



Streams Monitoring at Tumacácori National Historical Park

Importance

Riparian habitats constitute less than 2% of the land area in the American Southwest, but support the highest density and abundance of plants and animals of any habitat type, making streams and associated riparian areas critical to the ecological integrity of the region. Riparian areas supply food, cover, and water, and serve as migration routes and habitat connectors, for a variety of wildlife. They also help control water pollution, reduce erosion, mitigate floods, and increase groundwater recharge. Riparian systems perform numerous ecosystem functions important to human populations, yet are one of the most endangered forest types in the United States.

Monitoring Objectives

The overall goal of the Sonoran Desert Network (SODN) streams monitoring program is to detect broad-scale changes in aquatic and riparian ecological condition by observing selected ecological drivers, stressors, and processes. Specific, measurable objectives for streams monitoring at Tumacácori National Historical Park (NHP) are to determine the status of and detect long-term trends in:

- **Water quality** for daily, seasonal, and annual core water quality parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity), and seasonal nutrients, metals, inorganics, and bacteria.
- **Aquatic macroinvertebrates** for abundance of selected taxa and community structure and selected multimetric indicators of biotic integrity.
- **Surface water quantity** for seasonal and annual base flow conditions; frequency, magnitude, and duration of low-flow and flood events; and extent of wet and dry areas.
- **Channel morphology** for cross-sectional area, sinuosity, channel slope, and sediment size distribution.
- **Riparian vegetation cover** for dominant and common (>10%) of perennial species.
- **Fish** for communities on local and regional scales.

Status of the Effort

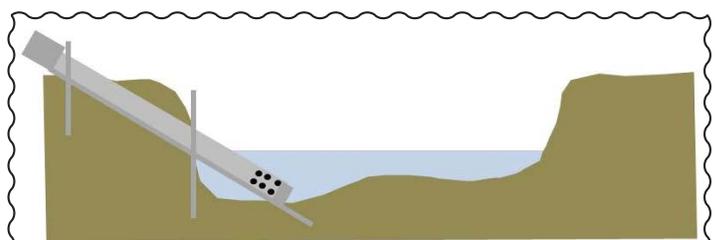
During 2012, SODN completed routine monitoring of water quality and water quantity during quarterly site visits to the park. These efforts were aided by use of a logging multiparameter water quality probe, which was deployed for two weeks in each of three quarters (high monsoon flows prevented summer deployment). Ten channel cross-sections, as well as channel slope, were surveyed in January. Aquatic macroinvertebrates were sampled in May and sent for analysis at the University



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Santa Cruz River, Tumacácori NHP.

of Utah's BugLab. Through a collaboration with the U.S. Environmental Protection Agency, SODN also collected and analyzed water samples for contaminants of emerging concern—those that have not traditionally been tested for during water quality sampling and may not be adequately cleansed by current wastewater treatment methods, such as pesticides, personal care products, and pharmaceuticals. Finally, in cooperation with park staff, the Arizona Game and Fish Department, and the Friends of the Santa Cruz River, SODN conducted fish sampling on the Santa Cruz River, including a sample site in the park at Santa Gertrudis Lane.



Probing the Depths of Water Quality

Over the past year, the SODN staff has been installing mounts for water quality monitoring equipment in all network parks where streams are monitored. The mounts provide “quasi-permanent” (so-called in recognition that flow events have the potential to render the mounts impermanent!) housing for stream probes that should prove stable and secure under most flow regimes.

This instrumentation will enable SODN staff to detect trends in important water quality parameters, such as temperature, pH, and dissolved oxygen, by examining variation across days, months, seasons, and years. The network's long-term goal is to install telemetry systems at these sites, enabling real-time streaming of water quality data.

Management Concerns

Trespass livestock

Trespass cattle and other livestock frequently gain access to the park when the boundary fence is damaged or purposefully cut. With the potential to deposit fecal material in or near the river, trample riparian vegetation, and erode the stream bank, trespass livestock represent a variety of threats to park resources, and dealing with them is a challenge for park managers.

Lead

At 0.042 mg/L, total lead exceeded the Arizona standard for partial body contact (0.015 mg/L) during springtime sampling. Further sampling will help determine whether this was a singular occurrence or part of a trend. Staff and visitors should exercise caution if wading in the stream.

Flow

The Santa Cruz River flows through the park on its way north after curving south into Mexico not far from its headwaters in the U.S. (see map). Sometimes known as “the lessening stream,” as its flow has historically varied widely with changes in natural conditions and human use, the Santa Cruz at Tumacácori NHP has been bolstered in recent years by a steady flow of effluent (~13 million gallons/day [mgd]) from the Nogales International Wastewater Treatment Plant (NIWTP), located 10 miles upstream of the park. The flow at Tumacácori

NHP is perennial, but directly dependent on the amount of effluent supporting the stream.

Without the effluent flow, the Santa Cruz River through Tumacácori NHP would likely be an intermittent or ephemeral stream system, primarily responding to rain events in the watershed. Any reduction in effluent flow could result in both local and widespread impacts, including reduced aquatic habitat, loss of aquatic and riparian species, changes in channel morphology, and impacts to water quality and fish communities.



The Santa Cruz is the only river to originate within the U.S., flow out of the country, and then re-enter it.

Such a reduction is, in fact, likely, due to the impending diversion of approximately 5 mgd of wastewater from the NIWTP to a new treatment plant recently built in Mexico. Continued monitoring and analysis of park resources will be necessary for park managers to make informed decisions about management, planning, and mitigation.

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These aerial photos show the effects of the introduction of effluent flow on the riparian corridor of the Santa Cruz River. Barely visible from the air in 1967 (left), the river in 1993 (right) is banked on both sides by a ribbon of trees and other vegetation that has reclaimed some of Tumacácori National Historical Park's former agricultural fields.