RIVER REVIVAL

Dam Removal: The Global View

For those of us now being saddled with the costs of years of unquestioned dam-building, it would be unconscionable to remain silent.

Dan Beard, Commissioner of the US Bureau of Reclamation (1993 - 1995)

Once revered as temples of engineering prowess, dams are now viewed more critically. Dams devastate river ecosystems and undermine the rights and livelihoods of affected communities. Increased international recognition of the high environmental and social costs of dams, along with river restoration successes in the US, are inspiring dam removal campaigns worldwide.

Numerous dams are now slated or proposed for removal. Many have simply outlived their purpose or sit abandoned, posing a danger to public safety. Other dams continue to operate, though with significant environmental and social consequences. Over a dam's lifespan, costs borne by damaged ecosystems and communities may outweigh other project benefits. With dam removal already outpacing dam construction in the US, decommissioning has significant implications for river management worldwide.

Around the world, the message is spreading — these dams are NOT forever. Let's bring our rivers back!

The U.S. Experience

The majority of dam removals have occurred in the US, where more than 75,000 dams over two-meters high obstruct some 950,000 km of waterways. In the past 75 years, hundreds of dams have been removed in at least 43 US states. The dam decommissioning trend is accelerating in the US, with 177 dams removed in the past decade, including 26 small dam removals in 1999.

One reason for the increase in decommissioning activities is the poor condition of the nation's dams, 1,800 of which are officially deemed unsafe. By 2020, 85% of all government-owned US dams will be at least 50-years old, the typical design lifespan. Supporters of dam removal are calling further attention to a serious lack of funding for dam safety programs. Secondly, dam removal is an emerging option in relicensing proceedings, in which private hydropower dam owners seek to renew 30- to 50-year operation agreements with the Federal Energy Regulatory Commission (FERC). More than 500 FERC licenses will expire in the next decade.

The dam relicensing process is forcing dam owners, government decision-makers, river advocates, and affected communities to re-evaluate the costs and benefits of dams, especially in light of mandates to protect endangered species, recognize tribal fishing rights, and give "equal consideration" to fisheries, recreation, and environmental quality. In a growing number of cases, removal of unsafe or obsolete dams represents the best river management option. A flood of river restoration campaigns currently advocates the removal of more than 100 dams from Maine to California.

FISHERY REST

Dams wreak havoc on native fisheries and river ecosystems. I cycles, block fish migration, and disrupt temperature regimes aquatic life. In addition, prime habitat is commonly lost, and

Rivers are resilient, however. After a dam is removed, fishe return remarkably quickly. Dam removal alone may be insuffi ever, and may need to be accompanied by additional measure pollution abatement, restoration of riparian habitat, and stric increase the rate and extent of restoration.

One year after the 1999 Edwards Dam removal, migratory fi impounded parts of Maine's Kennebec River. The alewife, a m to upstream spawning grounds, returned by the millions to a them in 160 years. In an attempt to protect other sea-run salmon, nine more dams are slated for removal on Maine's co Baraboo River more than doubled, from 11 to 24 species, just first free-flowing conditions since 1850. In France, the 199 tributaries is already revitalizing native shad, lamprey and sal

Small Dam Removal

Most of the 500 documented dam removals in the US involve obstructions less than 12 meters high. Removal of these dams is helping to restore hundreds of kilometers of habitat and invigorating stewardship of local watersheds.

COST

Dam owners, whether private or government, rarely plan or accept accountability for the costs of decommissioning. Yet, dam removal costs, in many cases, are significantly less than estimated expenditures for long-term safety and environmental compliance, repair, and maintenance. Removal costs of 70 small dams in Wisconsin, for example, were found to be an average of two to five times less than estimated repair costs. On the Baraboo River, the cost of removing the 3-meter-high Oak Street Dam was $30,000, compared to dam repair estimates of $300,000. In Maine, removal costs for the 8-meter-high Edwards Dam were roughly one-third the $9 million price tag of upgrading fish ladders to meet mandatory relicensing conditions.

