ARIZONA WATER CONSERVATION FACTSHEET

# Riparian & Stream Water Conservation Strategies

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THE UNIVERSITY OF ARIZONA COOPERATIVE EXTENSION
WATER RESOURCES RESEARCH CENTER
wrrc.arizona.edu/conserve

## Background

This fact sheet provides strategies and best practices for landowners and residents to sustain and restore riparian and stream health on their land and in their communities.

In the arid Southwest, **riparian*** areas serve as lifelines. Although they may occupy a small fraction of the landscape, these "ribbons of life" support most of the region's biodiversity.[1] However, they are increasingly stressed by drought, changes in climate, and growing water demands. Managing watersheds and **aquifers** as integrated systems takes advantage of natural processes to ensure that water sources remain resilient for the future. Approximately 94% of the streams in Arizona are **intermittent** or **ephemeral** but only a few **perennial streams** remain.[2] However, intermittent and ephemeral streams perform many of the same hydrologic functions as perennial streams: moving water, sediment, nutrients, and debris through the stream network and providing connectivity within the watershed.[3]

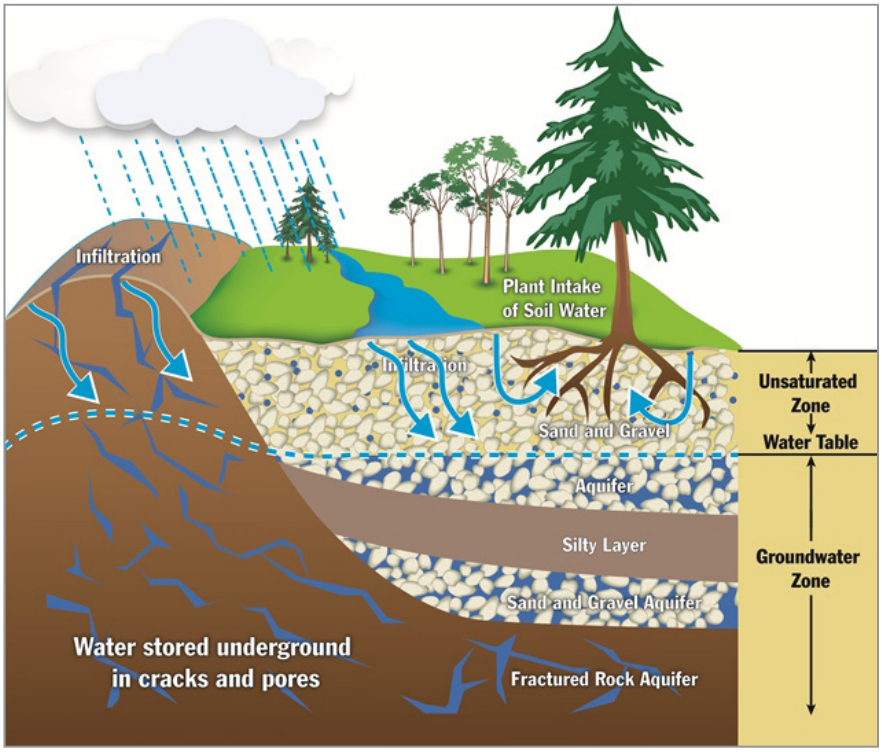


**Figure 1:** Diagram of interplay between surface and ground water. Source: https://www.gov.nl.ca/eccc/waterres/groundwater/.

When water from rain or snow soaks into the ground, it becomes **groundwater**. If the water table is high enough, groundwater can flow into surface-level rivers and streams, either on a permanent or seasonal basis. One of the common metrics for measuring the health of a stream is **baseflow**, which is the contribution of groundwater to a stream. The groundwater contribution to streamflow is particularly important during the dry and summer months because there is less rain and snowmelt. In periods of low rainfall or excessive ground water pumping, the water table can fall and cease to contribute to streamflow. This can happen even if the pumping occurs far away from the stream. This can result in streams that no longer have running surface water, but conservation strategies that slow runoff and encourage infiltration can raise water tables and increase streamflow.[4] Figure 1 shows how stream water seepage contributes to groundwater below the water table.

