

Air Quality Research Seeks To Protect Park Resources

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Air pollution can damage and destroy the very resources and values that NPS units have been created to protect and preserve. Data from the NPS air quality research and monitoring program show that park units are not islands isolated from the by-products of an urban and industrial society. Man-made air pollutants are transported long distances and have been detected at all NPS monitoring sites. Air pollution effects often are subtle and insidious.

The report, *Air Quality in the National Parks*, July 1988, summarizes the significant findings from the

NPS air quality research and monitoring program. Collected from 1977 through 1987, this information helps the NPS to remedy and prevent resource degradation. The research and monitoring focuses on:

- Visibility and particulate characteristics in the air.
- Visitor experiences as affected by visibility impairment.
- Gaseous pollutant concentrations in the air.
- Modeling of major air mass/pollutant transport.
- Biological effects on flora and fauna.

The program relies heavily on park personnel to collect the data on a day-to-day basis and to ensure that these data are reliable. Without this dedicated work, the NPS would not be so well armed to protect park units containing some of the world's most spectacular scenery, unique cultural and historic resources, and diverse wildlife and vegetative communities. These people deserve appreciation for their continuing fine efforts.

To provide detailed technical operation of the NPS air quality program, a team of experts has been established in Denver and in Fort Collins, Colo. These people respond to the air quality needs of the parks and oversee the research and monitoring activities.

The Research and Monitoring Program

Air quality research is conducted to determine the current status of air quality in NPS units, to identify any effects air pollution is having or may have on NPS resources or visitor experiences, and to determine sources of air pollution in the parks and the sensitivity of park resources to air pollution.

Air quality modeling is developed and used to study the transport and transformation of pollutants in the atmosphere. Information from the visibility monitoring network along with air quality models is used to determine the effect of man-made air pollutants on visibility at NPS sites.

Visibility monitoring has shown that, in addition to natural sources of visibility impairment, varying degrees of visibility impairment result from man-made pollution in virtually all monitored parks. NPS research findings suggest that fine sulfate particles are the single most important contributor to visibility impairment in most park units. Fine sulfate particles can be transported long distances in the atmosphere. They are primarily the result of sulfur oxide emissions from energy and industrial sources. Levels of sulfur dioxide as high as 40 percent of the short-term National Ambient Air Quality standards are found in some parks.

In the Colorado Plateau area, where Grand Canyon NP and several other units are located, fine sulfate particles are responsible for 40 to 60 percent of the visibility impairment. In eastern areas of the country, fine sulfates play an even larger role in visibility impairment. In the Pacific Northwest, sulfates are not the primary cause of visibility impairment; instead, fine carbon from controlled burning of timber and agricultural lands and natural forest fires play a prominent role.

Research on effects of visibility on the visitor experience in five NPS units indicates that clean, clear air is one of the parks' most important features. It appears that visitors value an environment undisturbed by man above all other features. Research findings on the effects of changes in visual air quality suggest that a

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John Sacklin, at Redwood NP, is shown with the IMPROVE (Interagency Monitoring of PROtected Visual Environments) particulate sampler. The IMPROVE program is designed to determine extent and causes of visibility impairment at selected Class I clean air areas throughout the United States. The cooperative program involves several federal agencies including the NPS. The monitor automatically takes 24-hour samples on Wednesdays and Saturdays. These are analyzed for trace elements, mass, ions, and carbon.

small increase in air pollution is more easily noticed and more disturbing to the human observer where the atmosphere is initially relatively clean.

Ambient air quality monitoring has found that ozone concentrations are high in some NPS units and even exceed National Ambient Air Quality Standards in several of these areas. These high concentrations occur not only in units located near urban areas, but also in areas that are relatively remote, such as Acadia, Great Smoky Mountains, Guadalupe Mountains, Mammoth Cave, Sequoia/Kings Canyon, Shenandoah, and Yosemite NPs, and Joshua Tree and Pinnacles National Monuments. Some ozone occurs naturally, but most of the ozone in the atmosphere results from the photochemical reaction of man-produced hydrocarbons, nitrogen oxides, and sunlight.

Even Admissible Concentrations Hurt

It is especially significant that some injury to sensitive plant species has been documented at ozone and sulfur dioxide concentrations *below* the National Ambient Air Quality standards. Biological effects research has found ozone effects, which appear as characteristic foliar injury on one or more species of plants and trees in virtually every park surveyed. This suggests that ozone injury is a widespread problem that occurs even at NPS units remote from urban areas.

There also is evidence suggesting that reduced growth and increased mortality of some sensitive species are occurring in some of the more heavily affected areas. Research has found an apparent loss of lichens in two urban parks and effects on these sensitive plants in many parks located near sources of sulfur dioxide. Elevated levels of sulfur and heavy metals have been found in vegetation in several parks.

The Park Service uses the information obtained from the air quality research and monitoring program to guide its participation in the following:

- Resource management planning within the National Park Service.
- Permit review concerning potential effects from increased emissions from proposed new major industrial and energy facilities outside park boundaries.
- Participation with state and local officials and industry in reaching decisions to minimize or eliminate potential impacts to the park resources and to the visitor experience.
- Reviews of environmental impact statements developed by other federal agencies concerning activities that might affect NPS units.
- Regulatory and legislative analyses.
- Development of interpretive programs to inform visitors about the importance and value of the air resource in parks.

- Development of NPS educational courses and materials to inform personnel about air quality roles, responsibilities, and management programs for the protection of park resources from air pollution.

Research's Role in Decisions

Information from the air quality research program is used to support NPS participation in decisions for protecting and managing air resources. In most cases, the air pollution affecting park resources and values comes from outside the parks. NPS concerns and recommendations regarding proposed or existing air pollution sources are directed to the governmental agency that has permitting or regulatory authority. Cooperation also is elicited from industry to ensure protection of NPS resources.

The Clean Air Act requires that the National Park Service be involved in reviewing state implementation plans and designed to prevent significant deterioration of air quality and to protect visibility. The Park Service also is required to evaluate the effects that a new air pollution source might have on nearby park resources. The NPS Air Quality Division has Servicewide responsibility for ensuring compliance with Clean Air Act requirements, in coordination with NPS regional offices and park units.

This is just one of the ways the Service is working "to conserve the scenery and natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (16 U.S.S.1). Our hope is to maintain the Park System's national treasures at a quality level that will continue to astound and inspire visitors. We hope they will also place a high value on knowing these resources are being protected and preserved for future generations.

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