INTERAGENCY MONITORING OF PROTECTED VISUAL ENVIRONMENTS

IMPROVE

Volume 4, No.1 Winter 1995 April 1995

IMPROVE MONITORING UPDATE

Preliminary data collection statistics for the Winter 1995 season (December, January, and February) are:

Data Type	Collection Percentage
Aerosol Data	93%
Optical (transmissometer) Data	95%
Optical (nephelometer) Data	92%
Scene (photographic) Data	91%

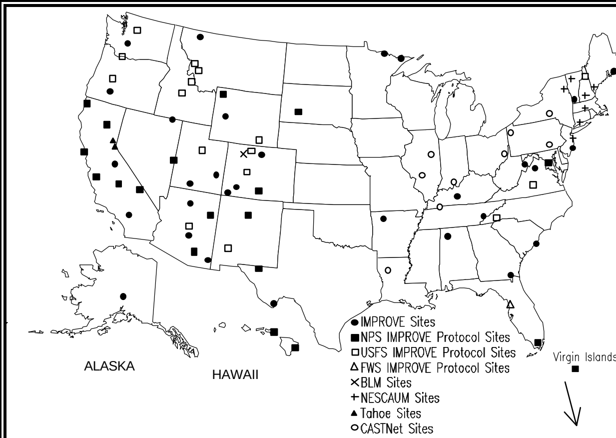


Figure 1. IMPROVE and IMPROVE Protocol Sites April 1995

Figure 1 is a map of the current IMPROVE and IMPROVE Protocol sites. The CASTNet program has adopted IMPROVE optical and scene monitoring protocols, but is using different aerosol monitoring techniques. Aerosol data for Summer 1994 are complete and seasonal summaries have been submitted to the NPS.

The Seasonal Summary Reports of Nephelometer-Based Visibility Data for Summer 1994 and Fall 1994 have also been delivered to the NPS.

The National Park Service funded a summary report regarding intensive photographic visibility monitoring performed at Isle Royale National Park, Michigan, during the summer and fall of 1991 and 1992. Two automatic visibility monitoring systems operated during the period, a 35mm camera system and an 8mm camera system, both viewing Thunder Bay, Ontario. A report that summarizes the visual conditions observed during the two-year period has been delivered to the NPS.

The National Park Service also provided funding for a summary report concluding the scene monitoring effort at Voyageurs National Park, Minnesota. The report describes the results of photographic monitoring from Summer 1990 through Spring 1991 when scene monitoring was discontinued. During this time, two 35mm cameras and one 8mm time-lapse camera documented the visual conditions within the park and the emissions from local industrial sources. The report was completed and delivered to the NPS in January 1995.

The Fish and Wildlife Service has funded the installation and operation of a time-lapse video monitoring system at Moosehorn National Wildlife Refuge, Maine. The system is documenting the visual conditions within the refuge and the dynamics of the plume from the nearby Georgia Pacific Pulp and Paper Plant.

VISIBILITY NEWS....

IMPROVE STEERING COMMITTEE MEETING

The IMPROVE Steering Committee meeting was held at the University of California - Davis (UCD) on February 16 and 17, 1995. A major recommendation from the meeting was the discontinuation of 35mm photographic monitoring at IMPROVE and IMPROVE protocol sites once a continuous five year photographic record has been compiled. Experience has shown that after five years of monitoring, a representative set of visual conditions has been captured and additional photographic monitoring yields little additional information for a given site. The exceptions are sites where the visibility is changing or expected to change due to the addition of new emission sources or source controls. The agencies that operate the affected IMPROVE sites, the National Park Service and Forest Service, are currently acting on the Steering Committee's recommendation.

SPECIAL STUDIES

Dallas-Fort Worth Winter Haze Project

The field monitoring component of the Dallas-Fort Worth Winter Haze Project (DFWWHP) Defining Study was completed with two winter intensive monitoring periods in December 1994 and February 1995. Data are now being compiled and will be analyzed over the upcoming months.

