

**PRELIMINARY AIR QUALITY AND AIR QUALITY RELATED
VALUES MONITORING CONSIDERATIONS
FOR THE SOUTHERN COLORADO PLATEAU NETWORK**

June 2003

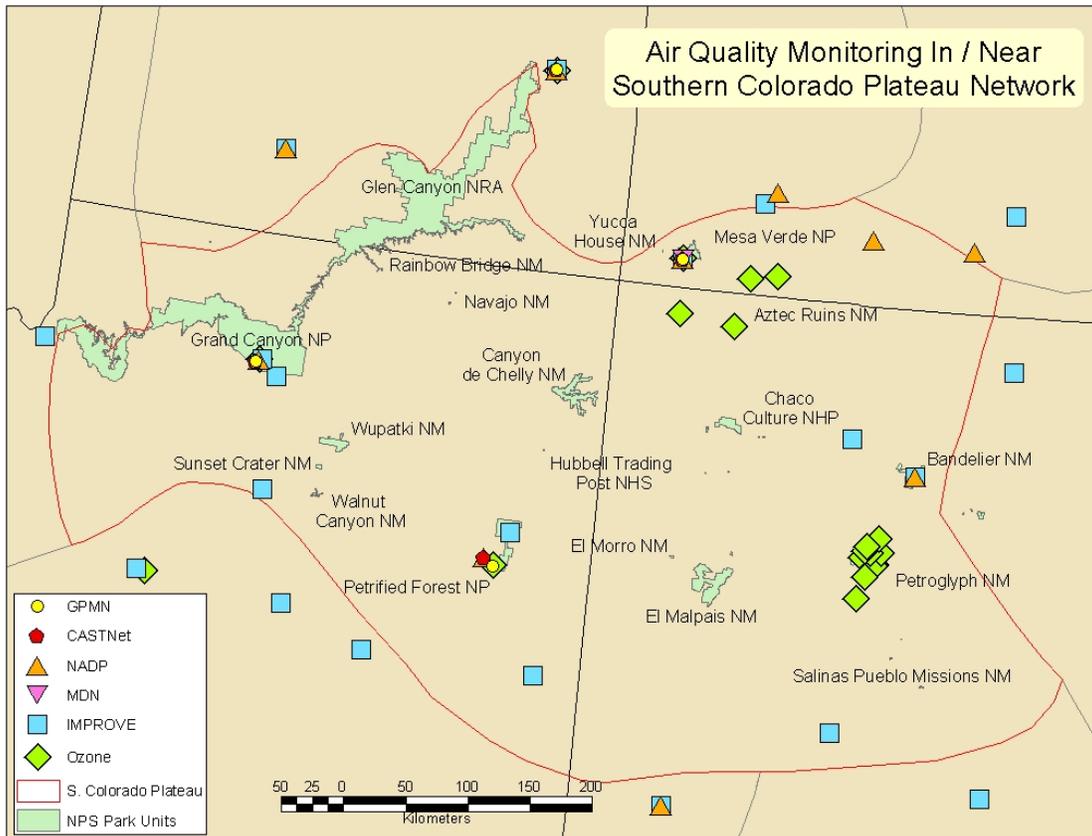
Introduction

The Southern Colorado Plateau Network (SCPN) contains 19 national park units, including four Class I air quality areas. Class I areas, which receive the highest protection under the Clean Air Act, include Bandelier National Monument (NM), Grand Canyon National Park (NP), Mesa Verde NP, and Petrified Forest NP. The remaining areas are Class II air quality areas and also receive protection under the Clean Air Act, but to a somewhat lesser degree. Air quality information for the Class I areas has been summarized on the website: <http://www2.nature.nps.gov:82/scripts/synth.dll>.

The NPS Air Resources Division (ARD) has contracted with the University of Denver (DU) to produce GIS-based maps and an associated look-up table that provide baseline values for a set of air quality parameters for all Inventory and Monitoring parks in the U.S. These maps and table are now available and serve as the Air Inventory for the parks. Air Quality Inventory products are available on the Internet at <http://www2.nature.nps.gov/ard/gas/> (see section called *Air Atlas*). Air Atlas uses both information from parks with on-site monitoring and information from all the major air quality monitoring networks.

In-Park Air Quality Monitoring in and near the SCPN

The following map shows air quality monitoring in and near the SCPN.



Visibility is monitored in all four Class I areas and in a number of USDA Forest Service (FS) wilderness areas in the region, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. Monitoring for the deposition of nitrogen and sulfur compounds in rain and snow is conducted at all four Class I areas, as well as some FS areas in the region, as part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN). Monitoring for the deposition of nitrogen and sulfur compounds in dryfall (“dry deposition”) is done at Grand Canyon NP, Mesa Verde NP, and Petrified Forest NP as part of the Clean Air Status and Trends Networks (CASTNet). Ozone is monitored as part of the NPS Gaseous Pollutant Monitoring Network in Grand Canyon NP, Mesa Verde NP, and Petrified Forest NP. In addition, Utah, Colorado, New Mexico and Arizona monitor ozone, usually in urban areas.

No monitoring is done at the remaining SCPN units. SCPN should evaluate the need for additional monitoring in areas without nearby monitors. In particular, SCPN should evaluate the need to measure dry deposition of nitrogen and sulfur in Bandelier NM.