## Risks for Riparian Areas

Estimates suggest that groundwater levels are falling in more than half of Arizona's 51 groundwater basins due to groundwater pumping that exceeds recharge.[5] A hotter, drier climate along with increased groundwater pumping have meant that more water is taken out of aquifers than can be replaced through natural processes. The impacts on the health of rivers, streams, and riparian areas are clear. As instream flows decrease, the negative impacts on riparian areas increase.[5] Nationally, a large percentage of riparian zones are considered "in degraded and non-functional conditions that require restoration," making them among the most drastically altered ecosystems in the nation.[6]

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**Highlighted words are defined in the online resources section for this factsheet.*

# Where are Riparian and Stream Areas in Arizona?

Some of the best-known riparian areas in Arizona are the Verde River, the San Pedro Riparian National Conservation Area, Agua Fria National Monument, and Fossil Creek. In the past, riparian habitats represented about 1% of the landscape in the West. Current estimates suggest that up to 95% of this habitat has been altered or destroyed due to such practices as river channelization, livestock grazing, agricultural land clearing, water impoundments, excessive groundwater pumping near streams, and urbanization.[7] Although riparian habitat and perennial streams only represent a small percentage of habitats, at least 274,139 miles of ephemeral and intermittent streams occur in every corner of the state.[11] Figure 2 shows the 9,236 stream miles in the ADEQ's Surface Water Protection Program (SWPP), representing 3 percent of the total.[9] Stream flow regimes in SWPP are 32% perennial, 18% intermittent, and 2% ephemeral, with the rest undetermined. Additionally, 21% of SWPP streams are considered critical habitat areas for 12 riparian and aquatic endangered species (see References for species list).[12,13]

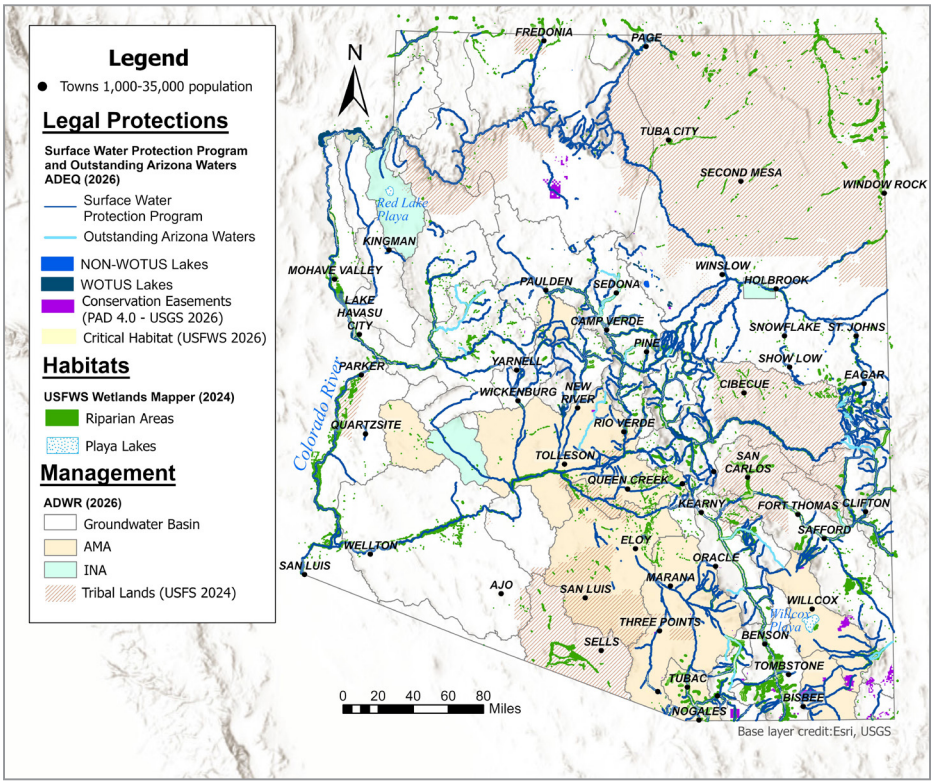


**Figure 2:** Arizona map of riparian vegetation,[8] Surface Water Protection Program[9] streams and Outstanding Arizona Waters, land and groundwater management,[10] and legal protections.

