



Atmospheric Deposition at Guadalupe Mountains NP

Importance

Air pollution damages resources and values that national parks are mandated to protect. Both the Clean Air Act and the National Park Service (NPS) Organic Act protect air resources in national parks, and NPS managers have a special responsibility to protect park natural and cultural resources. The Chihuahuan Desert Network (CHDN) monitors air quality conditions to understand their interactions with physical and biological components of the ecosystem. At Guadalupe Mountains National Park, the CHDN has identified atmospheric deposition and visibility as high-priority vital signs for monitoring.

Long-term Monitoring

For Guadalupe Mountains National Park (NP), the CHDN acquires, analyzes, and reports on air quality data from the National Atmospheric Deposition Program/National Trends Network (NADP, wet deposition), National Park Service-Air Resources Division (NPS-ARD) Gaseous Pollutant Monitoring Program (ozone), and the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program (visibility).

CHDN air quality monitoring objectives are to:

- Determine the conditions and spatial and temporal trends in ozone, nitrogen deposition, sulfur deposition, and visibility-reducing pollutants.
- Determine how ozone, nitrogen deposition, sulfur deposition, and visibility-reducing pollutants vary with associated vital signs (such as vegetation community composition, exotic plant status, and climate).

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).



Summer rain in Guadalupe Mountains National Park.

Park Overview

Guadalupe Mountains NP is designated as a Class 1 air quality unit under the Clean Air Act, which means it receives the highest protection under the Act. The air quality related values (AQRVs) of Guadalupe Mountains NP, resources that are potentially sensitive to air pollution, include vegetation, wildlife, water quality, soils, and visibility. Soils and vegetation in the park may be sensitive to nutrient enrichment from nitrogen deposition. In some parts of the country, nitrogen deposition has altered soil nutrient cycling and vegetation species composition, and native plants that have evolved under nitrogen-poor conditions have been replaced by invasive species that are able to take advantage of increased nitrogen levels.

Atmospheric Deposition

Overview

Atmospheric deposition can be wet (contributed through rain or snow) or dry (particles carried in the air). Wet deposition occurs when air-pollutant emissions, such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), 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 is not measured in Guadalupe Mountains NP.

Nitrogen (N) and sulfur (S) compounds deposited from air pollution can harm surface waters, soils, and vegetation. N and S deposition cause acidification of streams and lakes in some parts of the country, while N deposition is known to disrupt soil nutrient cycling and alter aquatic and plant communities. Surface waters and soils in Guadalupe Mountains NP are likely to be well-buffered because of an abundance of base cations in the soils and rocks; therefore, waters are not likely to be acidified by atmospheric deposition of S and N compounds. There may be areas in the park, however, where rock is resistant to weathering, and soils and water may be sensitive to inputs of acidic deposition, such as in potholes.

Monitoring Results

Only wet deposition is monitored at Guadalupe Mountains NP. Wet deposition data from NADP is used to evaluate trends and conditions in N and S compounds. NPS-ARD recently reported both long- and short-term trends and conditions for N and S in its *Air Quality in National Parks: 2009 Annual Performance and Progress Report*.

Long-term trend analysis by NPS-ARD (1989–2008) showed significant improvement ($p \leq 0.05$) in sulfate, but no trends in nitrate or ammonium deposition at Guadalupe Mountains NP. In the latter half of that period, 1999–2008, concentrations in ammonium, nitrate, and sulfate showed significant improving trends ($p \leq 0.05$). Figure 1 shows a graph from NADP for 1984–2010, illustrating the recent decrease in sulfate.

According to the NPS Air Resources Division, Guadalupe Mountains NP met its 2009 GPRA goal of improving or not degrading deposition conditions. The GPRA goal is met when deposition of nitrate, ammonium, and sulfate do not show degrading trends over a 10-year time period (1999–2008).

The NPS Air Resources Division uses an index to characterize each type of air quality measure as good, moderate, or of significant concern. For the period 2004–2008, nitrogen deposition was a significant concern at Guadalupe Mountains NP and sulfur deposition was in moderate condition. This reflects the fact that N deposition is approaching levels known to harm sensitive ecosystems similar to those found in Guadalupe NP, while S deposition is at moderate levels.

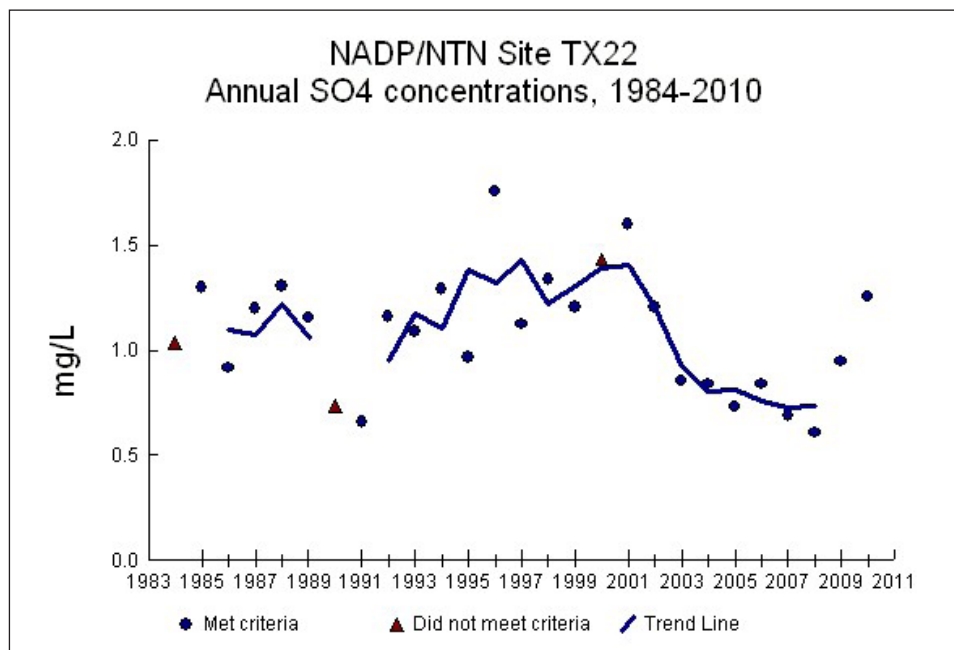


Figure 1. Wet deposition of sulfate at Guadalupe Mountains NP, 1984–2010.



For more information

Chihuahuan Desert Inventory & Monitoring Network | National Park Service | Las Cruces, New Mexico
<http://science.nature.nps.gov/im/units/chdn/>