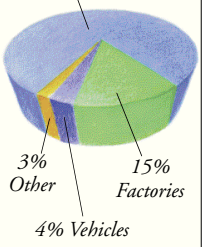
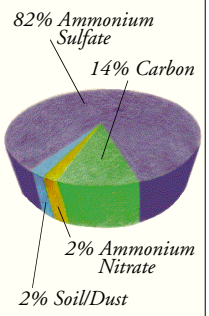
AIR QUALITY

AIR POLLUTION IS SHRINKING SCENIC VIEWS, HARMING PLANTS AND ANIMALS, AND DEGRADING HIGH ELEVATION STREAMS AND SOILS IN THE GREAT SMOKY MOUNTAINS. EVEN HUMAN HEALTH IS AT RISK. MOST POLLUTION ORIGINATES OUTSIDE THE PARK AND IS CREATED BY POWER PLANTS, INDUSTRY, AND MOTOR VEHICLES.



Sources of sulfur dioxide in the Southeast.



Types of particles which contribute to summer haze.

RESEARCH and monitoring conducted in Great Smoky Mountains National Park has shown that airborne pollutants emitted from mostly outside the Smokies are degrading park resources and visitor enjoyment. The burning of fossil fuels—coal, oil, and gasoline—causes most of the pollution. Inadequate pollution control equipment in many power plants, factories, and motor vehicles is the primary problem.

Wind currents moving toward the southern Appalachians transport air pollutants from urban areas, industrial sites, and power plants located both near and far. The height and physical structure of the mountains, combined with predominant weather patterns, tend to trap and concentrate human-made pollutants in and around the national park.

Air pollution travels here from as far away as the Midwest and Gulf states and stagnates in the mountains.

SHRINKING VIEWS AND PARTICLE POLLUTION

Views from scenic overlooks at the park have been seriously degraded over the last 60 years by man-made pollution. Since 1948, based on regional airport records, average visibility in the southern Appalachians has decreased 40% in winter and 80% in summer. These degradations in visibility not only affect how far one can see from an overlook, they also reduce how well one can see. Pollution causes colors to appear washed out and obscures landscape features. Pollution typically appears as a uniform whitish haze, different from the natural blue mist-like clouds for which the Smokies were named.

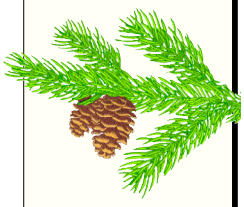
The burning of high-sulfur coal produces tiny airborne sulfate particles which scatter light and degrade visibility.

Visitors seldom see distant mountain ridges during the summer because of this regional haze. Annual average visibility at the park is 33 miles, compared to natural unpolluted conditions of 113 miles. During severe haze episodes, visibility has been reduced to under one mile.

Some park plants at risk from air pollution:

