

FACT SHEET // MAY 2025

Techniques for increasing watershed resilience to wildland fire

Fire is an ecosystem process managed in the contemporary western U.S. at great expense, but with mixed results yet it is one that can be re-worked to positive effect by melding ancient burning practices with contemporary scientific findings.

The "natural infrastructure" elements of stone and wood are components of ecosystem processes whose contemporary application, when guided by ancient practices and recent research, can mitigate some of the negative effects of contemporary fire regimes.

The following fact sheet is a summary of our 2025 working paper which considers how scientific research and creative on-the-ground applications that merge ancient and contemporary approaches and techniques can improve both pre-event resilience, and post-event recovery outcomes.

WHAT IS NATURAL INFRASTRUCTURE?

- Built from locally available rock and wood, often materials repurposed from fuels reduction projects.
- Built with a low profile with each piece fit tightly to reduce gaps, allowing water to rest and pass through slowly.
- Built to complement or participate with the existing form and function in place and mimic channel morphology.

BENEFITS OF NATURAL INFRASTRUCTURE

- Reduces fire effects
- Increases soil hydraulic properties
- Increases complexity and resilience for social, ecological adn economic benefits

EXAMPLES OF NATURAL INFRASTRUCTURE

- *Baffles and post vanes* arranged on alternating sides of a channel to induce meanders, slow water, and prevent erosion.
- One-rock structures man-made riffles placed in the channel to prevent down-cutting and increase moisture.
- *Head-cut bowls* armored faces of leading head-cuts that slow spill-over erosion and the uphill "unzipping" of slopes and meadows.
- Log mattress a protective cover to slow erosion and stabilize channel banks.
- *Beaver pond/beaver dam analog* slows water and creates a wetland habitat.



Above: Wyoming watershed work supports wildlife and livestock. Photo by Wyoming Game and Fish Department. Below: Zuni bowl arresting erosion. Photo by Watershed Artisans.



Case study highlight

In one watershed restoration experiment measuring two parallel arroyos—one treated with natural structures and the other left untreated as a control—researchers discovered that rock structures increased subsurface flows, reduced peak flow velocities during storms that cause erosion, and did not reduce downstream water availability, a common concern of land managers. In fact, the reality was just the opposite—flow volumes were higher overall in the treated watershed, and water was available over a longer reach of the channel and more predictable over time, increasing the potential for faster post-fire system recovery (Gooden and Pritzlaff 2021; Norman et al. 2016).

Considerations for future work

Much more needs to be accomplished, and at a faster pace. To be most effective and responsive in the face of current threats, restorative work needs to be valued as a common, fundamental way of "doing business" within existing economies results in a demonstrable bang-for-the-buck. It's not too much to ask, and today, the data and the vital reasons for restoration and pre-restoration are right at hand.

In many cases, their successful proposals for work include:

- training components for local groups and youth;
- complex, heterogeneous and nimble networks of organizations and abilities;
- inclusion of marginalized groups, solid scientific research, and monitoring; and
- involving local landowners and managers.

Link library: Resources provided throughout full synthesis

Туре	Content	Link
Case study	GIS StoryMap: Post-fire flooding: The Museum Fire	https://storymaps.arcgis.com/stories/44d0611ff9064628 90798b87b69c017e
Case study	Resources: Coconino County Flood Control District	<u>https://www.coconino.az.gov/2926/SchultzPipeline-</u> <u>Flood-Area</u>
Case study	Video: Zeedyk structure timelapse	https://www.youtube.com/watch?v=cfobSpapImA
Case study	Fact sheet: Post-fire watershed restoration and monitoring in the Chiricahua Mountains of Arizona	<u>https://www.swfireconsortium.org/wp-</u> <u>content/uploads/2024/09/Post-Fire-Watershed-</u> <u>Restoration-and-Monitoring-in-the-Chiricahua-</u> <u>Mountains-of-Arizona.pdf</u>
Case study	Website: Stories in New Mexico on Rio Grande watershed restoration	<u>https://www.nature.org/en-us/about-us/where-we-work/united-states/new-mexico/stories-in-new-mexico/restoration-projects-rio-grande-watershed/</u>
Case study	Video: The Restoration of Santa Clara Canyon	<u>https://www.swfireconsortium.org/2024/09/17/santa-</u> <u>clara/</u>
Case study	Documentary movie: The beaver believers	https://www.thebeaverbelievers.com

Research	Webinar: Pre- and post-Fire impacts of beaver dams and beaver dam analogs	https://www.swfireconsortium.org/2025/02/21/pre- and-post-fire-impacts-of-leave-dams-and-leave-dam- analogs/
Research	Video: Can rock dams reverse climate change, Re- greening a dryland watershed	https://www.youtube.com/watch?v=c2tYI7jUdU0
Research	Video: Beavers and wildfire: A stop-motion story by Emily Fairfax	https://www.youtube.com/watch?v=IAM94B73bzE
Research	Website: Aridland water harvesting study	https://www.usgs.gov/centers/western-geographic- science-center/science/aridland-water-harvesting-study
Guides & training resources	Book: Low-tech process based restoration of riverscapes design manual	https://lowtechpbr.restoration.usu.edu/manual
Guides & training resources	Video: An afternoon with Van Clothier, Grassland restoration methods	https://www.youtube.com/watch? v=NCu6xia9zKg&t=453s
Guides & training resources	Video: Why do rivers curve?	https://www.youtube.com/watch?v=8a3r-cG8Wic&t=3s
Guides & training resources	Video: Nature based structures for watershed restoration	https://www.youtube.com/watch? v=VUDlitH2uhl&t=76s
Guides & training resources	Video: Aridland water harvesting study animation	https://www.youtube.com/watch?v=gE2xqilei9g
Guides & training resources	Video: Wildfire recovery using engineering with nature principles	https://ewn.erdc.dren.mil/presentations/wildfire- recovery-using-engineering-with-nature-principles/

SCIENCE SYNTHESIS // Techniques for increasing watershed resilience to wildland fire



WHAT YOU WILL FIND:

- Case studies & examples of watershed
 restoration
- Fund proposal resources: research and examples of the many benefits
- Clearinghouse to guides, videos, and other useful resources

The **Southwest Fire Science Consortium** (SWFSC) is a regional organization that facilitates knowledge exchange and disseminates wildland fire research and information across agency, administrative, and state boundaries in the Southwest. Funding provided by the Joint Fire Science Program (JFSP). The SWFSC is one of 15 Fire Science Exchange Networks funded by JFSP.

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NAL NORTHERN ARIZONA

School of Forestry