Even large dams may be cheaper to remove than to repair and refurbish. Removing the 40-meter-high Condit Dam in Washington, for example, is predicted to cost $15 million. Estimated repair costs are twice that amount. The full cost of removing the large Elwha River dams (47- and 90-meter-high), the highest US dams ever funded for removal, are expected to exceed $200 million over a 20-year period.

In Wisconsin, community advocates working with state and local governments are making small dam removal the cornerstone of a statewide river restoration program, establishing the state as the national leader in small dam removal. The River Alliance of Wisconsin recently worked with a community to remove three unsafe, uneconomical small dams on the Baraboo River in south central Wisconsin. Removal of a total of four Baraboo River dams will be completed by 2002, freeing a 193-km stretch of river—the largest ever restored through dam removal in the US. Dismantling the dams on the Baraboo River will improve recreational fisheries, benefit diverse local stakeholders, and cost significantly less than dam repair.

Cost-effective river restoration projects in Wisconsin, and elsewhere across the US, are spurring efforts to decommission larger, more complicated projects in North America and around the world.

Columbia River Basin Regional Case Study

More large dams are proposed for removal in the Northwest US than anywhere else. Dams built since 1900 have caused catastrophic declines in Pacific salmon runs. As a result, activists, including the Northwest office of Friends of the Earth, are demanding removal of several large dams in Washington, including those on the Elwha, White Salmon, and Lower Snake rivers. Native American communities affected by these dams are redefining the legal basis for dam removal by affirming tribal fishing rights and government treaty obligations.

O R A T I O N

Dams obstruct river flows, alter nutrient and dissolved oxygen levels favorable to exotic fish species introduced.

eries and hospitable habitat conditions cient to fully restore river systems, how- es, such as protection of native fisheries, cter watershed management policies, to

sh returned in abundance to previously nigratory species that depends on access stretch of that river which hadn't seen species, including endangered Atlantic astal rivers. Fish diversity in Wisconsin's eighteen months after restoration of the 8 removal of two dams on Loire River lmon populations.

Dam decommissioning in the Northwest is significant for several reasons:

- Indigenous peoples are intervening in dam relicensing and exerting fishing rights;
- Endangered species protection and watershed restoration are being made a higher public policy priority;
- Government agencies are funding decommissioning studies and dam removal;
- The size, complexity, and cost of dams proposed for decommissioning is unprecedented.

Elwha River, Washington

The 43-meter-high Elwha Dam and 82-meter-high Glines Canyon Dam - the highest dams ever slated for removal at government expense - were built in the early 1900s to power timber mills in the nearby town of Port Angeles. The private dams, now within the Olympic Peninsula National Park, destroyed magnificent local runs of Pacific salmon, diminishing an irreplaceable cultural symbol. Extinction of Elwha River sockeye salmon, and drastic declines in the river's ten other native species, undermines fishing rights of the Lower Elwha Klallam, a federally recognized Indian Nation. In 1992, the government finally heeded tribal demands to provide "full restoration" of the Elwha River, including dam removal. After 25 years of campaigning by the Lower Elwha Klallam Nation and conservation organizations, Congress approved funds in 1999 to purchase the dams. Once acquired, the government will begin dam removal activities estimated to cost at least $100 million. Restoration of the Elwha represents the last, best hope for resolution of Lower Klallam fishing rights and a once spectacular salmon river.

White Salmon River, Washington

An historic 1999 agreement between the Yakima Tribe, government agencies, conservation groups, and a dam-owner directs a 38-meter-high private hydropower dam to be removed at the owner's expense. Dismantling the 87-year-old Condit Dam will bring back free-flowing conditions to the entire 72-km White Salmon River. Dam removal will help restore critical habitat for endangered salmon from the river's pristine headwaters all the way to its confluence with the Columbia River. Keeping the dams and complying with FERC relicensing conditions, including modern fish ladders, could cost dam-owner PacifiCorp more than $30 million—roughly two times dam removal estimates. PacifiCorp, a major regional power company, promises to finance the removal through a decommissioning fund generated by future hydropower revenues. Successful incorporation of tribal interests, and dam-owner acceptance of financial accountability for decommissioning costs are critically important lessons with far-reaching implications for river advocates around the world.