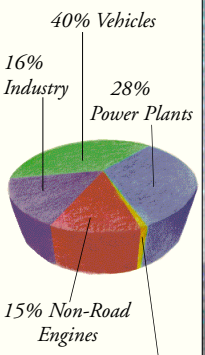
Black cherry tree

Tuliptree

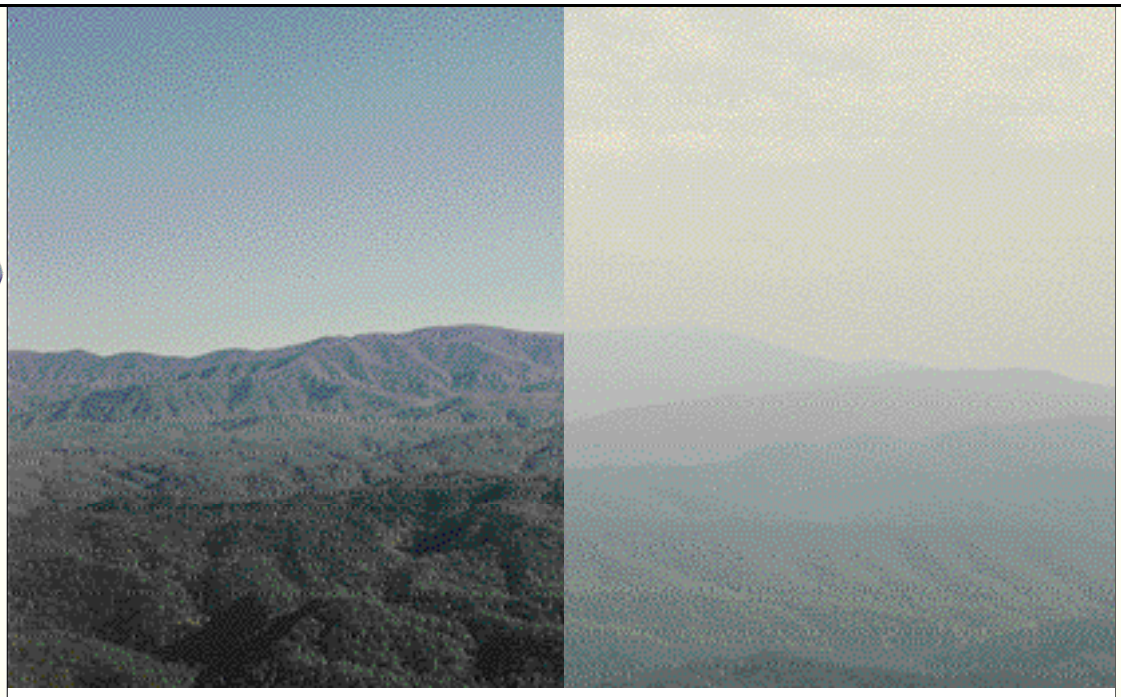


Red spruce

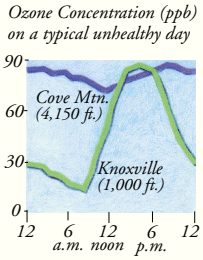
DURING SUMMER, OZONE POLLUTION MAY BE WORSE ON THE APPALACHIAN TRAIL IN THE SMOKIES THAN IN MANY CITIES IN THE EASTERN U.S.



Sources of nitrogen oxides in the Southeast.



Views from Look Rock air quality monitoring station. Photo on left shows day with good visibility. Haziness in photo on right is caused primarily by tiny sulfate particles.



Ozone pollution is higher overall in the mountains than at the lower elevations.

Summer sulfate particle concentrations and summer visibilty have shown improvement over the past decade. Coal burning electricity-generating power plants remain the source of most sulfates.

In a 1996 survey, 74% of summer visitors to the Smokies said clean air was "extremely important" to them during their visit; 84% said scenic views were "extremely important."

GROUND-LEVEL OZONE POLLUTION THREATENS PEOPLE, PLANTS

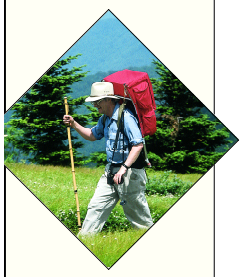
Another air quality problem, ozone pollution, threatens human health and park plants. Not to be confused with the naturally occurring, beneficial ozone layer which filters the sun's ultraviolet rays, ground level ozone is a colorless gas created when nitrogen oxides mix with volatile organic compounds in the presence of sunlight. Power plants, motor vehicles, and factories are the main producers of nitrogen oxides. Most ozone pollution originates outside the park and travels to the Smokies on prevailing winds during the summer months.

Ozone exposures in the park are among the highest in the East and have exceeded levels that threaten human health on over 300 days since 1990. On average, ozone levels over the ridgetops of the park can be up to two times higher than in nearby cities, including Knoxville and Atlanta.

Ozone is a respiratory irritant for humans. Research shows that ozone can cause coughing, sinus inflammation, chest pains, scratchy throat, even permanent lung damage and reduced immune system functions. Children, the elderly, people with existing health problems, and active adults are most vulnerable.

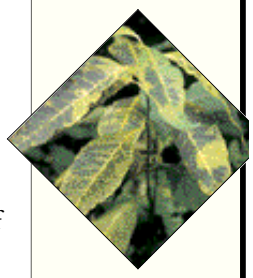
Ozone levels are injuring trees and other park plants. Thirty species of plants showed leaf damage after being exposed to controlled ozone levels similar to those that occur in the park.

