

Monitoring Climate and Water at Gila Cliff Dwellings National Monument

Gila Cliff Dwellings National Monument (/gicl/)

Overview

The West Fork Gila River, which crosses the northeastern portion of Gila Cliff Dwellings National Monument (NM), is a mountainous stream located in the Gila Wilderness. There is almost no upstream land use and little visitor impact in its small watershed.

Natural stressors include drought, flooding, and fire. Since 2001, drought has decreased streamflow in the stream, which sometimes runs dry near the park's eastern boundary. This area is also prone to flooding. Inside the park, the floodplain is bounded by canyon walls that act as a bottleneck, increasing the destructive force of high flood waters. In 2008, a large rain-on-snow event carved a new stream channel and washed out camp facilities and a bridge, resulting in necessary repairs and reduced visitation.



Collecting macroinvertebrates on the West Fork Gila River. NPS photo.

Two major fires have burned in the watershed in recent years: the 2011 **Miller Fire** (<https://www.nps.gov/fire/wildland-fire/connect/fire-stories/2011-parks/gila-cliff-dwellings-national-monument.cfm>) and the Whitewater–Baldy Fire, in 2012. Impacts from these fires have included degraded aquatic habitat, exotic-plant establishment, and potential future flooding and channel change.

Streams and riparian areas are critical to ecological integrity. Riparian areas supply food, cover, and water, and serve as wildlife migration routes. They also help control water pollution, reduce erosion, mitigate floods, and increase groundwater recharge. Riparian systems perform numerous ecosystem functions important to humans,

yet are one of the most endangered forest types in the United States.

At Gila Cliff Dwellings National Monument and three other National Park Service units, the **Sonoran Desert Network** (<https://science.nature.nps.gov/im/units/sodn/>) monitors stream health. The goal of the program is to detect broad-scale changes in ecological condition by observing certain parameters 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 are closely related to climate conditions. Because the two are better understood together, the Sonoran Desert 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.

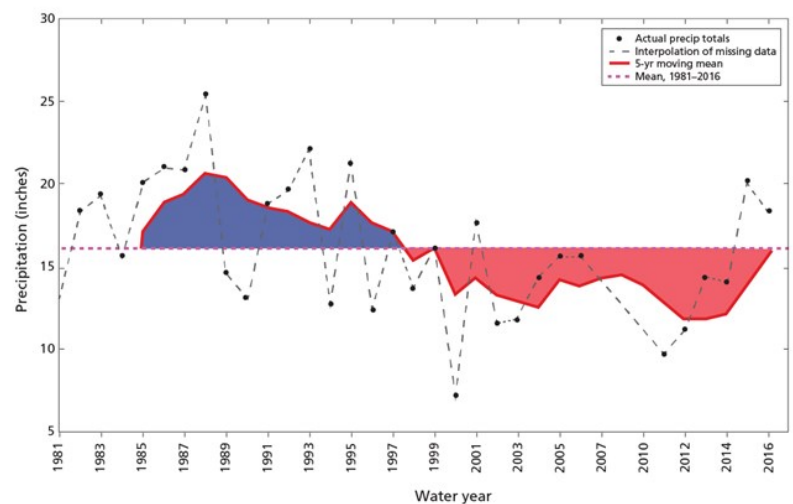
Recent Findings

Climate

Precipitation

In WY2016, overall annual precipitation was 113% of normal for Gila Cliff Dwellings National Monument (18.35" vs. 16.26").

Overall precipitation was essentially normal (104% or +0.29") for the fall and winter of WY2016—but rainfall in February and April represented less than 20% of normal. November was dramatically wetter than normal—288% of normal. Overall precipitation was above average (119%, 1.80") for the spring and summer months. Again, though, monthly variation was extensive. April and September were 200% wetter than normal. June rainfall was only 36% of normal. Drought indicators show that the last two “wet” years have not been enough to eliminate the multi-year precipitation deficit.



Five-year moving mean of annual precipitation, Gila Cliff Dwellings National Monument, 1981–2016. Blue and red fields represent water surplus and deficit. Image: climateanalyzer.org

Temperature

Fall and early winter air temperatures were generally close to normal ($\pm 2.5^{\circ}\text{F}$). As is usually the case, mean monthly low temperatures were below freezing from November to March. Warm-season maximum and minimum air temperatures were close to normal ($\pm 2^{\circ}\text{F}$), except in June and July, which were warmer than normal. Additional information on climate can be found at **The Climate Analyzer** (http://www.climateanalyzer.org/sonoran_desert/giclsansev).

Water Resources

Streamflow

Data collected at Gila Cliff Dwellings NM did not meet quality standards during water year 2016. Streamflow data from U.S. Geological Survey gauge 09430500 in Gila, New Mexico, 40 kilometers downstream of the monument were used to interpret conditions at the monument. Discharge was generally within the normal range, with high-flow events in late January, late July, and September.

Water Quality and Macroinvertebrates

There were five exceedances of state water quality standards in WY2016, meaning that 94% of samples were compliant with state standards. There were exceedances for *E. coli*, turbidity, and total aluminum. The aluminum exceedance was likely the result of precipitation flushing sediment into the stream during high streamflow. Higher concentrations of aluminum have been detected in the past; they are not the result of human activity.

Macroinvertebrates values were classified as “good.” Habitat measurements indicated that the system continues to recover from the impact of fires in water years 2011–2012. For more detailed information, see the most recent **full report** (<https://irma.nps.gov/DataStore/DownloadFile/599680>).