# Why Riparian and Stream Conservation Matters

## Enhanced Wildfire Recovery

Wildfires have impacts that persist long after the fire is suppressed. Rainfall runoff over catastrophic fire-damaged landscapes carries debris and sediments into streams, and contaminants can make their way into groundwater. Healthy riparian areas have been shown to mitigate wildfire severity and aid water quality recovery in post fire periods,[14] and benefits can last five to eight years *following* a fire.[15] Data suggests that areas with higher forest coverage and instream flows are associated with quicker ecosystem recovery times. Conversely, poorly maintained riparian areas, characterized by higher water temperature, increased sediment flows in flooding, and high algae levels, show less resilience following severe fires.[16]

## Flood Control

Restoration in riparian and upland areas can help develop natural buffers for absorbing and redirecting rising waters and provide space for seasonal flooding. There are two kinds of buffers: riparian forest buffers and upland forest buffers. Buffers are combinations of plants and landforms intended to mitigate the impact of land use on the stream.[18] By slowing the velocity of floodwater, healthy riparian zones reduce downstream erosion and protect infrastructure from flood activity.[19]

## Improved Water Quality

Riparian vegetation and soil act as a natural filtration system, trapping sediment and absorbing excess nutrients or pollutants before they reach the stream, which can ensure cleaner water for downstream users.[17]

## Recreational Opportunities

Riparian zones offer prime locations for birdwatching, hiking, and fishing. Riparian areas are associated with increased vegetative cover and cooler temperatures. Their cooler microclimates and unique aesthetic make them highly valued spaces for eco-tourism and community well-being.[20]

## Biodiversity

Though they occupy a small fraction of Arizona's land, riparian areas support the majority of its wildlife. They serve as essential migratory "highways" and provide habitat, food, and water for hundreds of species.[21] More than 360 species in the region are dependent on river habitats and are imperiled due to summer flow depletions.[22]

# Strategies to Support Riparian and Stream Ecosystems

## Instream Conservation Flow Rights

In the context of statewide water resources, instream flow rights (IFR) are among the most powerful tools for systemic conservation. Traditionally, western water law follows the principle of "use it or lose it." If an individual holds a water right but does not put the water to a legally recognized beneficial use, they can risk forfeiting that right. Historically, "using" water usually meant diversion from a river or stream for purposes such as agriculture, mining, or municipal supply. Leaving water in the stream generally did not count as a beneficial use.

However, wildlife and recreation were legally recognized in 1941 and 1962, respectively, as beneficial uses that did not require a diversion,[23] paving the way for granting instream flow rights. An instream flow right is "a legal entitlement to use surface water within a specified area of stream channel for fish, wildlife, or recreational uses."[24] These rights can protect entire river systems because they create a legally enforceable claim to water remaining in the stream. In 2021, another mechanism for protecting stream flow allowed surface water rights holders to file formal notice of water conservation with the Arizona Department of Water Resources (ADWR) through a Water Conservation Plan. Conservation plans allow rights holders to adopt environmentally friendly management practices without concern that they will lose any part of their right if they use less than their allotment, as they provide legal protection against forfeiture for up to 10 years after filing.[25] An updated list of current Water Conservation Plan Notices can be found on the ADWR website **https://www.azwater.gov/surface-water/conservation-irrigation-notices.**

All surface water rights pertaining to the Gila River and Little Colorado River, or their tributaries, are subject to ongoing general stream adjudications, where a court process defines the scope and priority of all surface water rights. Under certain circumstances, wells near a stream may also be subject to the adjudications process. The adjudications encompass tens of thousands of water rights claims, including instream flow rights and federal claims for environmental flows. These unresolved claims increase water supply uncertainty. See ADWR Resources link for more information..

