



## Capulin Volcano National Monument

# Air Quality, Atmospheric Deposition

Air pollution damages resources and values that national parks are mandated to protect. National Park Service (NPS) managers have a special responsibility to monitor and protect air quality and related resources from the adverse effects of air pollution, and to provide recommendations to protect park natural and cultural resources. The Southern Plains Network (SOPN) monitors air quality conditions to understand their interactions with physical and biological components of the ecosystem. It is important to effectively evaluate the effects of these hazards on ecosystem health.

Both the Clean Air Act and the 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 Capulin Volcano National Monument, the SOPN has identified atmospheric deposition as a high-priority vital sign for monitoring.

### Long-term Monitoring

For Capulin Volcano National Monument (NM), the SOPN acquires, analyzes, and reports on air quality data from the National Atmospheric Deposition Program/ National Trends Network (NADP, wet deposition) and from the National Park Service-Air Resources Division (NPS-ARD).

SOPN 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 supports 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).



Capulin Volcano National Monument.

### Park Overview

Capulin Volcano NM is designated a Class II air quality area under the Clean Air Act, which means it is afforded somewhat less stringent protection than areas designated as Class I. Although most parks in the SOPN are some distance from cities and other sources of pollution, they experience occasional poor air quality from pollutants such as nitrogen oxides, sulfur dioxide, ozone, and volatile organic compounds. These air pollutants may adversely affect air quality and natural resources, including vegetation, wildlife, soils, water quality, and visibility.

## 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<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and ammonia (NH<sub>3</sub>) from power plants, automobiles, agriculture, and other sources are transported and transformed in the atmosphere and deposited to ecosystems as sulfate (SO<sub>4</sub>), nitrate (NO<sub>3</sub>) and ammonium (NH<sub>4</sub>) compounds via rain or snow. Dry deposition of particles and gases occurs through complex processes, such as settling, impaction, and adsorption.

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.

### Monitoring Results

Only wet deposition is measured for Capulin Volcano NM. 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 in conditions for N and S in its *Air Quality in National Parks: 2009 Annual Performance and Progress Report*.

Long-term trend analysis (1984–2010) showed significant degradation in ammonium concentrations ( $p \leq 0.05$ ; increasing concentrations, Figure 1), and improvement in sulfate (decreasing concentrations, Figure 2). Nitrates showed no long-term trends.

Additionally, more recent trends (1999–2008), showed degradation in ammonium (increasing concentrations) and improvement in nitrate (decreasing concentrations). Sulfate showed no trends from 1999 to 2008.

According to the NPS Air Resources Division, Capulin Volcano NM met its 2009 GPRA goal for deposition. 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. Using a 5-year average of wet deposition data, 2004–2008, both N and S deposition were of moderate concern at Capulin Volcano NM.

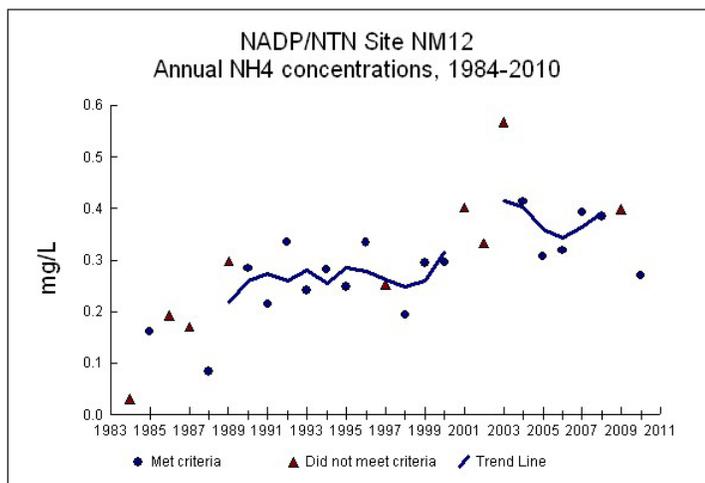


Figure 1. Trend lines (composed of a three-year, centered, weighted, moving average value) for concentrations of ammonium in wet deposition at Capulin Volcano National Monument, 1984–2010.

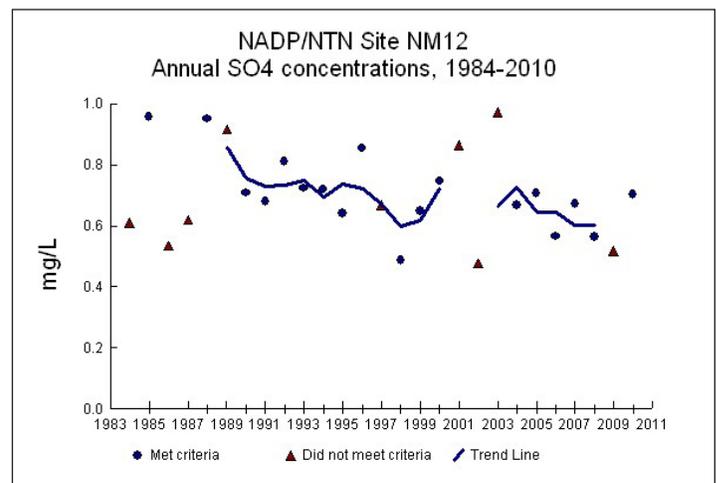


Figure 2. Trend lines (composed of a three-year, centered, weighted, moving average value) for concentrations of sulfate in wet deposition at Capulin Volcano National Monument, 1984–2010.



For more information

Southern Plains Inventory & Monitoring Network | National Park Service | <http://science.nature.nps.gov/im/units/sopn/>