Sonoran Desert Network
Air Quality Monitoring Brief

National Park Service
U.S. Department of the Interior

Intermountain Region
Inventory & Monitoring Program

2010

Atmospheric Deposition at Gila Cliff Dwellings NM

Importance

Both the Clean Air Act and the National Park Service (NPS) Organic Act protect air resources in national parks. Understanding changes in air quality can aid in interpreting changes in other monitored vital signs and support evaluation of compliance with legislative and reporting requirements. At Gila Cliff Dwellings NM, the Sonoran Desert Network has identified atmospheric deposition and visibility as high-priority vital signs for monitoring.

Long-term Monitoring

For Gila Cliff Dwellings National Monument, the Sonoran Desert Network (SODN) acquires, analyzes, and reports on air quality data from the web-based program archives of the National Atmospheric Deposition Program/National Trends Network and the Interagency Monitoring of Protected Visual Environments program.

SODN air quality monitoring objectives at Gila Cliff Dwellings NM are to:

1. Determine the seasonal and annual status and trends in concentrations of N- and S-containing ions; and
2. Determine the seasonal and annual status and trends in concentrations of visibility-reducing pollutants.

Management Applications

Information gathered from this protocol will:

- Support evaluation of compliance with legislative requirements of the Clean Air Act, regional haze guidelines, National Environmental Policy Act, and the Government Performance and Results Act (GPRA); and
- Facilitate interpretation of other SODN vital signs, such as vegetation and water-quality measurements.

Park Overview

Both local and distant air pollution sources affect air quality in Gila Cliff Dwellings NM. The park's air quality related values (AQRVs) are those resources that are potentially sensitive to air pollution, and include vegetation, fish and wildlife, and visibility. At present, visibility has been identified as the most sensitive AQRV in the park; other AQRVs may also be sensitive, but have not been sufficiently studied. Although visibility in the park is still superior to that in many parts of the country, it is often impaired by light-scattering pollutants (haze).

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Airshed, Gila Cliff Dwellings National Monument.

Atmospheric Deposition

Overview

Wet deposition occurs when air-pollutant emissions, such as sulfur dioxide (SO_2), nitrogen oxides (NOx), and ammonia (NH_3) from power plants, automobiles, agriculture, and other sources are transported and transformed in the atmosphere and deposited to ecosystems as sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4) compounds via rain or snow. Dry deposition of particles and gases occurs through complex processes, such as settling, impaction, and adsorption.

Atmospheric deposition can have a variety of effects on ecosystems, including acidification, fertilization, or eutrophication, and accumulation of toxins. In freshwater lakes, streams, and watersheds, deposition from nitrogen (N) and sulfur (S) compounds can cause changes in water chemistry that affect algae, fish, submerged vegetation, and amphibian and aquatic-invertebrate communities.

Monitoring results

From 1989 to 2007, concentrations of nitrate and ammonium in rain and snow showed a statistically significant degrading trend at Gila Cliff Dwellings NM (Figure 1). Sulfate concentrations showed a statistically significant improving long-term trend (Figure 2). Of 29 locations monitored, Gila Cliff Dwellings NM was one of 11 that exhibited a statistically significant

degrading long-term trend in ammonium concentrations (Figure 3). From 1999–2008, overall nitrogen deposition showed no trend, and sulfur deposition showed an improving trend. Nitrogen and sulfur deposition condition are both of moderate concern at the park. The park is meeting its 2009 GPRA goals for wet deposition.

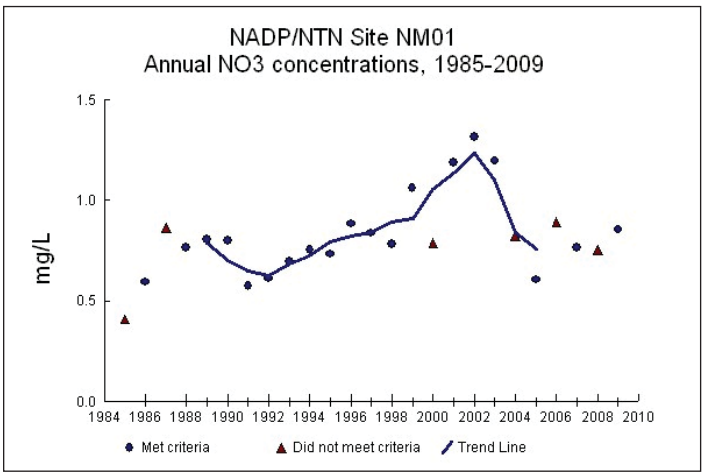

Figure 1. Trend lines (composed of a three-year, centered, weighted, moving average value) for concentrations of nitrate in wet deposition at Gila Cliff Dwellings National Monument, 1985–2009.

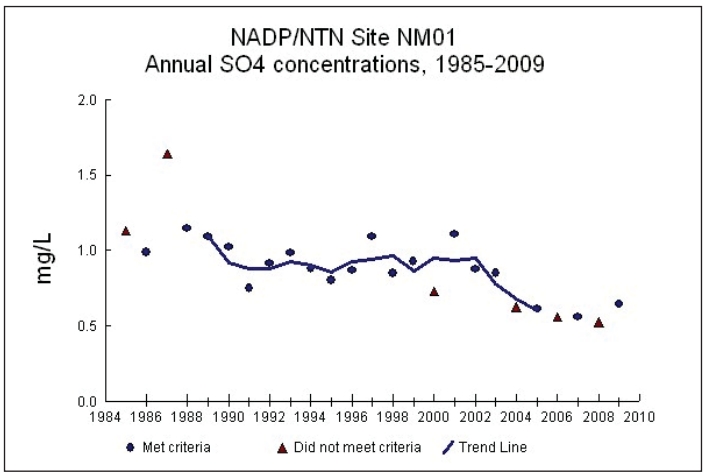

Figure 2. Trend lines (composed of a three-year, centered, weighted, moving average value) for concentrations of sulfate in wet deposition at Gila Cliff Dwellings National Monument, 1985–2009.

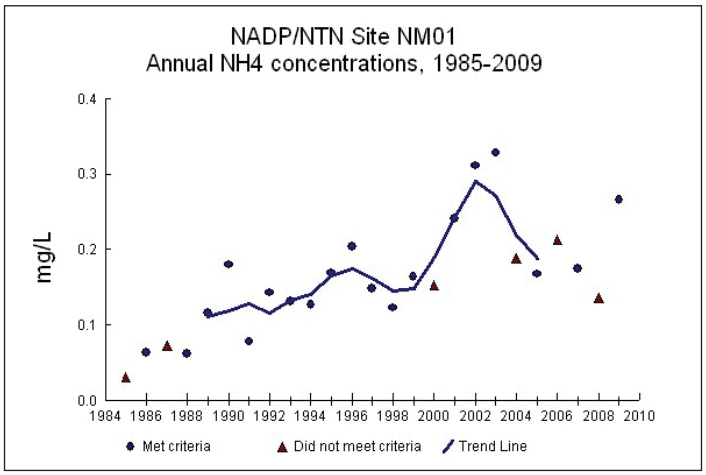

Figure 3. Trend lines (composed of a three-year, centered, weighted, moving average value) for concentrations of ammonium in wet deposition at Gila Cliff Dwellings National Monument, 1985–2009.

For more information

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http://science.nature.nps.gov/im/units/sodn/