

Research Update

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Bottom Line

Reclamation collaborated with universities, science centers, and Federal agencies to create a living database of interdisciplinary dam removal data and submit an article on common management concerns.

Better, Faster, Cheaper

Studying dam removals provides an opportunity to evaluate the far-reaching benefits and consequences of these significant river changes and watershed restoration efforts.

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Understanding the Dynamics Behind Dam Removals

Synthesizing ecological and physical effects of dam removal projects

Problem

When dams no longer serve their purpose or when that purpose can be met by other means, then dam decommissioning or removal is an option that can be considered. Dam decommissioning is rapidly emerging as an important river restoration strategy in the United States (U.S.). Over one thousand dams have been removed in the last few decades, including several large ones in recent years, such as Condit Dam and the Elwha River dams in Washington State.

Yet, few studies have evaluated the far-reaching consequences of these significant environmental changes, especially from removing large dams (over 30 to 50 feet high). In particular, interactions between physical and ecological aspects of dam removal are poorly known. From recent work, however, observations are now available from several diverse settings nationwide to allow synthesis of key physical and ecological processes associated with dam removals, including fish and benthic community response, reservoir sediment erosion, downstream sedimentation, water quality issues (including turbidity and contaminant transport), riparian vegetation, food web response, gene flow changes, effects on migratory aquatic species, and invasive species response.

Solution

Through this Reclamation Science and Technology Program research project, Reclamation staff participated in efforts to synthesize dam removal findings into a publically available database and a paper synthesizing common management concerns associated with dam removal.

The U.S. Geological Survey's (USGS) John Wesley Powell Center for Analysis and Synthesis (Powell Center) sponsored this effort to synthesize existing dam removal studies and data, thereby providing scientists and managers better knowledge of likely outcomes of future dam removals. The 20-member working group convened workshops in June 2014 and June 2015 at the Powell Center in Fort Collins, Colorado. The group consisted of Federal agency and academic biologists, hydrologists, geomorphologists,

— continued

The 20-member working group at the first Dam Removal Synthesis Meeting at the Powell Center in Fort Collins, Colorado, including two representatives from Reclamation's Technical Service Center, Jennifer Bountry and Tim Randle.



and engineers from throughout the U.S., along with representation from American Rivers, a non-profit leader in dam removal studies and implementation. Discussions and presentations revealed the tremendous growth of information from dam removals over the last few years, and pointed to several common patterns of physical and biological responses. The workshops combined group discussions to strategize prioritization of topics, assignment of working teams, small working groups targeted at reviewing and writing components for identified papers, and periodic “check in” presentations to get peer review from the larger group. The workshops also served the role of forming a peer network in the field of dam removal.

Application and Results

Dam Removal Database

To provide a publicly available database of dam removal literature and associated metadata, this research effort contributed funding for a “living” database of dam removal demographic data, led by USGS scientists and reviewed by Reclamation staff. Publications were located using the Web of Science, Google Scholar, and the University of California–Berkeley’s Clearinghouse for Dam Removal Information. This database added to an extensive literature search aimed at identifying documents relevant to the emerging field of dam removal science. The database now contains 179 citations that contain empirical monitoring information associated with 130 different dam removals across the U.S. and abroad. Data include publications through 2015 and were supplemented with the U.S. Army Corps of Engineers’ National Inventory of Dams database, USGS’s National Water Information System, and aerial photographs to estimate locations when coordinates of dam locations were not provided. This database provides managers, stakeholders, and the public with the information necessary to help make informed decisions about dam decommissioning.

Management Concerns Paper

Managers make decisions about if and how to remove dams in spite of uncertainty about likely physical and ecological responses. Stakeholders opposed to dam removal often raise concerns about negative effects, even if these concerns are not warranted at a particular site. This effort used a newly-available dam removal science database and other information sources to explore seven of these “Common Management Concerns” to investigate their occurrence and the contributing biophysical controls:

- Degree and rate of reservoir sediment erosion
- Excessive reservoir channel incision
- Downstream sediment aggradation
- Elevated turbidity
- Drawdown impacts on local water infrastructure
- Colonization of reservoir sediments by non-native plants
- Invasive fish expansion

This research helps managers identify multiple risks at a site and assess whether further analyses are warranted to evaluate these concerns at their sites, and demonstrates why these concerns should be considered in the context of other important factors like natural watershed variability and disturbance history.

Future Plans

This network has continued to collaborate, sharing new information and dam removal experiences from which each member can continue to learn and benefit from.

“Understanding how rivers and ecosystems respond to dam removals not only improves our fundamental understanding of river processes—in particular, flows and sediment—they also provide valuable lessons for managing river restoration and reservoir sedimentation for long-term sustainability.”

Jennifer Bountry
Hydraulic Engineer
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Collaborators

- USGS John Wesley Powell Center for Analysis and Synthesis
- U.S. Forest Service
- National Oceanic and Atmospheric Administration
- American Rivers
- Oregon State University
- University of Montana
- Dartmouth College, New Hampshire

More Information

www.usbr.gov/research/projects/detail.cfm?id=1666

USGS Dam Removal Science
Database:

<http://doi.org/10.5066/F7K935KT>

USGS Dam Removal Information
Portal:

www.sciencebase.gov/drip/

Tullos, D., M. Collins, J. Bellmore, J. Bountry, P. Connolly, P. Shafroth, and A. Wilcox. “Common management concerns associated with dam removal.” Forthcoming. Submitted to *Journal of the American Water Resources Association*.