Potential Risk to AQRVs in the SCPN

A table of selected Air Atlas data for the SCPN is attached that shows air quality parameters that may help determine the risk to air quality related values in the parks of the SCPN. Air quality related values (AQRVs) are those resources that are potentially sensitive to air pollution, and include vegetation, wildlife, water quality, soils, and visibility.

A review of the air quality table for SCPN indicates that pollutants of concern include ozone, nitrogen and sulfur compounds, and visibility-reducing compounds. In addition, mercury (as deposited by the atmosphere) is a growing concern in the SCPN.

Ozone

A review of the air quality table indicates that ozone concentrations and cumulative ozone doses (SUM06) are high enough to induce ozone injury symptoms in sensitive plant species under certain conditions. Peak ozone concentrations exceed 100 ppb and cumulative ozone doses exceed 15 ppm-hrs in some parks, both thresholds for ozone injury. In addition, trend data shows that ozone concentrations are significantly increasing in parks on the Colorado Plateau (Air Quality in the National Parks, 2nd ed.). NPSpecies indicates that each park in the SCPN has species known to be sensitive to ozone. Air Resources Division is conducting a park-specific risk assessment for ozone injury that will soon be available and will assist the SCPN in identifying those parks where the potential for ozone injury is high. The risk assessment will consider presence of sensitive species, ozone concentrations and doses, and environmental conditions (soil moisture, etc.). SCPN may want to consider vegetation surveys for ozone injury as part of the monitoring plans for at-risk parks.

Nitrogen and Sulfur

Estimates of nitrogen and sulfur deposition for the SCPN are relatively low; however, they are significantly elevated over natural estimates of deposition, suggesting that ecosystems are now experiencing higher levels of deposition than those they evolved under. In addition, trend information indicates that nitrogen deposition is increasing in parks on the Colorado Plateau; sulfur, while decreasing somewhat, is still elevated above natural conditions.

Deposition of sulfur compounds can have an acidifying effect; deposition of nitrogen compounds can have either an acidifying or fertilizing effect, or both.

Acidification occurs in areas with low-buffering capacity (few available base cations). Surface waters and soils in the SCPN are likely to be well-buffered and, therefore, insensitive to acidification. However, the SCPN network should verify this with its water quality and soil inventories. For example, in general, acid-sensitive surface waters have a pH below 6.0 and an acid neutralizing capacity (ANC) below 100 microequivalents per liter ($\mu\text{eq/l}$). However, there may be areas in some units where rock is resistant to

weathering and soils and water (e.g., in potholes) may be sensitive to inputs of acidic deposition.

Nutrient enrichment occurs in areas of elevated nitrogen deposition. There is growing concern on the Colorado Plateau that soils and vegetation may be affected by nutrient enrichment. In some parts of the country, nitrogen deposition has altered soil nutrient cycling and vegetation species composition; native plants that have evolved under nitrogen-poor conditions have been replaced by invasive species better able to utilize nitrogen. Studies are underway in Canyonlands NP to investigate nitrogen effects on soil dynamics, exotic plant invasiveness, and biological soil crusts. These studies may have applicability to units in the SCPN.

Visibility-reducing Pollutants

All units in the SCPN experience reduced visibility to some extent because of fine pollutant particles (haze). As noted above, visibility monitoring is conducted at the four Class I areas in the SCPN, as well as several FS areas in the region.

The U.S. Environmental Protection Agency's Regional Haze regulations require States to establish goals for each Class I air quality area to improve visibility on the haziest days and ensure no degradation occurs on the clearest days. An analysis of 1990-1999 data indicates that visibility in Mesa Verde NP is degrading on both the clearest and the haziest days. Visibility in Grand Canyon NP, Bandelier NM, and Petrified Forest NP is degrading on the haziest days and staying about the same or improving slightly on the clearest days.

Mercury

There is growing concern about mercury deposition to the Colorado Plateau, with increasing numbers of fish consumption advisories issued because of elevated mercury levels. The majority of mercury entering ecosystems comes from atmospheric deposition, unless there is a nearby mercury source (e.g., certain mining operations). Mercury in deposition comes from a variety of sources, including coal-burning power plants, incinerators, recycling plants, and forest fires (which re-emit anthropogenic mercury that has been previously deposited). Mercury in wet deposition has been monitored at one site in the SCPN, Mesa Verde NP. Monitoring in the park started in December 2001 as part of the Mercury Deposition Network (MDN). Data indicate that mercury deposition rates are quite high in the park; however, the data record is insufficient at this time for trend analysis. Because mercury monitoring sites are so few, it is not possible to interpolate the data between sites and derive estimates for sites without monitoring.

Relevant Websites

NPS Air Inventory (*Air Atlas*) - <http://www2.nature.nps.gov/ard/gas/>

Guidance for AQRV Analysis - <http://www2.nature.nps.gov:82/scripts/synth.dll>

NADP - <http://nadp.sws.uiuc.edu/>

CASTNet - <http://www.epa.gov/castnet/>

IMPROVE - <http://vista.cira.colostate.edu/improve/>

NPS Ozone Monitoring Data - <http://www2.nature.nps.gov/ard/gas/netdata1.htm>

Ozone - <http://www.epa.gov/air/data/index.html>

Mercury - <http://nadp.sws.uiuc.edu/mdn>