VISIBILITY NEWS continued on page 5

Feature Article

VISUAL AIR QUALITY IN BIG BEND NATIONAL PARK, TEXAS

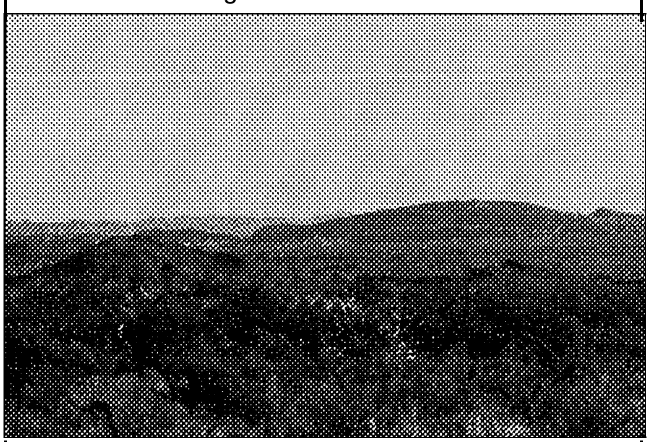
by the Division of Interpretation and Visitor Services, Big Bend National Park

Over the past 120 years, many national park areas have been set aside to protect their grand scenic beauty. In places like Big Bend, you can discover our country's most precious natural, cultural, and recreational resources. Big Bend's spectacular desert, mountain, and canyon vistas provided a strong incentive for the people of Texas to have this area preserved as a national park. Early on, they realized that extraordinary views such as those from the South Rim or Mariscal Canyon were valuable national treasures deserving protection.

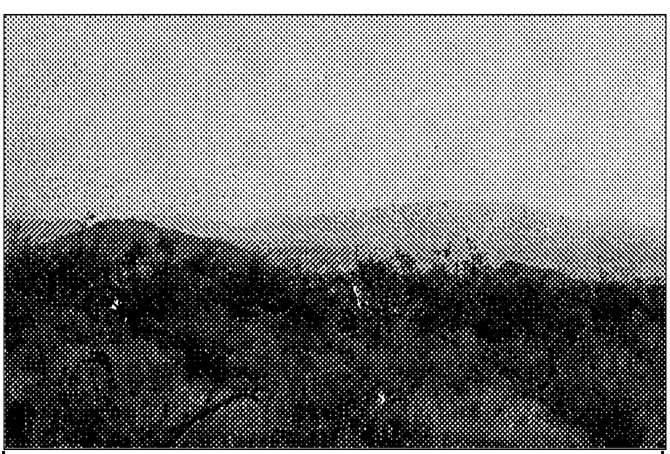
Thousands of people visit each year in search of the spiritual renewal afforded by the park's scenery. Visitors continue to be inspired by the natural vistas and place a high value on knowing that these visual resources are being protected for the enjoyment of future generations. However, air pollution is damaging the views and can destroy many of the values visitors seek.

In spite of Big Bend's remote location it is not immune to urban problems such as air pollution. Early photographs of the "Big Bend" documented magnificent, clear details of distant landscapes. Long-time residents and visitors verify stories of unparalleled clarity and unlimited visibility. However, by the 1970s, noticeable changes were making their incremental mark upon the park's scenic treasures. Pale grays began to replace the color of distant landscapes. Outlined images began to replace the vivid detail of craggy mesas and rough cliff faces. On the worst days, mesas and cliffs became completely obscured.

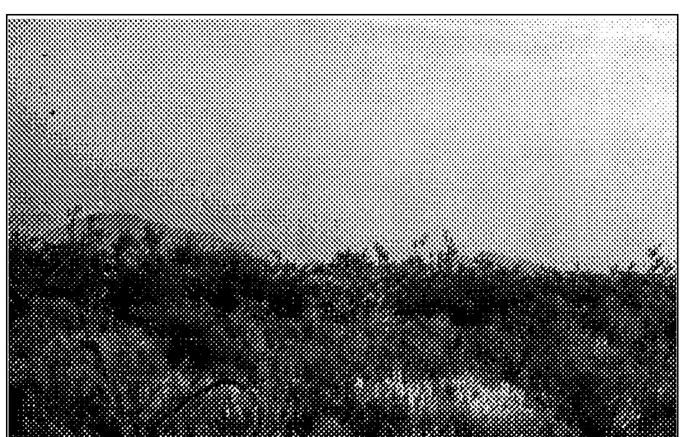
Three photos of the same scene illustrate dramatic differences in air quality and visibility in Big Bend National Park.



A pristine view,



a moderately hazy view,



and a poor view.

In 1977, Congress adopted the nation's first visibility requirements for national parks by amending the Clean Air Act. Big Bend was one of the first parks to receive funding to monitor and evaluate air quality and has conducted an air quality program since 1978. Goals of the program initially focused on establishing baseline data to compare and contrast future air quality trends. The program now includes instrumentation to fulfill IMPROVE protocols; a transmissometer, automatic camera system, and IMPROVE modular aerosol sampler in addition to acid rain and ozone monitors. (See "Current Air Quality Instrumentation" insert and pictures of instrument installations on pages 6 and 7.) Data collected at Big Bend focuses on identifying pollutant types and amounts and their effects on natural resources (including visibility) at Big Bend National Park.

