



# Visibility 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 (IMPROVE) 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).



Airshed, Gila Cliff Dwellings National Monument.

NATIONAL PARK SERVICE

## Visibility

### Overview

Visibility includes not only how far we can see, but how well we can see. Visibility is often expressed in terms of light extinction measured in deciviews (dv). Small pollutant particles in the air scatter and absorb light, causing haze and reducing visibility. As light extinction increases, visibility decreases.

Visibility is monitored in parks and wilderness areas as part of the IMPROVE program, a cooperative effort that includes the U.S. Environmental Protection Agency, U.S. Forest Service, NPS, U.S. Fish and Wildlife Service, Bureau of Land Management, National Oceanic and Atmospheric Administration, and several interstate air-quality management organizations.

### Monitoring results

For visibility trends, light extinction on the 20% clearest and haziest days is analyzed. Natural visibility condition on the 20% clearest days is about 2 deciviews (dv); on the 20% haziest days, 7 dv. In 2008, the average light extinction for the 20% clearest days at Gila Cliff Dwellings NM was 2.25 dv. For the 20% haziest days, light extinction was 11.24 dv (Figure 1). Light-extinction trends for the 20% clearest days decreased significantly (improving visibility) based on three-year running averages from 1999 to 2008, but no trend was shown for the 20% haziest days.

Visibility impairment results largely from small particles in the atmosphere. Figure 2 shows the contributions made by different classes of particles to haze. The primary visibility-impairing pollutants were ammonium sulfate, coarse mass, and organic carbon. Ammonium sulfate comes mainly from coal-fired power plants and smelters. Coarse mass consists of wind-blown dust, while organic carbon comes primarily from combustion of fossil fuels and vegetation.

For visibility condition, average light extinction is evaluated. Visibility conditions are rated as moderate at the park, with no trend. Because the park has had improving visibility on clear days, and visibility on the haziest days has shown no degrading trends, Gila Cliff Dwellings NM is currently meeting its 2009 GPRA goal for visibility.

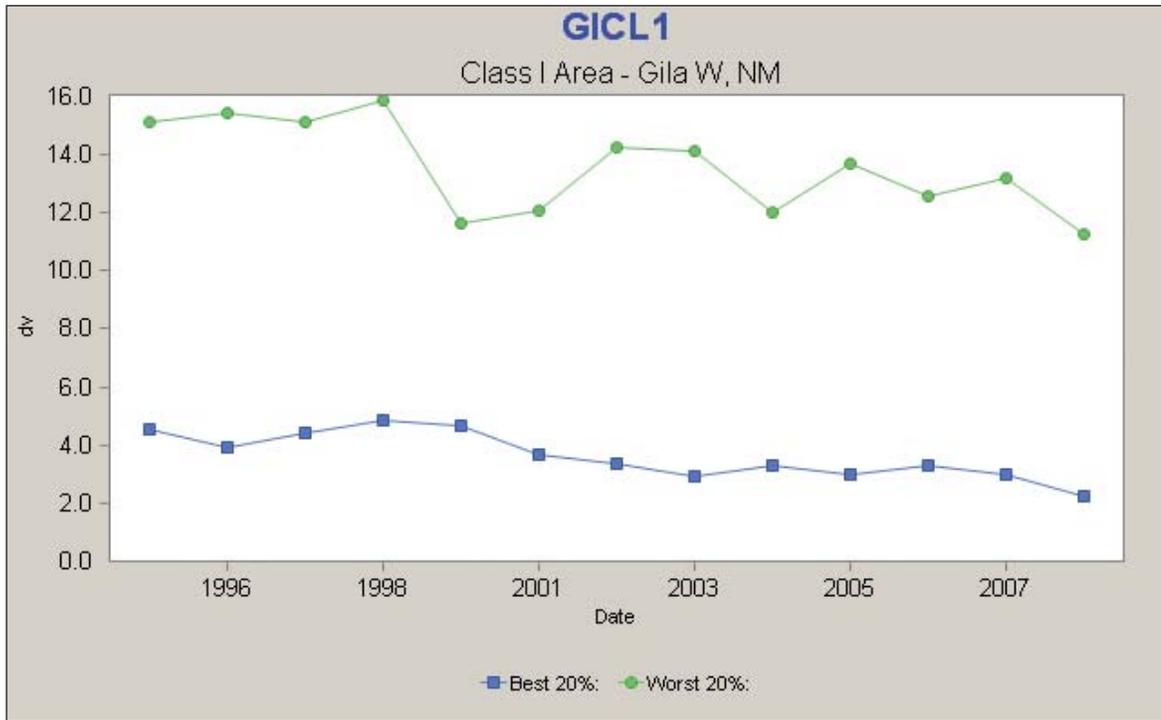


Figure 1. Trends in aerosol light extinction on the 20% best (clearest) days and 20% worst (haziest) days, Gila Cliff Dwellings National Monument, 1995–2008.

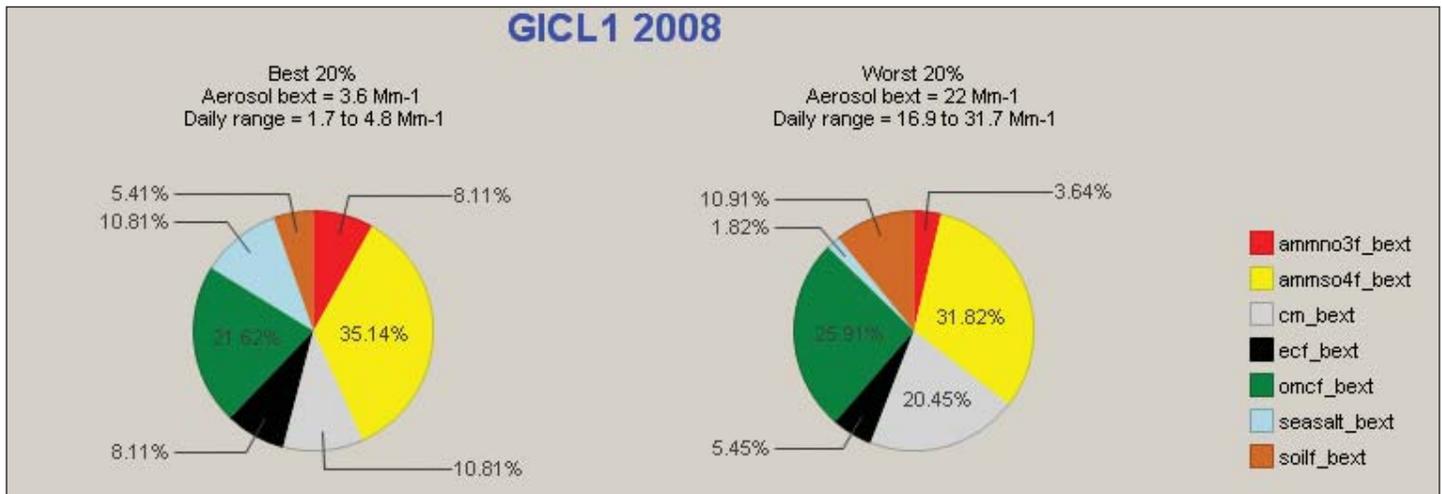


Figure 2. Composition of fine particles at Gila Cliff Dwellings National Monument, 2008.



**For more information**

Sonoran Desert Network Inventory & Monitoring Program | National Park Service | 7660 E. Broadway Blvd, Suite 303 | Tucson, Arizona 85710  
<http://science.nature.nps.gov/im/units/sodn/>