



Visibility at Tonto National Monument

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 Tonto NM, the Sonoran Desert Network has identified visibility as a high-priority vital sign for monitoring.

Long-term Monitoring

For Tonto National Monument, the Sonoran Desert Network (SODN) acquires, analyzes, and reports on air quality data from the web-based program archives of the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program. The SODN's air quality monitoring objective at Tonto NM is to 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 Tonto 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).

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 ex-



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Air quality monitoring station, Tonto National Monument.

inction 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 Tonto NM was 5.75 dv. For the 20% haziest days, light extinction was 13.78 dv (Figure 1). From 1991 to 2008, visibility significantly improved for the 20% clearest days, but had no trend for the 20% haziest days. More recently, from 1999 to 2008, light-extinction trends for the 20% clearest days decreased significantly (increasing air quality). 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, organic

carbon, and ammonium nitrate. 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. Motor vehicles are the primary source of ammonium nitrate in the atmosphere.

For visibility condition, average light extinction is evaluated. Visibility conditions are rated as moderate at the park. Because visibility is stable or improving, Tonto NM is currently meeting its 2009 GPRA goal for visibility.

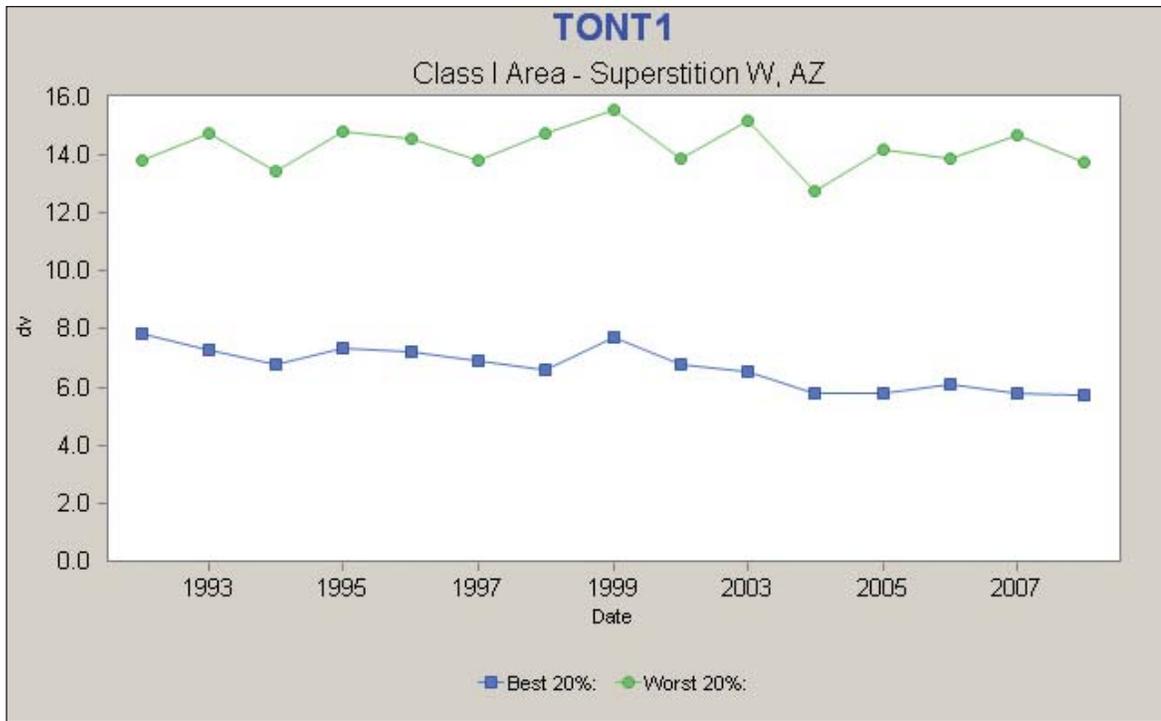


Figure 1. Trends in aerosol light extinction on the 20% best (clearest) days and 20% worst (haziest) days, Tonto National Monument, 1992–2008.

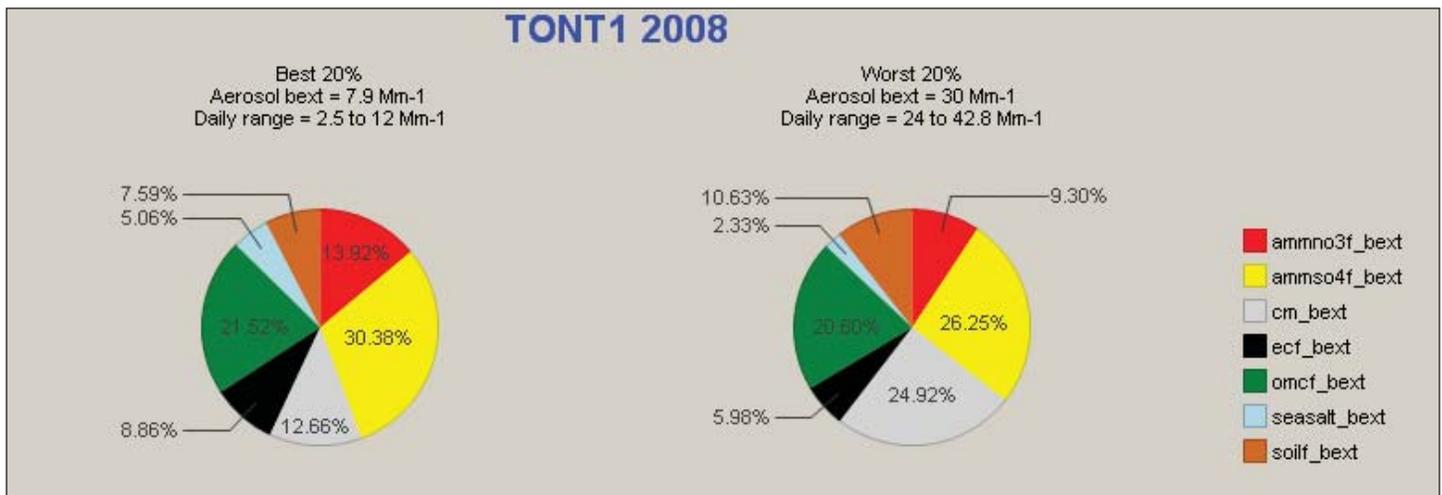


Figure 2. Composition of fine particles at Tonto National Monument, 2008.



For more information

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