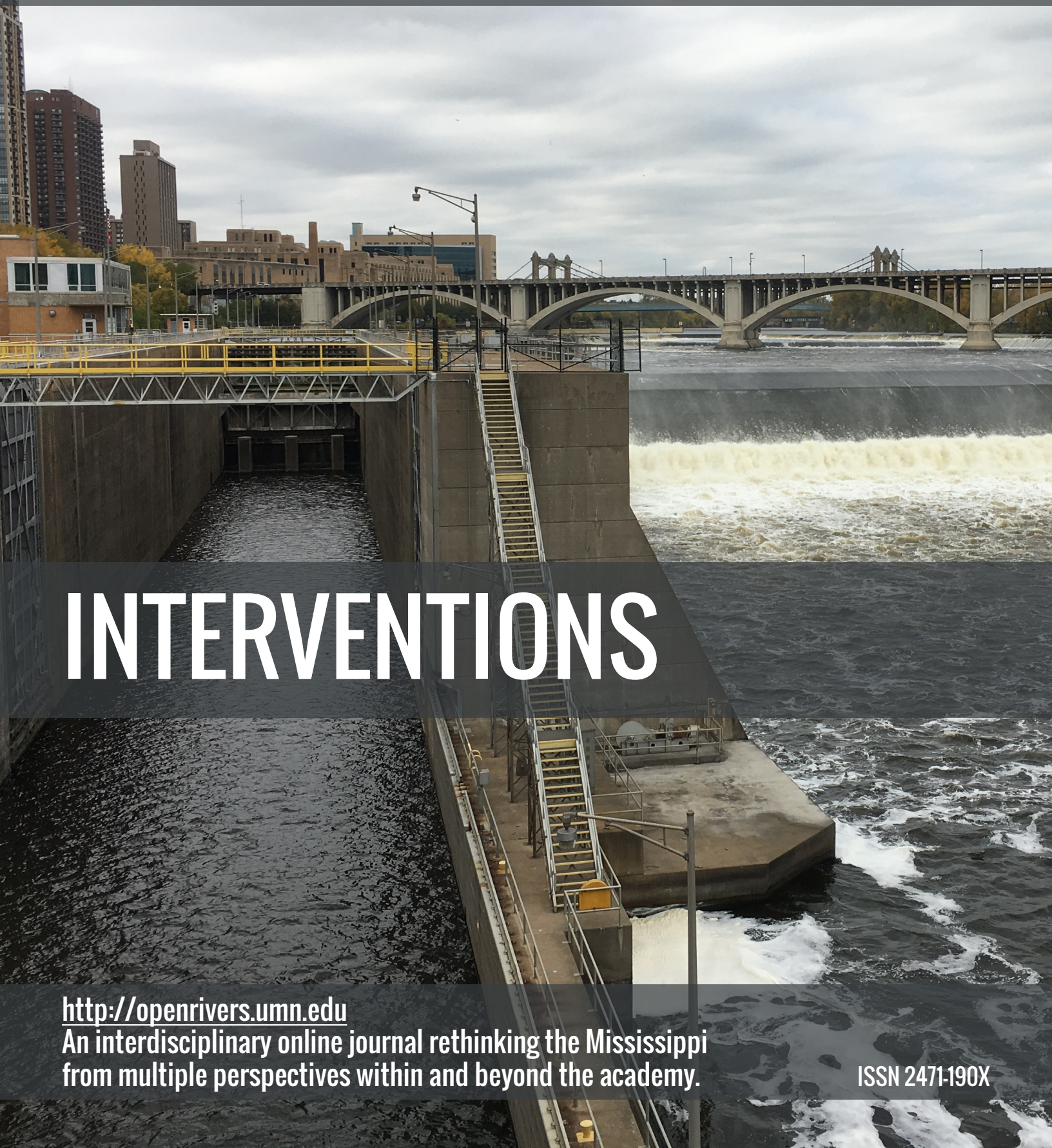
OPEN RIVERS : RETHINKING THE MISSISSIPPI



INTERVENTIONS

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The cover image is of St. Anthony Falls Lock, closed in June 2015. Image courtesy River Life, University of Minnesota.