Visual Range

Unpolluted air theoretically allows one to see large objects, such as mountain ranges, up to 240 miles away. During summer at Big Bend, pristine vistas occur only four percent of the time. Generally, park visitors find moderately hazy views. Six percent of the time in summer, visibility is extremely poor and visitors cannot see more than 30 miles.

Big Bend's visibility varies significantly by season, with the summer season typically having the poorest visibility and the winter season the best. There are some days of the year when Big Bend National Park experiences the filthiest air, in terms of visibility impairment, within any western national park.

Nearly half of the visibility impairment in the park is attributed to sulfate pollutants in the atmosphere. Studies have shown that when sulfur dioxide emissions are transported over long distances they are converted to sulfates which are primary contributors to reduced visibility.

In addition to sulfates, other compounds that reduce visibility include organic carbons, nitrates, and wind blown soil particles.

Pollution Sources

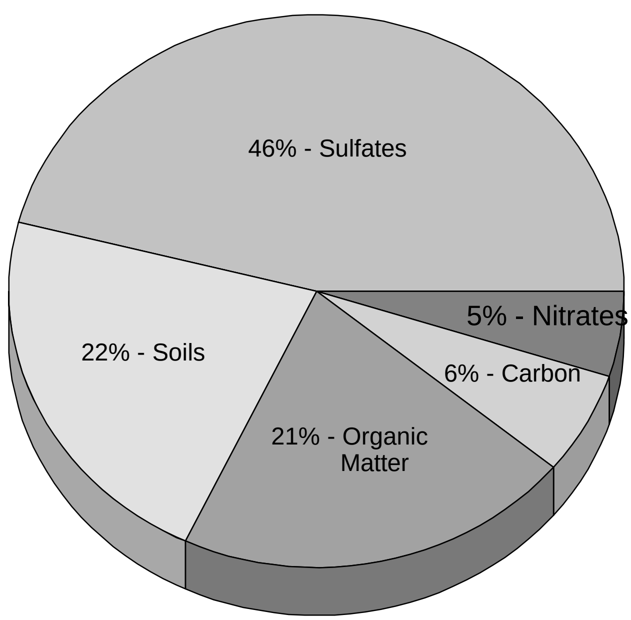
As illustrated on page 4, four major source regions contribute to Big Bend's visibility degradation. The largest contributor is east-central Mexico, particularly the industrial centers of Monterrey/Monclova and the Carbon I and II power plants near Piedras Negras. Power plants are major producers of sulfur and nitrogen oxides, the precursors of sulfates and nitrates. Zinc, one of the particulates detected at Big Bend, acts as a "fingerprint" to implicate the metal smelters at Monterrey.

A region labeled as central Mexico is the second largest contributor to visibility-reducing sulfates in Big Bend National Park. A distant third is the Gulf Coast petroleum processing region of the United States and Mexico and the fourth is closer to home, where wind-blown soil contributes to reduced visibility. At times, the Big Bend area records the heaviest windblown soil concentrations in the United States.

Researchers calculate that approximately 75% of the visibility impairment in this area originates from Mexican sources. This is due to predominate weather patterns, the easy transport of sulfate pollutants over long distances, and large emissions of sulfur dioxide. The remaining air pollution comes from sources in the United States including Houston/Galveston, El Paso, and the Midwest.

In 1993, National Park Service officials learned about the expansion of a coal-fired power plant in Coahuila, Mexico. Although they comply with Mexican law, neither the existing plant, Carbon I, nor the new expansion, Carbon II, have air pollution controls for sulfur dioxide. When Carbon II is completed, it is estimated that this power plant complex will emit 250,000 tons of sulfur dioxide into the atmosphere each year making it the seventh largest source of sulfur dioxide emissions in North America. In the prevailing southeasterly wind

The causes of visibility impairment in West Texas between 1988 and 1991 included:



Nearly half of Big Bend's visibility reduction is due to sulfates. Sulfur dioxide is primarily produced from burning coal, especially in power plants. Sulfur dioxide converts to ammonium sulfate when it comes in contact with moisture in the atmosphere. We see it as a white haze. The Carbon I and II power plants will produce 250,000 tons of sulfur dioxide each year.

MAJOR POLLUTION SOURCES

1 Four major source regions contribute to Big Bend's visibility degradation:

East-central Mexico, particularly the industrial centers of Monterrey/Monclova and the Carbon I and II power plants near Piedras Negras.

Located 130 miles southeast of Big Bend, Carbon I and II are coal-fired power plants designed to produce about 2,600 megawatts of electricity once Carbon II becomes completely operational in 1995 or 1996. According to the NPS, the plants will emit 250,000 tons per year of sulfur dioxide and could reduce visibility at Big Bend by 60 percent.

