



The Science of Conserving Native Fish

Mitigating Potential Effects of Flow Experiments along the Green River in Dinosaur National Monument



On the Green River, scientists are helping ensure that solving one problem doesn't cause another for native fish. Analyzing long-term monitoring data collected in Dinosaur National Monument allowed them to suggest modifications to proposed experimental flows from Flaming Gorge Dam. The modifications may provide long-term benefits to Colorado pikeminnow.

Background

River systems, and the species that depend on them, need variations in flow to stay healthy. In addition to water, rivers carry plants and sediment—often from side canyons and cliff walls—downstream. As this material is deposited on river banks, the banks grow larger and the channel narrows. Seeds grow into plants that hold the sediment together, encouraging more deposition. Under natural conditions, large floods occasionally help the river “take out the trash,” scouring away sediment and vegetation encroaching on the river banks and in the channel (see example from the Gun-

nison River, below). Low flows between floods dry out the banks, helping to kill plants that would otherwise narrow the channel.

Dams regulate river flow to generate electricity, store water, and reduce flooding. Dam managers adjust the flow to best meet those goals. As a result, streamflows are often more stable than they would be naturally. When base and peak flows are kept too constant from day-to-day or year-to-year, plants can grow in the channel, trapping sediment. As a result, the river can narrow and side channels can fill with sediment. This reduces habitat variety and biodiversity and can impact recreational uses.

Experimental flow releases can create controlled flooding and improve river health. Controlled high flows can reconnect rivers to their floodplains, create and refresh spawning bars important to fish, clear sandbars of vegetation that had prevented camping, and recharge local groundwater.



Monitoring site on the Gunnison River, Black Canyon of the Gunnison National Park, before, during, and after a flood of 12,800 cubic feet per second in 2017. Note the small tree on the river-right bank prior to flooding (left), in the channel during flooding (middle), and completely washed away after the flood (right). Also note the herbaceous and shrubby vegetation visible on the bank (left), inundated (middle), and absent (right).



Satellite imagery of the Green River from 1976 (left) and 2011 (right) shows narrowing and simplification of the channel over time, as well as vegetation encroachment. Note that the side channel seen in 1976 was completely filled in by 2011.

Proposed Flows Raise Questions

In 2017, the managers of Flaming Gorge Dam were asked to carry out experimental flow releases to promote survival of native fish—and discourage survival of invasive fish—on the Green River. The proposal called for elevated summer base flows, intended to promote larval growth of the endangered Colorado pikeminnow. Midsummer spike flows would discourage spawning of invasive smallmouth bass. The Upper Colorado River Endangered Fish Recovery Program requested the experimental flows.

Though supportive of native fish conservation, scientists from the National Park Service (NPS) and U.S. Geological Survey (USGS) saw the potential for unintended consequences to the river's ecosystem. They wondered if the proposed flow experiments might help native fish to survive their early life stages, but degrade the habitat they need for adulthood.

Why? The proposed changes would decrease variation in flows within and between years—which could promote sediment deposition and unwanted vegetation growth along the river banks and channel. This, in turn, could cause narrowing of the channel, side channels, and backwater habitats used by young Colorado pikeminnow (see example above).

For example, in a dry year, increasing summer base flows (July–September) relieves summer drought stress. This may allow riparian vegetation, including invasive tamarisk, to

establish on inundated surfaces that would otherwise be too dry to support them. Repeating these flows in the following year would help the plants to live into the next year, increasing their size and likelihood of long-term survival. This vegetation would increase drag on the water, slowing down the river and leading to even more sediment deposition. As a result, the proposed flow modifications could benefit endangered pikeminnow in the short term while degrading their habitat in the long term.

Monitoring Offers Solutions

Based on knowledge gained through long-term monitoring of the Green and Yampa rivers in Dinosaur National Monument (and a literature review; see report below), the NPS/USGS team recommended tweaks that may allow the program to better meet its goals. In short, managers could vary the timing and discharge of experimental flows in response to changing conditions. Long-term annual monitoring, like that done by the [Northern Colorado Plateau Network](#), plays a key role in this adaptive management strategy. It can help managers to know how the river channel and vegetation change after different natural or dam-released flows. It will also help them recommend future flows and experiments.

For example, if monitoring reveals that vegetation encroachment is occurring and snowpack is high in a given year, then dam managers could prescribe a spring peak of the maximum feasible magnitude and duration to remove the vegetation. Managers could also help simulate scouring flood conditions in some years by timing peak flows from Flaming Gorge Dam to coincide with peak flows on the Yampa River. In drier years, base flows could be reduced below proposed levels to help desiccate and kill young riparian vegetation.

Managers could also help prevent establishment of unwanted vegetation by following midsummer spike flows with rapid, rather than gradual, declines in flow, and by eliminating spike flows in some years. Subsequent monitoring could be used to assess effectiveness of these strategies and refine the experiments.

River Jargon

Base flow: Flows that occur after the spring runoff has occurred

Spike flow: A brief increase in flows during the summer months, designed to simulate or enhance flows that are a result of summer monsoons.

Side channel: A channel that branches off and then returns to the main channel, resulting in islands

Backwater: An area of water open to the channel at one end

For more information, see [Friedman, J. F. 2018. Potential effects of elevated base flow and midsummer spike flow experiments on riparian vegetation along the Green River. Natural Resource Report NPS/NRSS/WRD/NRR—2018/1603. National Park Service, Fort Collins, Colorado.](#)