Lower Snake River, Washington

A high-profile campaign is pushing for decommissioning of four dams on the Lower Snake River in eastern Washington, which historically supported 50% of the 15 million salmon returning annually to the Columbia River Basin. Today, the river faces a fisheries catastrophe, despite a 30-year, $3-billion hatchery and mitigation program. The 30-meter-high dams were built after 1960, severely impeding fish migration, and are now blamed for the salmon's imminent extinction. Dam critics, including Lower Columbia River Basin tribes whose salmon are guaranteed by treaty, are calling on government agencies to honor native fishing rights and uphold the Endangered Species Act. Many support breaching the multi-purpose dams, thus returning a 225km stretch of river to free-flowing conditions. Immediate breaching of the dams and recovery of the fishery will avert further litigation and tribal trust liabilities that could cost the government billions of dollars - many times more than the cost of removing the dams in the first place.

The debate on whether to remove the Lower Snake River dams illuminates a trade-off between particular economic benefits, such as subsidized irrigation, electricity, and river barge traffic, and broader societal values supporting healthier river systems.

TECHNICAL CHALLENGES

Removing Accumulated Sediment

Dams trap immense quantities of river sediment. Up to 1% of the world's total reservoir storage capacity is lost annually to sediment accumulation. Each year, for example, an average of 65 million tons of sediment settle behind the Colorado River's Glen Canyon Dam, diminishing the long-term effectiveness of the dam. In addition to creating problems for existing dams, sediment poses challenges during dam removal. Sediment removal is likely to represent the most costly and technically intensive aspect of decommissioning large dams.

Specific sediment removal techniques vary depending upon the amount of sediment, reservoir characteristics, project age, and the effectiveness of periodical flushes, if at all feasible, to pass trapped sediment downstream. Sediment removal must be conducted carefully, as excessive release can damage sensitive downstream habitat. On Washington's Elwha River, for example, experts propose gradual, incremental drawdowns to transport sediment without harming spawning habitat or juvenile salmon.

A potential effect of sediment flushing is release of accumulated contaminants into fisheries or water supplies. Following removal of a 9-meter-high dam on New York's Hudson River in 1973, tons of trapped toxins were suddenly exposed in the old riverbed or flushed downstream. Hazardous waste in sediment poses significant health risks, degrades water quality, and ultimately requires extensive cleanup efforts. Thus, thorough sediment analysis and prior assessment of the foreseeable effects of releasing sediment must be included in decommissioning studies.

Replacing Dam Functions-Finding Alternatives

A key aspect of dam removal planning is early identification of alternative sources of hydropower, irrigation and public water supply, or other dam functions. Dam removal often entails trade-offs between competing river functions. However, US experience with dam removal demonstrates that replacement can be accomplished with minimal difficulty. For example, a single hydropower dam may contribute only a fraction of a region's overall power - alternate sources are often readily available. In other cases, such as in the removal of 12 small dams on California's Butte Creek in 1998, dismantling dams has only negligible effects on water supplies due to complementary mitigation (e.g., improving efficiency of irrigation systems). Developing a comprehensive management plan that accounts for displaced dam functions minimizes the negative impacts of removal. Where changes or impacts are unavoidable, society may accept them as the price of long-term river restoration.

Funding Decommissioning

Financing decommissioning remains an afterthought for most dam owners. One reason is the lack of formalized institutional arrangements ensuring regular, periodic monitoring of dams. The World Bank-sponsored World Commission on Dams calls for stringent dam performance evaluations every 3-5 years and recommends setting aside funds for future decommissioning. Decommissioning funds established before or during project operation, such as those mandated for nuclear power plants, will help offsets future decommissioning costs, especially for large dams. Those who build, finance, and operate dams should be held responsible for the costs of decommissioning them.

DECOMMISSIONING METHODS

Appropriate methods of dam decommissioning depend on project attributes (such as size, type and location of dam), river characteristics, and intended objectives (such as fisheries restoration, land reclamation and recreation). Dam decommissioning is thus highly site-specific. Careful planning minimizes public health and safety risks to downstream communities.

- Complete removal is often accomplished by first temporarily diverting the river, then using heavy equipment (e.g., wrecking ball, backhoe, and hydraulic hammer) to dismantle the dam. The removal of the 7-meter-high, 280-meter-long Edwards Dam on Maine's Kennebec River was accomplished in a matter of days using this technique.