2 A region labeled as Central Mexico is the second largest contributor to visibility-reducing sulfates in Big Bend National Park.

3 A distant third is the Gulf Coast petroleum processing region of the United States and Mexico.

4 Fourth is closer to home where wind-blown soil contributes to reduced visibility. At times, the Big Bend area records the heaviest windblown soil concentrations in the United States.

pattern of the area, Big Bend sits directly downwind, 130 miles away from Carbon I and II. The imminent addition of 130,000 tons per year of sulfur dioxide from Carbon II into the atmosphere poses a significant threat to the region's air quality.

Big Bend celebrated its 50th anniversary during the summer of 1994. Employees from the park's earliest days attended, along with CCC crew members who had helped build the first roads and bridges into the mountains. Comments regarding the deterioration of the park's air quality were often heard from these original Big Benders, with an expression of profound regret for what has been lost.

The National Park Service serves as the steward of America's finest resources, including scenery and air quality. A reality of the 1990s is that this is an increasingly difficult task to do, and impossible to do alone. If park resources are to be conserved for future generations, the public must become involved.

AIR QUALITY PERSONNEL AT BIG BEND

The success of air quality monitoring programs at IMPROVE and IMPROVE protocol sites greatly depends on the dedication of the local air quality staff. At Big Bend National Park, **John Forsythe**, Physical Science Technician, is currently the primary air quality/visibility station operator. John is responsible for routine site servicing and operations that include instrument maintenance, calibrations, and troubleshooting. He documents on site system performance and communicates regularly with the air quality contractors.

John and his wife Melissa moved to Big Bend in 1988 after enjoying the desert for many years during vacations. It simply became impossible to leave.

John worked for one year at the Chisos Mountains Lodge as purchase agent before beginning his NPS career as a seasonal firefighter. Later he contracted to perform the first ever complete spring survey of the 800,000 acre park, often spending entire weeks alone and on foot in the desert. He then worked with the Law Enforcement Division as a dispatcher, and more recently as a biological technician monitoring endangered species such as peregrine falcons, Big Bend gambusia (fish), and Mexican long-nosed bats.

Air quality efforts at Big Bend are also supported by other dedicated staff members including **Betty Alex**, GIS Technician, who currently supervises all park air quality programs and **Raymond Skiles**, Wildlife Management Technician, who installed several of the air quality systems now in use.

VISIBILITY NEWS continued from page 1

Southeastern Aerosol and Visibility Study (SEAVS)

The Southeastern Aerosol and Visibility Study (SEAVS) to be conducted this summer in Great Smoky Mountains National Park is a collaborative effort among the National Park Service (NPS), Electric Power Research Institute (EPRI), electric utilities, universities, and consulting firms. The primary study objectives are:

- To determine the contribution of major constituents (e.g., dust, sulfate, organics, and associated water) to the total particle mass and the light extinction (i.e., haze) for a regionally representative location in the southeastern U.S.
- To produce a field data set under humid eastern conditions to test and improve models that simulate aerosol composition and light scattering.

A key component of the study will be to develop, reconfigure, and enhance monitoring systems and data and simulation methods to assess the relationships between emissions and fine particle concentrations in the east.

Most existing monitoring systems were originally developed to study visual air quality in the arid west. Modifying existing systems and designing new ones to better characterize eastern aeorosols, where high humidity, organics, and other factors influence fine particles differently then in the west, will provide the study participants with continuing challenges. The knowledge gained from this study will provide vital new information to address a wide range of air quality concerns and to support regional assessment programs such as the Southern Appalachian Mountains Initiative (SAMI). The SEAVS field program is currently scheduled for six weeks during July and August 1995.

For further information on SEAVS, contact Pradeep Saxena at EPRI or Bill Malm at the NPS.

Mount Zirkel Reasonable Attribution Visibility Study

The one-month winter intensive for the Mount Zirkel visibility study was completed during early February through early March 1995. Aerosol, visibility, and meteorological measurements were collected at sites throughout the Yampa River drainage in northwestern Colorado. The harsh environmental conditions of the Rocky Mountains during the winter period presented monitoring challenges to both the service personnel and the equipment. Annual monitoring continues at selected sites within the region. Following analysis of the data collected during the winter intensive, preparations for two summer/fall intensives will be finalized.

CURRENT AIR QUALITY INSTRUMENTATION AT BIG BEND

WET DEPOSITION MONITOR Installed 1980
Precipitation chemistry is monitored as part of the National Atmospheric Deposition Program (NADP). Precipitation samples collected and initially analyzed at the park are sent to the Central Analytical Laboratory of the Illinois Water Survey for additional chemical analyses. Big Bend has been monitoring precipitation chemistry since 1980, longer than any other site in Texas.

