Sonoran Desert Network
Air Quality Monitoring Brief

National Park Service
U.S. Department of the Interior

Intermountain Region
Inventory & Monitoring Program

2010

Ozone 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 program (visibility).

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

Saguaro National Park was designated a Class I air quality area, which provides special protection through state air quality permits. Both local and distant air pollution sources affect air quality in Saguaro NP. The park's air quality related values (AQRVs) 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, visibility in the park is often impaired by light-scattering pollutants (haze).

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Skunkbush (*Rhus trilobata*), found in Saguaro National Park, is known to be sensitive to ozone exposure.

Ozone

Overview

Ground-level ozone, produced by the reaction of nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of sunlight, is one of the most widespread pollutants affecting vegetation and public health in the U.S. Combustion processes from power plants, automobiles, and industries are the main anthropogenic emitters of NOx. Vehicles, industries, and natural vegetation emit VOCs.

In humans, exposure to ozone can cause respiratory problems and impairment of the body's immune system. Ozone also affects vegetation, including both agricultural crop species and natural species in national parks. Several plant species that occur in Saguaro NP are known to be sensitive to ozone, including *Pinus ponderosa* (ponderosa pine), *Populus tremuloides* (quaking aspen), and *Rhus trilobata* (skunkbush). Ozone has been monitored in Saguaro NP since 1982.

The U.S. Environmental Protection Agency (EPA) has set ozone national ambient air-quality standards of 75 parts per billion (ppb) averaged over an 8-hour period to protect human health (primary standard) and vegetation (secondary

standard). Compliance with the standards occurs if the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at a monitor over the course of one year does not exceed 75 ppb. Areas not meeting the standards are designated as non-attainment areas, and states are required to develop plans to bring such areas into attainment.

In addition, scientists use various exposure indices to quantify ozone exposure to plants—indices considered biologically relevant because they take into account both peak ozone concentrations and cumulative exposure to ozone. These indices include the W126 (the annual index of the sum of weighted hourly concentrations, 8AM–8PM, during the three-month period with the maximum index value).

Monitoring results

Ozone levels at Saguaro NP are currently meeting EPA standards. However, if proposed changes to those standards are adopted, the park may exceed both the primary and secondary standards.

In 2008, ozone levels at Saguaro NP exceeded the national standards (eight-hour average of 75 ppb) on one day. The fourth-highest eight-hour ozone concentration for the park was 74 ppb, and the three-year running average (1999–2008) of the fourth-highest daily eight-hour ozone concentration was also 74 ppb. In January 2010, the EPA proposed to lower the primary standard from 0.075 ppm (75 ppb) to a level within the range of 0.060–0.070 ppm (60–70 ppb). Saguaro NP would exceed a standard of 60–70 ppb.

No strong linear trends were shown for the fourth-highest eight-hour concentration (Figure 1), SUM06, or cumulative sum W126 for annual maximum three-month period (Figure 2).

The EPA has proposed to set the level of the new secondary (W126) standard in the range of 7–15 ppm-hours. In 2008, Saguaro NP exceeded the upper end of that proposed range, with a value of 19 ppm-hour. The W126 index provides a useful metric for assessing the potential for harm to vegetation due to cumulative ozone exposure.

Since 1989, Saguaro NP has exceeded the fourth-highest average threshold of 75 ppb 0–10 times in 17 different years, and 10–20 times in two different years (Figure 3). If ozone concentrations increase, the area may be in violation of the national standard. Ozone levels at Saguaro NP are currently rated in moderate condition with no trend, and the park is meeting its 2009 GPRA goal for ozone.