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PERSPECTIVES ON RIVER INTERVENTIONS

By Patrick Nunnally

Over the past two decades, river management has added a new approach to the "toolbox" of efforts to undo some of the damage caused by earlier generations of river interventions. Humans have intervened in river flows for millennia, damming water courses and creating levees to shape river flows, all in the name of providing expanded benefits from managed river flows.

But things have changed recently. According to "The Undamming of America," some 500 dams have been removed in the United States over the past decade. Even more unusual, a recent program from The Nature Conservancy and the US Army Corps of Engineers, the Sustainable Rivers Program (SRP), seeks to alter the function of dams to increase the ecological functions of

Elwha River at Goblin's Gate by Jeff Taylor.

the rivers containing the dam. Rather than just eliminating the dam, the SRP aims at restoring some of the river's key functions while retaining the dam itself.

This "Geographies" column discusses the SRP and the removal of the Elwha Dam in Washington State (the largest dam removal project in the country to date) as contexts for the closure of the Upper St. Anthony Falls Lock in Minneapolis. These two cases illustrate important elements of the theme of "interventions" in our management of rivers and point to complex ways in which, once we have interfered with a river's "natural" hydrology, some of that function may be "restored," while other parts may not be. Taken together, the SRP and the Elwha cases point to the possibilities and limits in thinking about "river restoration."

The Sustainable Rivers Program

Typically dams are managed for a limited number of purposes, such as flood control and power generation, or navigation. Ecosystem management rarely comes into the picture, although that is increasing in places like the Missouri River where endangered species are part of the river system. Conflicts emerge when multiple purposes are mutually exclusive. Managers may want to

What little remained of the Elwha Dam as of February 14, 2012, by Ben Cody.

release water for hydropower, but downstream sites would then get flooded. These are competing human uses within the mandate for building the dam in the first place.

The SRP changes the pattern by actively managing the dam and river flows to mimic the river's pre-dam dynamic. Typically rivers rise and fall on fairly regular cycles according to rainfall and snowmelt. Higher flows inundate floodplains, creating conditions where certain kinds of fish spawn and that are conducive to some kinds of vegetation that are important in a variety of ways such as roots holding soil. If a dam fixes the water level at one point, or fixes and then puts too much water on the floodplain, then the ecosystem loses out, in addition to the possibility that human benefits are potentially in conflict.

The SRP has conducted long-term experiments with dams and rivers in several parts of the country. On Kentucky's Green River, revised water releases kept lake levels higher and allowed commercial recreation to take place for an extended period each year. The Bill Williams River in Arizona, which is a tributary of the Colorado River, had dam operations adjusted in coordination with Colorado River management to allow for more water storage upstream and rejuvenation of floodplain forest habitat to the benefit of hundreds of plant and animal species.

It sounds easy to manage the river as nature would, but there are a number of significant challenges. Scientists may find it hard to determine precisely the impacts of altering river flow and to match those impacts to what were the hoped-for benefits. The Corps of Engineers also does not always have authorization to change how it manages its dams. There are 472 reservoirs containing Congressionally authorized flood storage waters; 116 of those also generate hydropower. Changing management of these facilities in order to reflect better how the river would naturally work, and maximizing an expanded list of benefits to the human and natural communities, is a matter requiring better science, better engineering, and stronger arguments about the need for change.

Read more:

- http://www.nature.org/ourinitiatives/habitats/riverslakes/sustainable-rivers-project-fact-sheet-pdfnull.pdf
- http://www.iwr.usace.army.mil/Missions/Environment/Sustainable-Rivers-Project/
- http://www.nature.org/ourinitiatives/habitats/riverslakes/sustainable-rivers-project.xml

Elwha

While it's true that in some cases dams can be managed to achieve a greater range of benefits, sometimes a dam just needs to come out. The case of dam removal on the Elwha River illustrates the manifold benefits that can happen when dams are removed and a river "comes back to life" even after a century of blockage.

The Elwha River ran unchecked to Puget Sound until the early decades of the twentieth century, when two dams were built to provide hydroelectricity for industrial growth of the nearby community of Port Angeles, on the Olympic Peninsula west of Seattle, WA. The Elwha Dam went up in

1914, its 108- foot high bulk blocking salmon runs up the river and altering the river's hydrology. The Glines Canyon Dam (210 feet high) followed in 1927 to supply more power. In the late 1970s, both dams, by now located in what had been designated Olympic National Park, failed their relicensing tests and the possibility of removing them came to the fore. It was not until 1992 that an act of Congress called for the dams' removal and even later, in 2011, before demolition began. Decades of work by the Lower Elwha Klallam Tribe, the national advocacy group American Rivers, and a host of other organizations came to fruition in 2014 when the Glines Canyon Dam was finally completely opened and the river ran free again. The Elwha Dam had been removed by 2012.