- Breaching of dams allows the river to flow around existing dam structures. Heavy machinery is typically used to breach earthen portions of dams located in relatively wide river corridors. Breaching is recommended for partial dam removal, such as the Lower Snake River dams, and represents a relatively inexpensive decommissioning option for larger structures, when feasible.

- In the case of some concrete dams, controlled explosives are used to demolish dams. Explosives were used to remove dams on the Clearwater (1963), Clyde (1996), Loire (1998), and Kissimmee (2000) rivers, among others. Occasionally, a combination of explosives and heavy machinery are required, especially with larger projects.

- Campaigns promoting decommissioning of barrage-type dams with radial gates, such as the Nagara Estuary Dam in Japan and Thailand's Pak Mun Dam, advocate simply raising the gates. This re-creates more natural river conditions without the immediate cost of removal.

What is dam decommissioning?

Dam "decommissioning" means the deactivation of a dam project's principle functions and may include: dismantling power generating equipment, permanently opening dam gates, partial breaching of earthen structures, or complete and permanent removal. Dam removal is neither as rare, nor as radical, as dam defenders claim. To date, a variety of dam types designed for a range of functions have been successfully removed.

The International Experience

Internationally, grassroots campaigns are calling for dam removal to restore rivers and promote the rights of affected communities. Activists are targeting dams that continue to have significant negative social and environmental impacts while failing to live up to economic promises.

Canada

Growing interest in decommissioning and river restoration in Canada reflects that in the US, though Canada's regulatory regime differs, especially because dam licenses in Canada are issued in perpetuity. Of the 2,000 dams in British Columbia, 400 have either outlived their usefulness, provide only marginal benefits, or severely harm coastal fisheries. With the removal of nearly two-dozen small dams in the province, support is growing for more ambitious decommissioning proposals.

On British Columbia's Theodosia River, a plan to revitalize lucrative commercial- and sport-salmon fisheries in the Georgia Straits is the basis for a plan to decommission a 35-year-old water diversion dam. If removed, the 8-meter-high, 125-meter-long, Theodosia Dam would be the largest dam ever dismantled in Canada. *"No dam was meant to last forever – they do age and, eventually, outlive their usefulness. When that occurs, I believe we have to look at the decommissioning or dismantling option in an effort to restore habitat,"* stated Mark Angelo, Chair of the 140,000-member-strong Save the Theodosia Coalition, who helped secure government approval for decommissioning. Rather than dismantle the entire dam right away, stakeholders are exploring more immediate decommissioning options, including water diversion reductions. *"It's a cautious, risk-averse approach to dam decommissioning and will do much to repair one of Georgia Strait's great salmon rivers,"* asserts Angelo.

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France

Inspired by decommissioning efforts on the Elwha River in the US, the SOS Loire Vivante (Living Loire) network is working to restore France's only remaining native salmon river by removing old dams. In 1998, two dams on tributaries of the Upper Loire were demolished to help protect the last Loire salmon. First, the 12-meter-high Saint-Etienne-du-Vigan Dam on the Upper Allier was removed, marking the first case in which France's state-owned electricity utility destroyed a dam to restore salmon habitat. The Vienne River, the second largest Loire tributary, also flows freely now after demolition of the 4-meter-high Maisons-Rouges Dam. A dam in Kernansquillec on the Leguer River was also dismantled, in 1996, after rapid sedimentation had reduced the reservoir capacity by 50%. Dam removal in France and the Loire River management plan reflect growing awareness across Europe, where concessions for thousands of dams built before 1950 are to be reviewed in the next decade.

Czech Republic

Since 1991, local NGOs and concerned citizens have campaigned to remove three small dams impounding 1,300 acres of riparian and woodlands habitat along the Morava and Dyje rivers. The Ramsar Convention, which lists the affected area as wetlands of international importance, obliges the Czech Government to maintain the ecological character of the site. While conservation groups succeeded in securing a degree of restoration through partial draining of two reservoirs in 1995, the Czech Ministry of Agriculture may not support the ongoing restoration efforts. Czech conservation groups such as the Ecological Institute Veronica are calling on the international community to support decommissioning of the Nove Mlyny dams and demand continued restoration efforts in the area.

