



Fossil Creek Restoration: an Ecological Experiment

A publication of the Stream Ecology and Restoration Group
at Northern Arizona University

Exotic species, pollution, and human appropriation of fresh water have degraded streams and lakes around the world and contribute to the widespread losses of native species. Can ecosystem restoration projects help reverse these alarming trends? In Fossil Creek, Arizona, scientists and natural resource managers are working together to find out.

Nearly a century ago, Arizona Public Service (APS) built a hydropower dam on Fossil Creek. Reduced flow caused by the dam and invasion by exotic fish have caused native fish populations to decline. APS, natural resource managers, and scientists hope their ambitious restoration plan can fix this damaged ecosystem.

The Restoration Plan has two parts. First, the reach of the creek immediately below the dam will be purged of exotic fish. Second, water will no longer be diverted for hydropower production, but instead will be allowed to flow in the natural stream channel. Return of full flows by decommissioning the dam is scheduled for December 31, 2004, though it's not yet decided whether the dam will be removed completely or only partially. Safety, liability, and aesthetic concerns argue for completely removing the dam, but there are ecological reasons to leave a portion of it in place. First, the dam is an effective barrier to exotic species migrating further up stream. Second, the dam prevents sediments from being unleashed into the stream. Third, the pool created by the dam has an extensive riparian zone that supports the largest known breeding population of lowland leopard frogs in the Coconino National Forest.

To eradicate exotic fish, managers will treat the river with a chemical that kills fish called Antimycin A. Prior to chemical treatment, native fish will be removed and kept in holding tanks, to be released back into the stream once the exotics have been eradicated. The plan also includes constructing a barrier at the downstream end of the chemical treatment to prevent reinvasion of exotic fish from the Verde River.

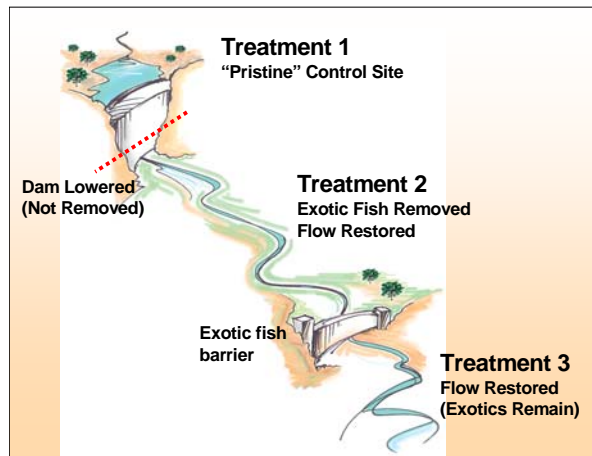


Figure 1. The Fossil Creek Restoration Project viewed as an ecological experiment with three treatments: 1) 'Control', above the dam in pristine state, with no exotic species and with a natural flow regime, 2) 'Complete Restoration', where exotics are removed and flow is restored; and 3) 'Partial restoration', below the barrier, where flow will be restored but exotic species will still be present.

Working Together for Restoration

Restoring the Fossil Creek ecosystem will benefit freshwater resources in Arizona, enhancing visitors' aesthetic and recreational experiences and providing a native fishery in a region where native fish are increasingly rare. Equally important, the collaboration between managers and scientists in the design, execution, and monitoring of this ambitious restoration project can serve as a model for stream restoration.

Of the hundreds of dam removal projects that have already occurred around the country, very few monitored the recovery of the ecosystem. Fewer still had enough baseline information to be able to articulate clear goals for ecosystem recovery. Did restoration really restore the ecosystem? Why, or why not? Unlike most dam removal projects around the country, it **will** be possible to answer these questions in Fossil Creek.

As an experiment, Fossil Creek has three treatments (Figure 1). The reach above the reservoir is mostly pristine, having experienced neither flow reduction nor invasion by exotics. This reach (Treatment 1) provides baseline conditions and a target for restoration.

The reaches below the dam have been altered by a century of flow reduction and invasion by exotic species. Will restoring flow promote the unique chemistry and morphology of these reaches, increasing habitat availability for aquatic and riparian species? Will the chemical treatment release natives from exotic competitors and predators? The synergy between scientists and natural resource managers in Fossil Creek provides a unique opportunity to address these key questions.

Fossil Creek, a model system. Fossil Creek offers a unique opportunity to document ecosystem

responses to restoration because researchers and managers are working together to collect sufficient baseline data prior to restoration and to develop a plan to evaluate ecosystem recovery. Treating the restoration project as an ecological experiment makes Fossil Creek a model system for restoration programs around the world.

For further details, please consult the Draft Environmental Assessment:

www.fs.fed.us/r3/coconino/nepa.index.shtml

Supported by the National Science Foundation, the US Forest Service, the Arizona Heritage Fund, the Ecological Restoration Institute and the Merriam-Powell Center for Environmental Research