



Fort Larned National Historic Site

Air Quality, Visibility

Air pollution damages resources and values that national parks are mandated to protect. National Park Service (NPS) managers have a special responsibility to monitor and protect air quality and related resources from the adverse effects of air pollution, and to provide recommendations to protect park natural and cultural resources. The Southern Plains Network (SOPN) monitors air quality conditions to understand their interactions with physical and biological components of the ecosystem. It is important to effectively evaluate the effects of these hazards on ecosystem health.

Both the Clean Air Act and the 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 Fort Larned National Historic Site, the SOPN has identified visibility as a high-priority vital sign for monitoring.

Long-term Monitoring

For Fort Larned National Historic Site (NHS), the SOPN acquires, analyzes, and reports on air quality data from the web-based program archives of the Inter-agency Monitoring of Protected Visual Environments (IMPROVE) Program (visibility) and from the National Park Service-Air Resources Division (NPS-ARD).

The NPS-ARD has determined that data collection stations within 100 km provide a reasonable representation of conditions at sites that have no monitoring stations locally. Fort Larned NHS uses data from Cedar Bluff, which is about 81 km northwest of the site, to report on air quality trends.

SOPN air quality monitoring objectives are to:

- Determine the conditions and spatial and temporal trends in ozone, nitrogen deposition, sulfur deposition, and visibility-reducing pollutants.
- Determine how ozone, nitrogen deposition, sulfur deposition, and visibility-reducing pollutants vary with associated vital signs (such as vegetation community composition, exotic plant status, and climate).



Soldiers could fire their rifles through loopholes like this one in the event of an attack at Fort Larned National Historic Site.

Management Applications

Information gathered from this protocol supports 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).

Park Overview

Most visitors who come to national parks expect clean air and clear views. The prairie at Fort Larned NHS once stretched from one horizon to the other, supporting prairie dogs, pronghorn antelope, wolves, elk, grizzly bears, and vast herds of bison. In turn, these plants and animals supported the people who lived on this land, including the Cheyenne, Arapaho, and Kiowa. In the generations that have passed, the land has changed dramatically with agriculture and development. Although most parks in the SOPN are some distance from cities and other sources of pollution, they experience occasional poor air quality from pollutants such as nitrogen oxides, sulfur dioxide, ozone, and volatile organic compounds. These air pollutants may adversely affect air quality and natural resources, including vegetation, wildlife, soils, water quality, and visibility. Fort Larned NHS is designated a Class II air quality area under the Clean Air Act, which means it is afforded somewhat less stringent protection than areas designated as Class I.

Visibility

Overview

Visibility includes not only how far we can see, but how well we can see. Visibility is expressed in terms of the perceptible change in light extinction measured in deciviews (dv). Small pollutant particles in the air scatter and absorb light, causing haze and reducing visibility; as light extinction and dv increases, visibility decreases. Visibility is monitored in parks and other areas as part of the IMPROVE program, a cooperative effort that includes the U.S. Environmental Protection Agency, U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, National Oceanic and Atmospheric Administration, and several interstate air-quality management organizations.

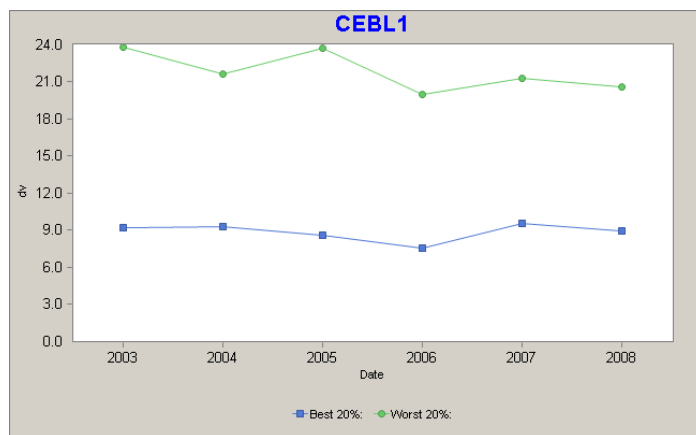


Figure 1. Trends in aerosol light extinction on the 20% best (clearest) days and 20% worst (haziest) days, Cedar Bluff (representative of Fort Larned NHS), 2003-2008.

Monitoring Results

For visibility trends, light extinction is analyzed on the 20% clearest and haziest days. Ten-year trends (1999–2008) showed possible improvement ($p > 0.05$; decreasing light extinction trends) for the 20% haziest days (Figure 1). In 2008, the average light extinction for the 20% clearest days at Fort Larned NHS (at Cedar Bluff) was 8.99 dv, and 20.6 dv for the 20% haziest days. Natural visibility condition on the 20% clearest days was about 2 dv; on the 20% haziest days, 7 dv.

The main contributors to haze in 2008 were ammonium sulfate (primarily from coal-burning power plants, yellow slice in Figure 2), ammonium nitrate (from emissions from vehicles, industries, or fires, red slice in Figure 2), and organic carbon (from fires, vegetation, and human activities, green slice in Figure 2). The NPS Air Resources Division uses an index to characterize each type of park air quality measure as good, moderate, or of significant concern. For 2009, visibility was a significant concern, and met the 2009 GPRA goal of improving or not degrading visibility conditions.

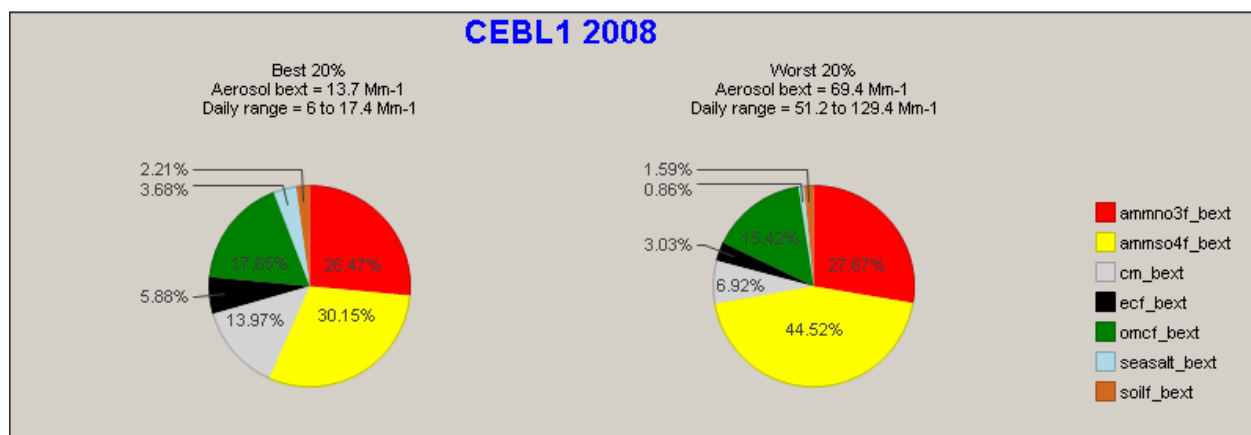


Figure 2. Composition of fine particles at Cedar Bluff (representative of Fort Larned NHS), 2008.



For more information

Southern Plains Inventory & Monitoring Network | National Park Service | <http://science.nature.nps.gov/im/units/sopn/>