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Climate and Water Monitoring at Tumacácori National Historical Park, 2017

Tumacácori National Historical Park (/tuma/)

Overview and Importance

Many National Park Service units in the U.S. Southwest were established to protect precious cultural resources. In most cases, however, the surrounding natural environment is an equally significant part of the story.

When Padre Eusebio Kino and his fellow missionaries visited the Tucson Basin in 1694, the Santa Cruz River valley was controlled by the Sobaipuri, an O'odham group. Their villages were situated along streams, near concentrations of plants and animals, including freshwater fish. Father Kino also founded his mission near the banks of the Santa Cruz. River water allowed the mission to grow grapes, grain, vegetables, medicinal plants, and maintain livestock.

Tumacácori National Historical Park preserves Kino's mission sites and a segment of the Santa Cruz River. Since 1951, the river has received a steady flow of treated effluent from the Nogales International Wastewater



The Santa Cruz River at Tumacácori National Historical Park supports a rare cottonwood-willow southwestern riparian environment.

Treatment Plant (NIWTP), 10 miles upstream of the park. As a result, the park segment now supports a rare southwest cottonwood–willow riparian environment, one of the most endangered ecosystems in the U.S. Recent changes to effluent inputs have **reduced the river's flow**, (<https://www.nps.gov/articles/vanishingsantacruzr.htm>) however.

Streamflow is just one of the parameters the **Sonoran Desert Network** (<https://science.nature.nps.gov/im/units/sodn/>) is monitoring at Tumacácori and three other National Park Service units. The goal of the program is to detect broad-scale changes in stream health by observing certain measures over time—and to give park managers early warning of any issues they may need to address. The network measures water quality, water quantity (streamflow), channel morphology (the shape and composition of the streambed), riparian vegetation, and macroinvertebrate communities.

Stream conditions ([/im/sodn/streams.htm](https://science.nature.nps.gov/im/units/sodn/streams.htm)) are closely related to climate conditions. Because the two are better understood together, the network reports on climate in conjunction with water resources. Reporting is done by water year (WY), which begins in October and ends the following September.



Climate monitoring station at Tumacácori National Historical Park.

Recent Findings

Climate

In WY2017, overall annual precipitation was 68% of normal for Tumacácori National Historical Park (11.26" vs 16.56"). Precipitation in December and January was greater than normal. October, November, February, and March were extremely dry. The monsoon was strong for three weeks in July, but tapered off quickly, a pattern seen throughout the Sonoran Desert. Air temperatures were generally 2–8°F warmer than normal, with the exception of the mean maximum temperature in January. The extended regional drought that began in 2000 continued through WY2017. Additional information can be found at

[climateanalyzer.org](http://www.climateanalyzer.org)

(http://www.climateanalyzer.org/sonoran_desert/sagtuma).

Groundwater

Groundwater is one of the most critical natural resources of the American Southwest, providing drinking water, irrigating crops, and sustaining springs, rivers, and streams throughout the region. At Tumacácori National Historical Park, groundwater monitoring is conducted via automated and manual sampling of water wells at various

depths. The three monitored wells at Tumacácori indicated that mean groundwater levels in WY2017 were higher than the mean of the data record for each well (0.18–0.48 ft). Water levels dropped in response to dry spring conditions, then quickly increased with monsoon precipitation and flow events.

Streams

Streamflow

Streamflow data for this report were recorded at U.S. Geological Survey gauge 09481740, five kilometers downstream from Tumacácori National Historical Park. Streamflow during WY2017 was slightly above the 25th percentile for a majority of WY2017. Spring and early summer discharge was below normal, with drying/no flow events likely occurring during the end of June and early July. The WY2017 monsoon was generally above average, providing average flow into the fall. A majority of the annual amount of water flowing into the Santa Cruz River system comes from monsoon storms.



Sonoran Desert Network staff display water quality samples (foreground) and monitor streamflow (background).

Water Quality

Water quality monitoring occurred ~150 meters downstream from the southern boundary of the park, at the Santa Gertrudis index site. There was one exceedance of state water quality standards for *E. coli* during WY2017, resulting in an average of 99% overall compliance with state standards. However, it is likely that *E. coli* estimates exceeded the state standards on more than this single occasion, especially during and after precipitation events.

Macroinvertebrates and Fish

Macroinvertebrate and fish sampling occurred on the Santa Gertrudis index reach, a 460-meter length of the Santa Cruz River directly downstream of the southern boundary of the main unit at Tumacácori National Historical Park. Values for the Arizona Index of Biological Integrity (an index used to measure wetland health) have placed the park segment of the Santa Cruz River at or below impaired status since WY2012 (although there is not an established index threshold for effluent-dominated streams in Arizona). However, the stability of diversity and abundance of mayflies (Ephemeroptera) and caddisflies (Trichoptera)—and low abundance of indicators of poor water quality, such as midge larvae (Chironomidae)—indicated that the habitat and water quality at the index reach were generally positive in WY2017.

Three fish taxa were collected during collaborative sampling at the Santa Gertrudis index reach in WY2017: longfin dace (*Agosia chryogaster*), Gila topminnow (*Poeciliopsis occidentalis*), and western mosquitofish (*Gambusia affinis*). The continued presence of longfin dace, and an increase in the federally endangered Gila topminnow, are positive indicators of the animals' response to improved water quality and habitat features on this reach.

For more detailed information, see: Filippone, C., E. Gwilliam, L. Palacios, and K. Raymond. 2018. *Status of climate and water resources at Tumacácori National Historical Park: Water year 2017.*

(<https://irma.nps.gov/DataStore/Reference/Profile/2253797>) Natural Resource Report NPS/SODN/NRR—2018/1671. National Park Service, Fort Collins, Colorado.

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