



# Visibility at Saguaro National Park

## Importance

Both the Clean Air Act and the National Park Service (NPS) Organic Act protect air resources in national parks. Saguaro National Park is designated as a Class I area, receiving the highest protection under the Clean Air Act. 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 Saguaro NP, the Sonoran Desert Network has identified ozone and visibility as high-priority vital signs for monitoring.

## Long-term Monitoring

For Saguaro National Park, the Sonoran Desert Network (SODN) acquires, analyzes, and reports on air quality data from the web-based program archives of the National Park Service–Air Resources Division (NPS-ARD) Gaseous Pollutant Monitoring Program (ozone) and the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program (visibility).

Because the NPS-ARD has determined that particulate (visibility) monitors within 100 km (60 miles) may be reasonably considered representative of a park's air quality, the IMPROVE monitors at Saguaro NP are also suitable for reporting on air quality at Coronado National Memorial and Tumacácori National Historical Park.

SODN air quality monitoring objectives at Saguaro NP are to:

1. Determine the seasonal and annual status and trends in ozone concentration; 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 Saguaro NP. The park's air quality related values (AQRVs)



Airshed, Saguaro National Park.

are those resources that are potentially sensitive to air pollution, and include vegetation, wildlife, water quality, soils, 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).

## 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.

Saguaro National Park was designated a Class I air quality area in 1977. Visibility in Class I air quality areas has been granted special protection under the Clean Air Act through state air-quality permits and regional haze regulations. The “regional haze” regulations require states to establish goals for each Class I area to improve visibility on the haziest 20% of days and ensure that no degradation occurs on the clearest 20% of days. A goal of regional haze regulations is to achieve natural visibility conditions by 2064, although individual states may make the case for a different long-term goal.

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. The State of Arizona is an associate member of IMPROVE, and funded the Saguaro West site (see below).

### 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 Saguaro NP was 6.05 dv (Saguaro East) and 7.79 dv (Saguaro West). For the 20% haziest days, light extinction was 13.29 dv (Saguaro East) and 14.93 dv (Saguaro West) (Figure 1). From 1990 to 2008, light-extinction showed improving trends for both the 20% clearest and 20% haziest days. From 1999 to 2008, no trend was detected for the 20%

clearest days. The 20% haziest days showed a non-statistically significant improving trend.

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, ammonium nitrate, coarse mass, and organic carbon. Ammonium sulfate comes mainly from coal-fired power plants and smelters. Motor vehicles are the primary source of ammonium nitrate in the atmosphere. 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. At Saguaro NP, Coronado NMem, and Tumacácori NHP, visibility is rated as moderate with no degrading trends. These parks are currently meeting their 2009 GPRA goals for visibility.

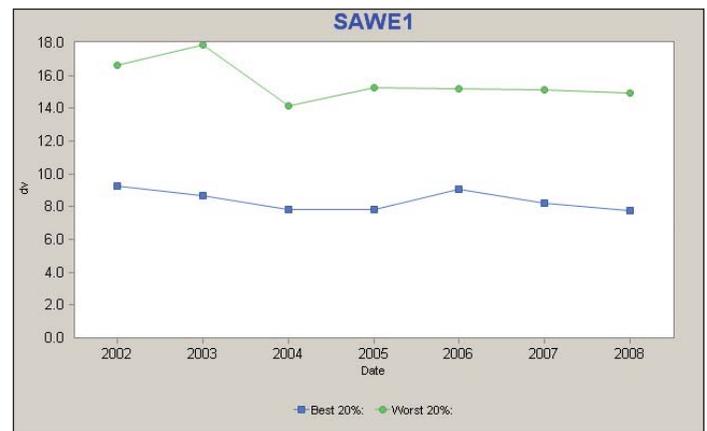
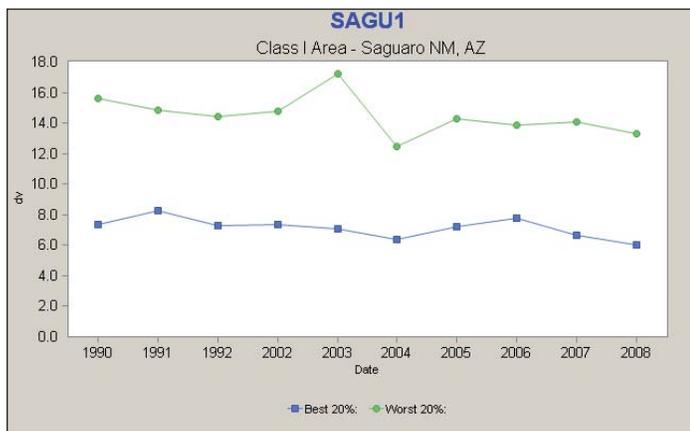


Figure 1. Trends in aerosol light extinction on the 20% best (clearest) days and 20% worst (haziest) days at Saguaro National Park East (left), 1990–2008, and Saguaro National Park West (right), 2002–2008.

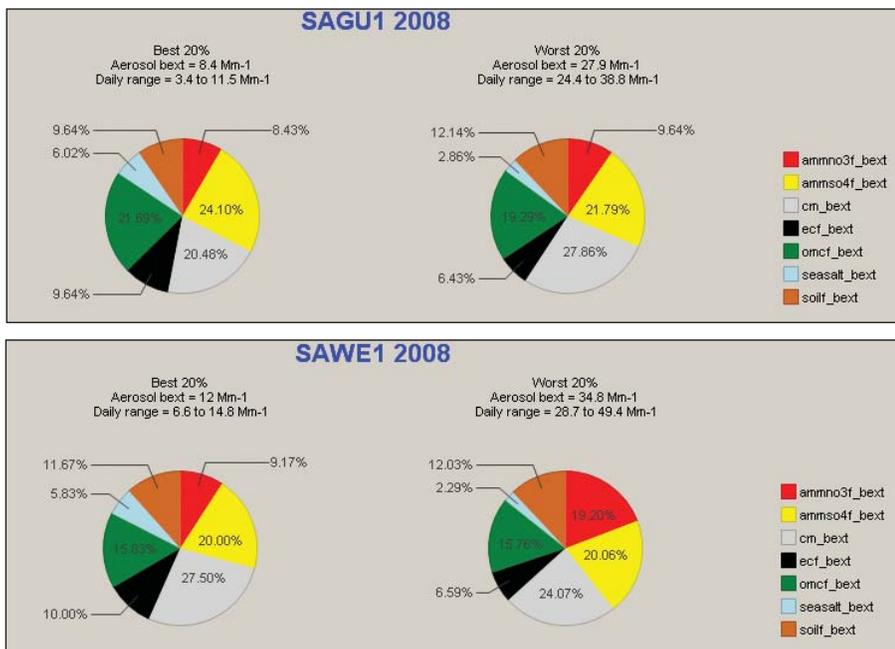


Figure 2. Composition of fine particles at Saguaro National Park East (top) and West (bottom), 2008.



### For more information

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