Thailand

In Thailand, decommissioning campaigns have arisen as a result of social and ecological disruptions caused by dam construction on the Mun River, the largest tributary of the Mekong. The 135-MW Pak Mun Dam was funded by the World Bank and completed in 1994. As a direct result of the dam, more than 20,000 people have been affected by drastic reductions in fish populations upstream of the dam site, and other changes to their livelihoods. Villagers have occupied the dam site for 20 months and are demanding that dam gates be permanently opened to allow fish migration.

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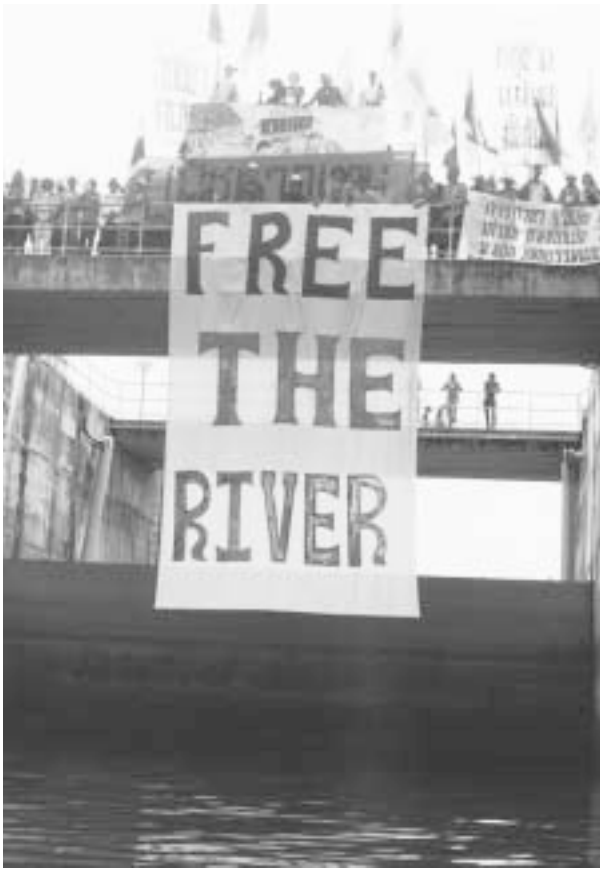
The Rasi Salai Dam, the first project to be completed in a massive scheme to build 13 irrigation dams on the Chi and Mun rivers, is currently useless and likely to remain so. The reservoir overlays a geological salt dome that now makes the water too salty for irrigation. It also inundates the largest freshwater swamp forest in the Mun River basin, a source of food and traditional medicine for local villagers. More than 15,000 people lost farmland due to the reservoir, sixty-percent of whom remain uncompensated.

After months of occupying the Rasi Salai Dam site to protest the dam and demand decommissioning, local activists finally got results. In July 2000, Science Minister Arthit Urirat ordered the gates of Rasi Salai Dam to be opened for two years to restore the land and undertake proper environmental impact assessments. In response, villagers agreed to vacate their protest site on top of the dam. The Thai government has yet to acquiesce to protesters' demands for decommissioning Pak Mun.

Colombia

The 340-MW Urrá I Dam, completed in 1997, has decimated downstream fisheries, affecting 60,000 fishers. The dam directly displaced 12,000 people on the Sinu River. In April 2000, the dam-building company, Colombian officials, and representatives from the indigenous Embera-Katio people who lived in the Urrá reservoir area agreed to compensatory measures featuring a clause stating the Embera's right to have a say in decommissioning the dam. The agreement represents one of the first cases in which dam-affected indigenous peoples in a developing country have been assured official recognition in future decommissioning negotiations.



Juan José López Negrete from ASPROCIG, which represents affected people downstream of the dam, met representatives of the Swedish company Skanska, which constructed the dam.

"We didn't come here to pose moral questions to your company because you built Urrá," he said. *"We came here to let you know that the construction of Urrá signifies the slow death of our culture. What we are asking is that you learn from the experience of Urrá and reform your environmental policies so you don't make the same mistakes in other parts of the world. Even though you think Urrá is history, we are counting on your support for the decommissioning of the dam, given your technical knowledge."*

SO, YOU WANT TO REMOVE A DAM...

