

Arizona: Burning Hot

Building Climate Resilience for Fish and Communities through Land and Water Conservation Projects

Jewels of the Desert

Arizona boasts an array of native species of fish that call the rugged landscape home. Disturbances such as landslides, wildfires, and floods are a historical part of the western landscapes inhabited by these desert fish but previously these disturbances have been less frequent or severe, allowing for the systems to recover between events or even improve conditions as new habitat was created.

Over millions of years, fish like the beautifully spotted Apache Trout, or the golden-hued Little Colorado Spinidace, have thrived amid the boom-and-bust drought cycle of streams and rivers within the ponderosa pine and pinyon-juniper forests, and grassy meadows. But now these and other fish are threatened with extinction as communities use more and more water, introduced species out-compete them, and access to important habitat is blocked or fragmented.

Designated as Arizona's State Fish, the Apache Trout was historically found only high in the headwaters of a few rivers. Once nearing extinction, Apache Trout has been restored to a significant portion of its former range in the White Mountains after decades of cooperative protection and recovery efforts.

Smoldering Issues

With climate change, increased warming is resulting



Beyond the effects to fish, wildfires also impair drinking water supplies for people in the Southwest. Large post-fire sediment fluxes impact drinking water systems two ways.

First and perhaps foremost is the danger that reservoirs, roads, and treatment works will be filled, damaged, or otherwise disrupted by sediment. Second, loads can kill fish and require expensive water treatment processing. These impacts are highest in areas immediately adjacent to and downstream from fires.

in earlier snowmelt, forest drying, and larger and more frequent wildfires. Higher temperatures can make the water too warm for Apache trout, or dry up creeks. Warm water can kill fish during fires or afterwards as streamside trees that once kept waters cool are burned. Fires also make hillsides more susceptible to landslides during severe summer rains, resulting in major flows of ash, mud, and sediment that clog streams and block channels, fill in spawning areas, and choke fish. As disturbances become larger and more frequent, and occupied habitats become smaller and more fragmented, fish populations decline and blink out.



Zach Beard

Restoring headwater stream and meadow habitats are key to the recovery of the Apache Trout. These grass-covered wetlands are critical to storing and cleaning water from melting snow and thunderstorms. Healthy meadows maintain a higher water table, ensuring a reliable flow downstream through healthy headwater streams and provide shade, critical habitat, and food sources for fish. Work crews using shovels plant willows and build beaver dam-like structures that halt erosion, restore healthy meadows, and elevate the water table. Engineers using heavy machinery design and construct complex stream channels and reshape floodplains and riparian areas.

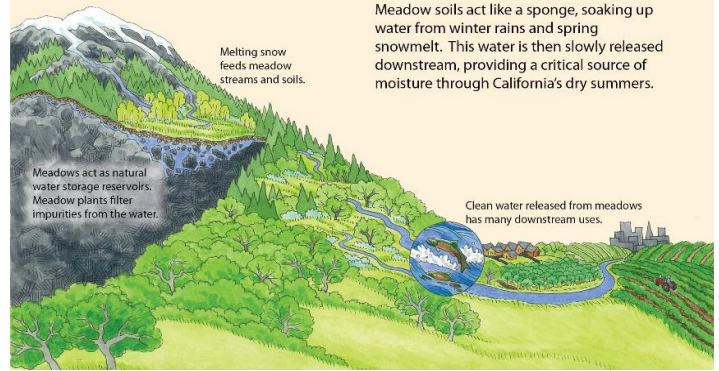
This work improves stream habitat and healthy meadows, conserves and improves stream flows, and rebuilds multiple populations of these fish across Arizona's forests. If a future wildfire burns in one watershed, and that individual population does not survive the ash and mudflows that often follow fire, other healthy populations in neighboring intact meadows and streams can recolonize the burned area as the water quality returns.

After years of suppressing fire to protect houses and cities, our national forests are burning up at an unprecedented rate. The Apache-Sitgreaves National Forest in Arizona has seen the two largest fires in the state's history in the past decade, burning over 1 million acres, and costing hundreds of millions of dollars to suppress and contain. Wildfires increase susceptibility of watersheds to both flooding and erosion, and thus can impair drinking water supplies and fish.

Water in the Desert

About half of the water supply in the southwestern United States is supplied by water from forests, which generally yield higher quality water than any other resource. Conservation and restoration of headwaters can protect downstream drinking water supplies. Wet meadow habitats, such as in the Coconino and Apache-Sitgreaves National Forests, are critical to storing water from melting snow and thunderstorms, and then slowly releasing cold, clean water to protect against droughts. Because of the cooperation among Forest Service scientists and staff, livestock ranchers, and many partners, key meadows that conserve water and provide habitat for the Little Colorado Spinedace have been restored. This small, orange-finned fish is now thriving and will be a strong candidate to be removed from the federal Endangered Species Act.

Meadows Store and Filter Water



Headwaters Fact: Restoring headwaters through meadow restoration is a key approach to bolstering these desert landscapes' ability to withstand a warming climate and needs to be replicated across much larger geographies.

By the Numbers—Desert Watersheds

- More than **12 million acres** of land, including important water-supply watersheds, have burned in the southwestern U.S. in the past 30 years.
- **Two-thirds** of Arizona's fish species are endangered or threatened.

LAND AND WATER CONSERVATION SOLUTIONS



Reforestation, wetland restoration, and soil conservation can store massive amounts of carbon while restoring biodiversity, cleaning water and air, and rebalancing ecological systems. Healthy forests shade streams and provide steady clean water. Recent work suggests that reforestation of 2.5 billion acres of land to sequester carbon could mitigate 25 percent of global emissions. Planting trees is a cost-effective way to draw carbon out of the air, restore our public lands, create jobs, provide critical wildlife habitats, and improve downstream drinking water quality.



Reduce wildfire fuels and expand prescribed burning, with the goal of decreasing the threat of unnaturally large wildfires by restoring more natural vegetation types and spacing, and managing for lower-risk, lower-intensity managed fires.



Expand watershed stewardship work to restore healthy streams and meadows to conserve water supplies and the many rare fish who rely on this habitat, such as by planting trees to shade streams, designing complex stream channels, and adding beaver dam-like structures.