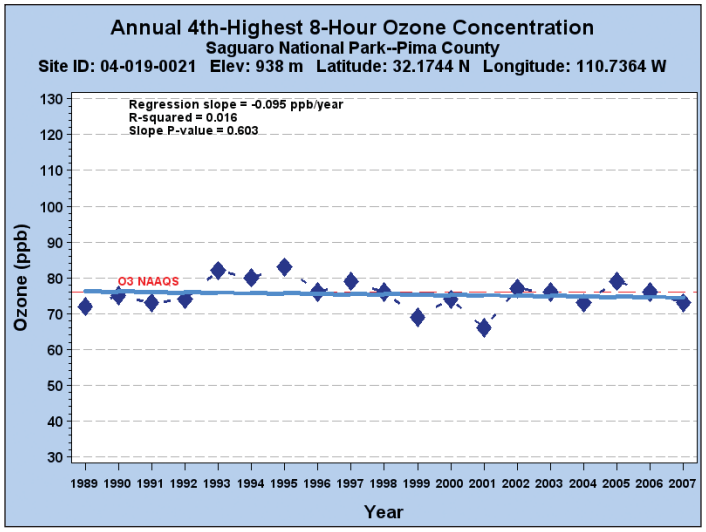

Figure 1. Trend in annual fourth-highest daily maximum eight-hour ozone concentration, Saguaro National Park.

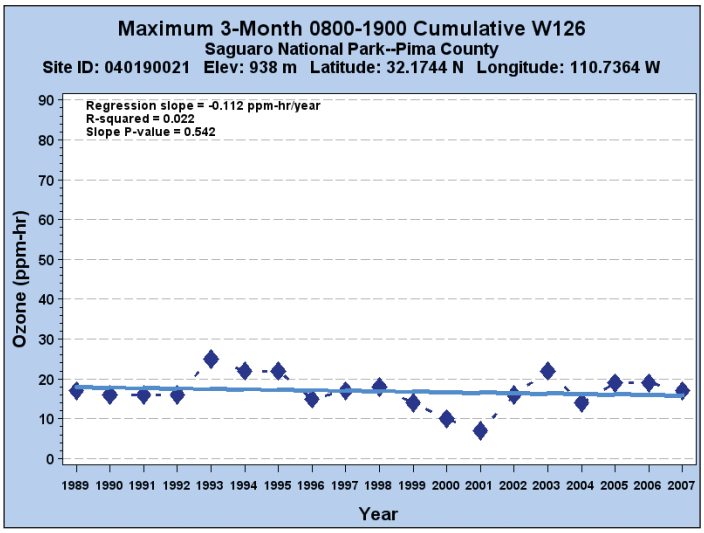

Figure 2. Trend in cumulative sum W126 for annual maximum three-month period, daytime hours, Saguaro National Park.

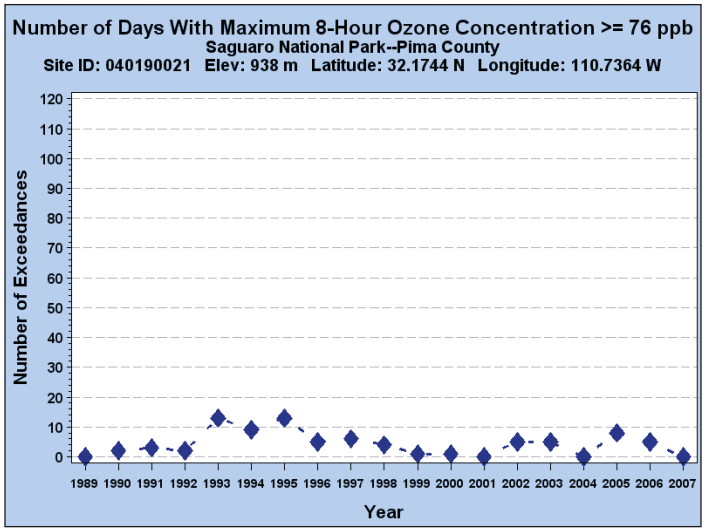

Figure 3. Number of days with exceedances of the >76 ppb ozone standard at Saguaro National Park, 1989–2007.

For more information

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