People feel passionately about rivers and, sometimes, for dams as well. Efforts to restore rivers, fisheries, and livelihoods lost to dams can be met with resistance and skepticism, especially if decommissioning advocates neglect to educate important stakeholders, address technical, legal, and economic cost issues, or examine feasible alternatives and possible negative impacts. Addressing these elements early in a decommissioning campaign leads to strong partnerships between different stakeholders.

1. Do your homework. Know who owns the dam, what legislative processes apply, which resources, what rights, and whose interests would be affected by continued dam operations and by decommissioning. Identify stakeholders and the costs and benefits of dam removal from their perspectives. Know the relevant government agencies, interested organizations, communities and unions, and assess the depth and range of their interests. Study precedents and dam removal case studies. Don't automatically assume you know who supports or opposes decommissioning. Some people that you assume would oppose dam removal may not, and vice versa.

2. Identify alliances and develop working partnerships. A diverse constituency is critical in dealing effectively with controversial issues around dam removal, even when parties agree that a project is not worth preserving. Include dam preservationists wherever possible. Partnerships require time and diligence to cultivate.

3. Anticipate opposition. Have your facts straight and plenty of information available. Effective decommissioning campaigns allay concerns related to potential impacts to or changes in local jobs, landmarks (i.e., the dam and "the lake"), property rights, and old ways of doing things (e.g., reservoir-based recreation or fisheries). Critics can turn into allies when they are presented with well-reasoned, scientifically sound arguments favoring restoration.

4. Educate everybody. Foster dialogue between stakeholders to resolve issues pertaining to the costs and benefits of restoration. Get on record with local, regional and national governments and demand consideration of decommissioning possibilities.

This brochure was produced by the **River Revival** *project of* **International Rivers Network**. *Your organization can join the movement to restore the world's rivers by endorsing the Walker Creek Declaration; you can keep current on dam removal around the world, by subscribing to the River Revival Bulletin (send an e-mail to info@riverrevival.org); consider supporting this important work by becoming a member of IRN! Learn more about all the ways to get involved by visiting our website at www.riverrevival.org!*

IRN
International Rivers Network
Linking Human Rights and Environmental Protection

International Rivers Network supports local communities working to protect their rivers and watersheds. We work to halt destructive river development projects, and to encourage equitable and sustainable methods of meeting needs for water, energy and flood management.

FOR MORE INFORMATION:

River Revival (IRN): 1847 Berkeley Way, Berkeley, CA 94703. Tel: 510.848.1155. E-mail: info@riverrevival.org. Web: www.riverrevival.org.

Friends of the Earth (NW Office): 4512 University Way, NE, Seattle, WA 98105. Tel: 206.297.9460. E-mail: foenw@foe.org. Web: www.foe.org.

American Rivers (Rivers Unplugged): 1025 Vermont Ave., N.W. Suite 720, Washington, D.C. 20005. Tel: 202.347.7550. E-mail: riversunplugged@amrivers.org. Web: www.amrivers.org.

River Alliance of Wisconsin: 306 E. Wilson St., Ste 2W, Madison, WI 53703. Tel. 608-257-2424. Email:wisrivers@wisconsinrivers.org. Web: www.wisconsinrivers.org.

Friends of the River: 915 20th Street, Sacramento, CA 95814. Tel: 916.442.3155. E-mail: info@friendsoftheriver.org. Web: www.friendsoftheriver.org.

European Rivers Network: 8 Rue Crozatier, 43000 Le Puy, France. Tel: 33.4710208.14. E-mail: ern@rivernet.org. Web:www.rivernet.org.

Ecological Institute Veronica: Panská str. 9, 60200 Brno, Czech Republic, Tel: 420.542218351.

South-East Asia Rivers Network (SEARIN): 78 Moo 10, Suthep Rd., Tambol Suthep, Chiang Mai, 50300, Thailand. Tel: 66.53.278334. E-mail: searin@chmai.loxinfo.co.th. Web: www.searin.org.

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