The most notable ecological benefit from the dams' removal was the return of salmon up the river where they had been blocked for nearly a century. Fish started appearing in the river within a month of the demolition, and nesting sites appeared in the next season. The number of fish recorded in the river has steadily increased, although it could take a decade or more for numbers to approach pre-dam levels.

The return of salmon is just one of several ecological changes that have accompanied dam removal. Mammals such as bears and otters have appeared, drawn by salmon as food stocks, and dying salmon have meant nutrient replenishment to the river corridor. The former reservoir lakebeds, now exposed to the air, have reseeded, and forest and meadows have begun to appear. Overall, 70 miles of spawning habitat have been restored. The river has begun eroding its banks again, releasing large trees that move downstream and catch on the riverbed, providing both a more braided stream and habitat for a number of birds and animals.

The sediment pulse after the dam removal released 4.6 million cubic yards of sand and gravel downstream and into Puget Sound. Aquatic invertebrates were smothered, but have begun to recover. The shape and material of the beach at the river's mouth have changed, which bodes well for the return of clams, crabs, and other long-lost species. An easily overlooked benefit of the dam removal was the restoration of a healthy intersection between river and ocean, the river contributing sediments that form a healthier nearshore environment.

Dam removal has had important cultural benefits as well. The Lower Elwha Klallam tribe has made its home along the river from time immemorial. After a pause to allow salmon stocks to replenish, the tribe hopes to begin ceremonial catches soon. Rejuvenation of a complex ecosystem with diverse plant and animal species is likewise important to tribal people.

The Elwha Dam removal is widely credited as the "largest dam removal in the world," but, as with so many other things, the claim appears to depend on what is being measured. The Glines Canyon Dam is the tallest that has been removed. Dam removal projects that are in process or complete on the Klamath (CA/OR), the Baraboo (WI), Milwaukee (WI), and Des Plaines (IL) Rivers have all involved removal of multiple dams. River management on the Penobscot River in Maine has restored some 1,000 miles of habitat either through dam removal or construction of fish passages. When complete, the Klamath work is estimated to restore 300 miles of habitat, in comparison to the 70 restored miles on the Elwha.

There is, rightly, a growing controversy about river "restoration." Up until very recently, practitioners spoke readily of "restoring" a river or a landscape around water to "presettlement" conditions. Of course, this view implies that Native people were not even present, that the land and waters were a "blank slate" before colonizing Europeans showed up. The many problems with this argument are by now well known, and there is growing recognition, as well, that in a regime

of climate change, "restoration" is simply not possible. Too many conditions have changed to say that the Elwha River has been "restored" to its pre-1900 conditions. Nevertheless, the project on the Elwha, as well as those on the Bill Williams River and the Green River, demonstrates the number and range of benefits that are possible when we intervene in a river's dynamic system, undoing the damage that we have previously committed.

Learn more:

- http://projects.seattletimes.com/2016/elwha/?utm_campaign=coschedule&utm_source=twitter&utm_medium=americanrivers
- https://tours.fishviews.com/tour.html?id=elwha-river&utm_campaign=coschedule&utm_source=twitter&utm_medium=americanrivers#1104
- https://www.americanrivers.org/2016/04/worlds-biggest-dam-removal/
- http://news.nationalgeographic.com/2016/06/largest-dam-removal-elwha-river-restoration-environment/?utm_campaign=coschedule&utm_source=twitter&utm_medium=americanrivers
- http://www.elwha.org/home.html
- https://www.americanrivers.org/2016/09/five-years-later-elwha-reborn/

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About the Author

Patrick Nunnally coordinates the River Life Program in the Institute for Advanced Study at the University of Minnesota. He serves as editor for *Open Rivers* and was one of the lead scholars for the University's John E. Sawyer Seminar, "Making the Mississippi: Formulating New Water Narratives for the 21st Century and Beyond," funded by the Andrew W. Mellon Foundation.