## Donating Water Rights for Conservation

Water rights holders can also donate their rights for conservation purposes. This donation can be temporary or permanent and occur with or without financial compensation. These donations are frequently realized through conservation easements. Lease agreements also may be developed for temporary reservation of rights for conservation. See Figure 2 for conservation easement locations and Resources for a table on selected state and federal policies that are relevant to riparian and stream conservation.

## Collaborative Watershed Partnerships

In the last 30 years, many collaborative watershed partnerships, composed of members from both the public and private sectors, have worked to solve complex issues addressing water resource availability at the watershed scale. Partnerships like the Upper San Pedro Partnership were created to increase base-flow in the river, whereas other partnerships, like the Aravaipa Watershed Conservation Alliance, have focused on restoration that protects water and riparian habitat for wildlife, native fish, sustainable agriculture, and recreation.[26] See Resources for information on collaborative partnerships.

# Natural Restoration Strategies

There are both large- and small-scale restoration projects that can contribute to the health of riparian areas and increase water availability to streams. The following strategies can be applied at the watershed scale to produce benefits over large areas, or to small-scale projects producing similar benefits.

## Induced Meandering

The process of induced meandering is meant to capture a stream's natural inclination to "meander," which assists in the development of the floodplain next to a stream. Flood plains have multiple benefits, namely reducing flood peaks and erosion and enhancing habitats along the streams. Induced meandering can expedite floodplain development with structures, vegetation, and the application of running water. Structures used in meandering restoration, such as vanes, baffles, post vanes, and pickets can be used to redirect, absorb, and trap the stream's water and energy, encouraging a more beneficial path.[27]

## Low Tech Process-Based Restoration (LTPBR)

LTPBR projects are designed to mimic natural processes. Unlike conventional "form-based" restoration, which often uses heavy machinery or concrete to shape a stream, LTPBR focuses on adding roughness to a system so the water can infiltrate into the ground. Examples of roughness features are rock dams, gabions, and land contouring. LTPBR requires minimal training and can be "installed" by a small group of volunteers. As such, LTPBR provides options for landowners who are interested in supporting riparian areas on their land without much cost.[28] See Resources below for further information on LTPBR methods.

## Removal of Invasive Plant Species

**Invasive species** tend to displace native plants and animals in an ecosystem, with undesirable consequences.[29] Common invasive species in the southwest include stinknet, salt cedar or tamarisk, buffelgrass, fountain grass, giant reed, Malta starthistle, Scotch thistle, red brome, yellow blue stem, and quagga mussels.[30,31] For example, giant reed, *Arundo donax*, a non-native grass originally introduced for erosion control and aesthetics, out competes native plants and consumes 4 times more water, clogs streambeds, and increases flooding and wildfire risk. Removing invasive species is a meaningful strategy for protecting riparian habitats and can serve as a community building activity.[32]

## Beaver Restoration

Beavers are powerful allies in restoring stream beds to slow stream flow. Beaver activity has been associated with stable or rising groundwater tables and improved soil quality for native plants.[33] Compared to conventional engineering projects that may cost up to $500,000 per acre, beaver restoration is inexpensive.[34] It capitalizes on the instinctual behaviors of beavers to maintain infrastructure, using local natural materials, making their reintroduction a highly efficient solution for rural and remote Arizona watersheds. While individual landowners may not be able to recruit beavers, some community-based initiatives for beaver reintroduction and restoration have achieved significant benefits.

# Getting Started

If you are interested in conserving water for riparian and stream ecosystems on your property or your favorite location, there are many resources available to help. Look for a collaborative watershed partnership in your area and check out the resources provided with this factsheet. **Please use the QR code below or visit wrrc.arizona.edu/conserve to find definitions, resources, and references (corresponding to numbers in the text) used for the creation of this factsheet.**

**Additional Definitions, Resources, and References**

wrrc.arizona.edu/conserve

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