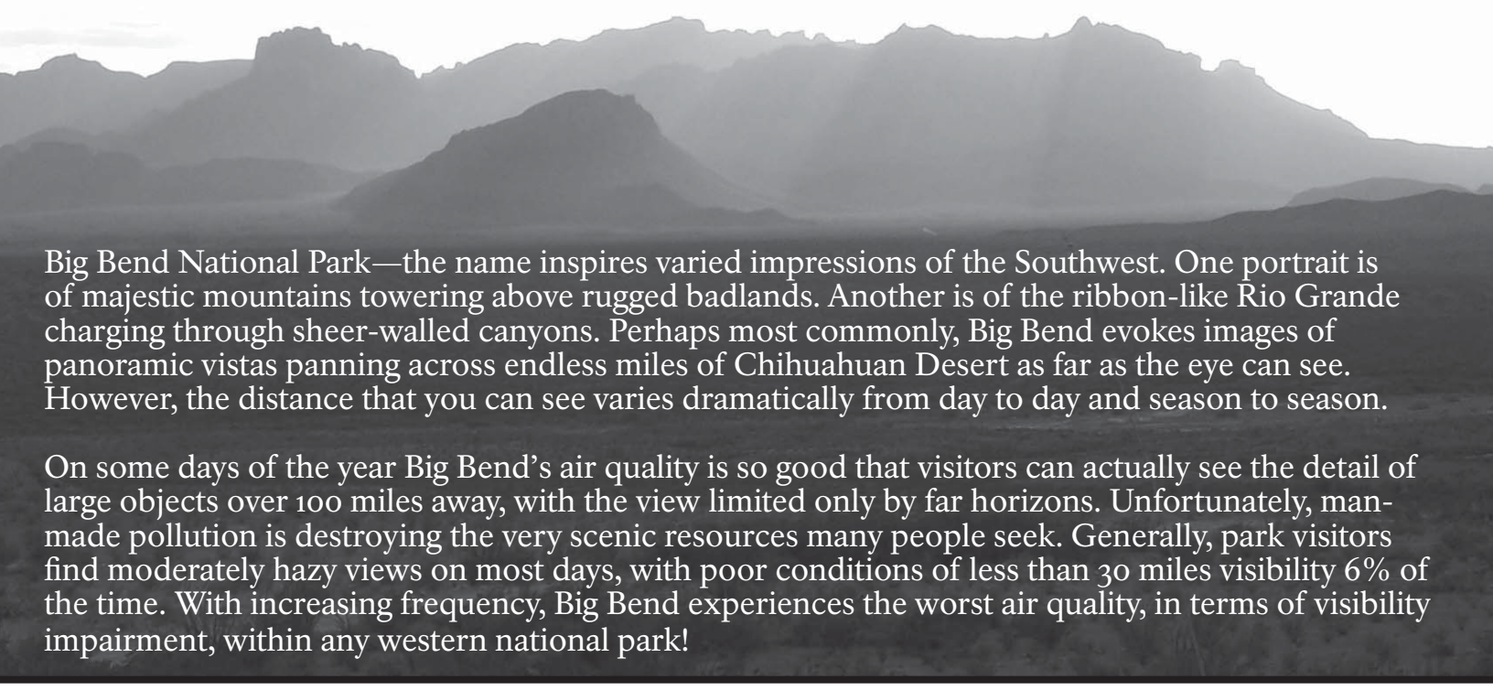
Up in the Air

Air quality issues in the Big Bend



Big Bend National Park—the name inspires varied impressions of the Southwest. One portrait is of majestic mountains towering above rugged badlands. Another is of the ribbon-like Rio Grande charging through sheer-walled canyons. Perhaps most commonly, Big Bend evokes images of panoramic vistas panning across endless miles of Chihuahuan Desert as far as the eye can see. However, the distance that you can see varies dramatically from day to day and season to season.

On some days of the year Big Bend's air quality is so good that visitors can actually see the detail of large objects over 100 miles away, with the view limited only by far horizons. Unfortunately, man-made pollution is destroying the very scenic resources many people seek. Generally, park visitors find moderately hazy views on most days, with poor conditions of less than 30 miles visibility 6% of the time. With increasing frequency, Big Bend experiences the worst air quality, in terms of visibility impairment, within any western national park!

National Parks and the Clean Air Act

In 1970, Congress passed the Clean Air Act; amendments to the act were passed in 1977 and 1990. The goal of the Act is safe and acceptable ambient air quality. The Clean Air Act includes special provisions to help protect air quality in national parks and other federal lands. The act outlines federal land manager responsibilities, including participation with regulatory agencies in decisions that might affect air quality in federally-protected areas. It directs that "Primary" air standards be set to protect public health. "Secondary" standards protect the national welfare, including resources and values found in the national parks. For "dirty" or non-attainment areas of the country, the Act directs that "reasonable further progress" be made toward attainment of the standards.

For "clean" regions, the Act seeks to "prevent the significant deterioration" of air quality, particularly in areas of special natural, scenic, or historic values. These regions are classified as "class I areas" and include many western national parks, one of which is Big Bend. By enacting clean air legislation, Congress expressed the national desire to preserve the scenic values we have come to expect in our national parks.

Monitoring and Data Collection

In spite of Big Bend's remote location and presumed immunity to such urban problems as air pollution, noticeable changes in the park's air quality appeared during the 1970s.

In response to this impending threat and the congressional mandate to preserve scenic values, park managers began an air monitoring program in 1978. Big Bend's monitoring program includes an assortment of data collection systems:

Aerosol Sampler
A "vacuum cleaner" inhales air for 24 hours twice per week. Filters are analyzed for substances such as sulfates, nitrates, organic carbon, and soil.