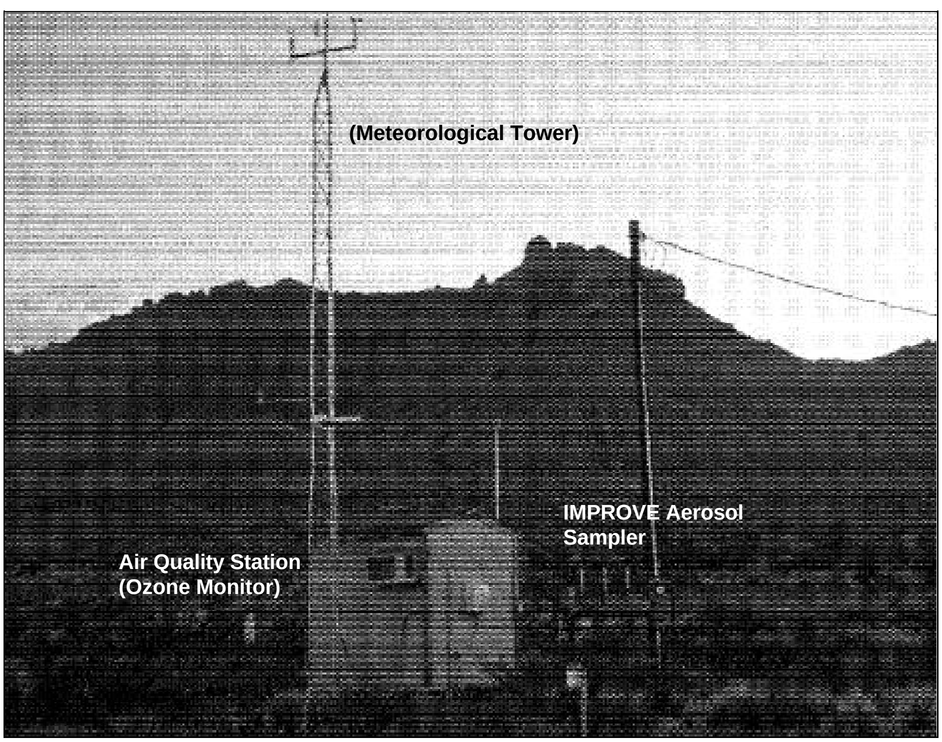
AUTOMATIC CAMERA SYSTEM Installed June 1986
The automatic 35mm system is mounted at Panther Junction and takes photographs of a vista NE towards Dagger Mountain. Photographs are taken each day at 9:00 a.m., 12:00 noon, and 3:00 p.m.

AEROSOL SAMPLER Installed March 1988
The IMPROVE modular aerosol sampler collects samples for 24 hours every Wednesday and Saturday. The filters trap substances such as sulfates, nitrates, organic carbon, and soil. The filters are then analyzed at the University of California at Davis (UCD). All aerosol data are forwarded to the NPS Air Quality Division for further analyses.

TRANSMISSOMETER Installed December 1988
The transmissometer transmitter is located near Grapevine Hills and sends a light beam to the receiver telescope installed at Panther Junction. Transmissions occur for 10 minutes each hour, measuring the amount of light scattered or absorbed by particles and gasses in the atmosphere. Data is collected and transferred via satellite to Air Resource Specialists (ARS) in Fort Collins, Colorado, where it is compiled and forwarded to the NPS Air Quality Division for further analysis.

OZONE and METEOROLOGICAL MONITORS Installed September 1990
Located at the K-Bar research area, this equipment continuously measures atmospheric ozone and meteorological conditions.

AIR QUALITY STATION and IMPROVE AEROSOL SAMPLER



The air quality station and IMPROVE aerosol sampler are located in the K-Bar research area at Big Bend National Park approximately 4.5 km south of the Panther Junction Visitor Center.

TRANSMISSOMETER

Transmitter Station

The transmissometer transmitter station is located in the north-central section of Big Bend National Park on a low ridge in the Grapevine Hills approximately 6 km north of the Panther Junction Visitor Center and 4.75 km from the transmissometer receiver station.

Receiver Station

The transmissometer receiver station is located on the lower north side of Lone Mountain approximately 1 km north and 1 km west of the Panther Junction Visitor Center.

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First Class Mail

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IMPROVE Steering Committee members represent their respective agencies and meet periodically to establish and evaluate program goals and actions. IMPROVE-related questions within agencies should be directed to the agency's Steering Committee representative. Steering Committee representatives are:

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