



Ozone at Chiricahua National Monument

Importance

Both the Clean Air Act and the National Park Service (NPS) Organic Act protect air resources in national parks. Chiricahua National Monument 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 Chiricahua NM, the Sonoran Desert Network has identified atmospheric deposition, ozone, and visibility as high-priority vital signs for monitoring.

Long-term Monitoring

For Chiricahua 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 (wet deposition), Clean Air Status and Trends Network (dry deposition), 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 Chiricahua NM are to:

1. Determine the seasonal and annual status and trends in concentrations of N- and S-containing ions and dry-deposition chemistry;
2. Determine the seasonal and annual status and trends in ozone concentration; and
3. 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.



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

Park Overview

In 1977, Chiricahua National Monument 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 Chiricahua NM. 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).

Ozone

Overview

Ground-level ozone, produced by the reaction of nitrogen oxides (NO_x) 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 NO_x. 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 Chiricahua NM are known to be sensitive to ozone, including *Pinus ponderosa* (ponderosa pine) and *Rhus trilobata* (skunkbush). Ozone has been monitored in Chiricahua NM from 1989 to 1992 and 1995–present.

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 Chiricahua NM 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 Chiricahua NM did not exceed the national standards. The fourth-highest eight-hour ozone concentration for the park was 68 ppb, and the three-year running average of the fourth-highest daily eight-hour ozone concentration was 69 ppb. However, 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). Chiricahua NM would exceed a standard of 60 or 65 ppb. Since data collection began in 1989, CHIR and FOBO have never exceeded the current threshold of 75 ppb on five or more days in a single year (Figure 1).

No strong linear trends were shown for the fourth-highest eight-hour average (Figure 2) or cumulative sum W126 for annual maximum three-month period (Figure 3). The EPA has proposed to set the level of the new secondary (W126) standard in the range of 7–15 ppm-hours. In 2008, Chiricahua NM exceeded the upper end of that proposed range, with a value of 17 ppm-hour. The W126 index provides a useful metric for as-

sessing the potential for harm to vegetation due to cumulative ozone exposure.

Ozone levels at Chiricahua NM and Fort Bowie NHS are currently rated in moderate condition with no trend. These parks are currently meeting their 2009 GPRA goals for ozone.

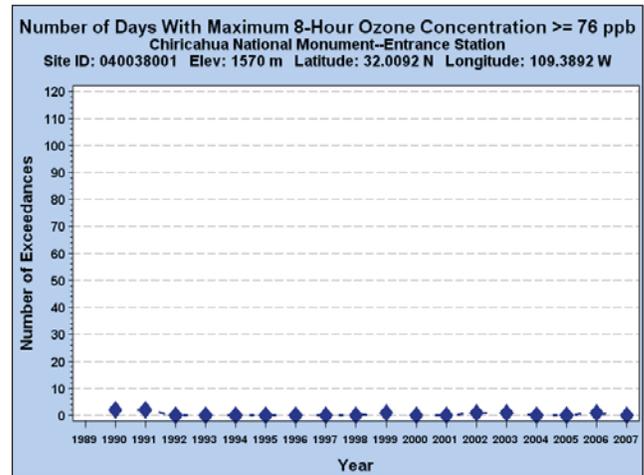


Figure 1. Number of days with exceedances of the >76 ppb ozone standard at Chiricahua National Monument, 1989–2007.

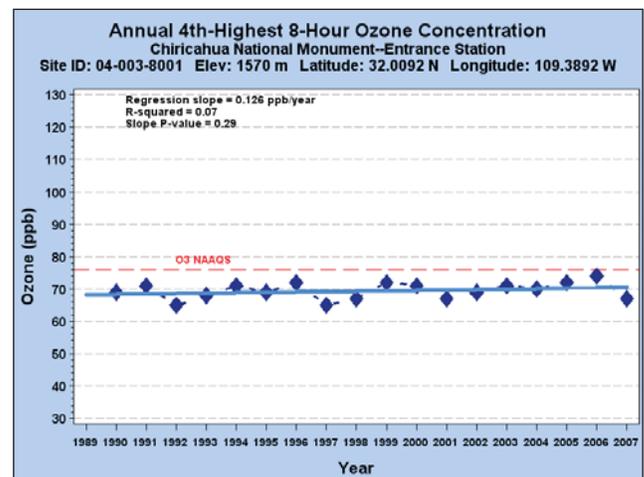


Figure 2. Trend in annual fourth-highest daily maximum eight-hour ozone concentration, Chiricahua National Monument.

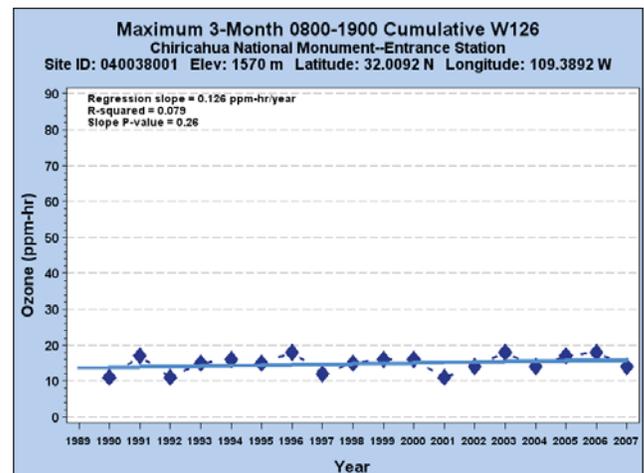


Figure 3. Trend in cumulative sum W126 for annual maximum three-month period, daytime hours, Chiricahua National Monument.

For more information

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