Automated Camera System
A permanently mounted camera that takes photos of the same distant scene at 9:00 am, 12 noon, and 3:00 pm each day, providing a daily account of visibility.

Ozone Monitor
A device that measures ozone, a potentially harmful form of oxygen, in the atmosphere on a continuous basis.

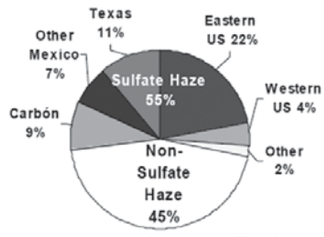
IMPROVE
The IMPROVE (Interagency Monitoring of Protected Visual Environments) program is a cooperative air quality monitoring effort between federal managers; regional, state, and tribal air agencies and the Environmental Protection Agency. The IMPROVE monitoring program was established in 1985 to aid in the implementation of the 1977 Clean Air Act goal of preventing future and remedying existing visibility impairment in 156 Class I areas.

National Atmospheric Deposition Program
Part of a nationwide system which monitors trace elements of metals and chemicals found in precipitation samples. Big Bend has been monitoring precipitation chemistry, including acidity, since 1980, longer than any other Texas site.

Particulate Monitor
Two machines which determine the amounts of very tiny particles in the air. Current research shows these particles may be very harmful to health, no matter what the particle is made of.

Current Knowledge

Dagger Mountain
***Above*: viewed under poor visibility conditions.**
***Below*: Excellent visibility conditions.**



Sources of sulfate pollution on the haziest days

After years of data collection and analysis, researchers are now able to interpret the transport and transformation of pollutants that contribute to the park's reduced visibility.

1978–1999
The first 21 years of air quality monitoring in Big Bend helped scientists to understand large scale air flow patterns and to identify what kinds of pollutants were contributing to declining visibility.

Air quality in this area varies significantly by season. Prevailing winter winds are from the north and west, while summer winds are from the southeast. Typically, the winter season has the best visibility, while the summer season has the poorest. During the summer, air masses arriving in this region from the southeast bring the highest concentrations of pollutants and hence the poorest visibility conditions. A typical summer wind pattern for Big Bend may begin two days earlier in East Texas, circulate into Louisiana, dip south along the Gulf Coast, migrate west into Mexico, and finally blow toward the northwest into this area.

Nearly half of Big Bend's visibility reduction is due to sulfates, while organic carbons, nitrates, and wind-blown soil particles account for the remaining components. Sulfur emissions help create a white haze that often diminishes or obscures the scenic landscapes in Big Bend National Park. Sulfate particles form in the atmosphere from chemical reactions of sulfur dioxide gas. Sources of sulfur dioxide include coal-fired power plants, metal smelters, refineries, other industrial processes, and volcanoes.

1999–Present
With a solid base of knowledge concerning air flow patterns and pollutant types, the next step was to identify sources of emission. In 1999, the National Park Service and the U.S. Environmental Protection Agency carried out the Big Bend Regional Aerosol and Visibility Observational (BRAVO) study. Other participating agencies were the Texas Commission on Environmental Quality and the Electric Power Research Institute.

Because sulfates are the major chemical component of visibility-reducing particles, the study focused on sulfate production mechanisms and the relative contribution of sulfur dioxide sources to visibility impairment in Big Bend National Park. The BRAVO study involved a four-month intensive monitoring period from July through October 1999, followed by five years of data analysis and modeling effort.

BRAVO Study Results
Released in September 2004, the BRAVO study results revealed a much more complex situation than was originally imagined. The sulfur dioxide sources of influence on visibility at Big Bend NP are highly variable during the year. The BRAVO study found that, under easterly wind conditions, the eastern United States, Texas, and sources along the northeastern border of Mexico contribute to haze.

On average, during the study period more than half of the sulfate at Big Bend National Park came from the United States, in particular from the eastern United States and Texas.

Eastern United States and eastern Texas sources were the largest contributors to peak particulate sulfate episodes during the BRAVO study period.

Airflow from eastern Texas and the eastern United States into the Big bend is most frequent during late summer and early fall months, when sulfate contributes most to haze.

On average, Mexican sources contributed just over a third of the sulfate.

Regional transport results in the mixing of emissions from distant sources which can be more than 1000 km apart.

What Can You Do?

Get Involved and Informed
Let people know that you care. Learn about local efforts and issues. Public libraries contain references on various topics addressing air pollution. Talk to your state or federal environmental agency to become familiar with air quality issues in your area.

For more information on air quality in Big Bend National Park visit the park website at http://www.nps.gov/bibe/ or write to:

Superintendent
Big Bend National Park
PO Box 129
Big Bend, Texas 79834

During your visit to Big Bend join a ranger for a guided walk or evening presentation to learn more about issues affecting park resources.

Get involved in local efforts by supporting ballot measures and candidates sensitive to air quality issues.

Reduce Your Carbon Footprint
Since automobiles are a major source of air pollution, how you drive and care for your car is important. Use an energy-conserving grade motor oil, use reformulated or "clean" fuels, and drive at a medium speed. Most cars operate most efficiently between 35 and 55 miles per hour. Keep your engine tuned and maintain the correct tire pressure.

Electricity generation can be a source of air pollution. Reduce your energy consumption by using energy-efficient lighting wherever possible, at home or work. Ask your utility company about its customer energy conservation program. Purchase energy-efficient appliances.

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