To further quantify ozone injury to plants, permanent monitoring plots were set up in the



Ozone and particle pollution threaten public health.

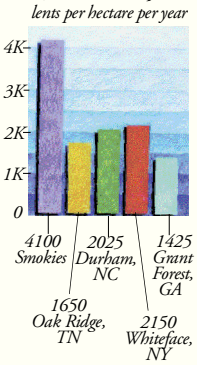
Healthy tall milkweed plant



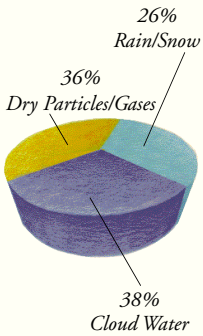
Ozone-damaged tall milkweed

ACID RAIN, ACID CLOUDS, AND DRY DEPOSITION COMBINE TO DUMP OVER 150 POUNDS OF SULFATE AND NITRATE PER ACRE ANNUALLY ON HIGH ELEVATION SITES IN THE GREAT SMOKY MOUNTAINS.

Quantities are equivalents per hectare per year



Great Smoky Mountains National Park receives more nitrogen and sulfur from the air than any other monitored site in North America.



Acid fallout by wet, dry, and cloud sources.

park. In general, researchers found that ozone exposure and damage to plants are worse at the higher elevations. They also documented that up to 90% of black cherry trees and tall milkweed plants in numerous park locations show leaf symptoms of ozone damage. Some of the other plants that show ozone leaf symptoms include tuliptree, sassafras, winged-sumac, blackberry, and cutleaf coneflower.

ACID RAIN, ACID CLOUDS, AND NITROGEN OVERLOAD

Plants and animals in the park are also threatened by airborne sulfur and nitrogen pollution. The park receives the highest sulfur and nitrogen deposition of any monitored national park. These pollutants fall to the ground not only as acid rain, but also as acidic dry particles, gases, snow and cloud water. The average acidity (pH) of rainfall in the park is 4.7, more acidic than natural rainfall (5.0-5.6). Clouds with acidity as low as 2.0 pH bathe the high elevation forests above during much of the growing season.

Research shows that certain high elevation soils in the park are receiving so much airborne nitrogen that they are suffering from advanced nitrogen saturation. This condition limits the availability of forest nutrients, especially calcium, to plants and causes the release of toxic aluminum that can hurt vegetation (red spruce) and streamlife (brook trout). Mountain streams and forest soils are being acidified to the point that the health of the park's high elevation ecosystems is in jeopardy.

FEDERAL MANDATES FOR CLEAN AIR

Congress passed the Clean Air Act in 1970, establishing national policy for preserving, protecting, and enhancing air quality. The 1977 amendments designated all national parks that exceed 6,000 acres as mandatory Class I areas worthy of the greatest degree of air quality protection under the Act. Also under the Act, Congress mandates the federal land manager (Department of Interior Assistant Secretary for Fish, Wildlife, and Parks) to "protect air quality-related values," including visibility, flora, fauna, surface water, ecosystems, and historic resources. It further directs the land manager to "assume an aggressive role in protecting the air quality values of land areas under his jurisdiction... In cases of doubt the land manager should err on the side of protecting the air quality-related values unimpaired for the enjoyment of future generations."

Congress has mandated that park resources be protected from air pollution.

FINDING SOLUTIONS

Recent analysis shows that park air quality is improving for haze, particles, ozone, and acid rain. The Park Service is optimistic that park air quality will continue to improve over the next decade because of existing and new air quality regulations and other actions, including:

- An Environmental Protection Agency (EPA) program took effect in 2004 that reduced nitrogen oxides in most eastern states by 30%. The Tennessee Valley Authority (TVA) installed nitrogen oxide emission controls on the two power plants closest to the park, which reduced emissions by 71%. This lead to less ozone pollution and nitrogen deposition in the park.
- The EPA issued the Clean Air Interstate Rule and the Clean Air Mercury Rule in 2005 for eastern states which will lower electric utility emissions of sulfur dioxide, nitrogen oxides, and mercury by 73%, 61%, and 70%,

High elevation streams and soils have little ability to neutralize or "buffer" acids from sulfur and nitrogen pollution.

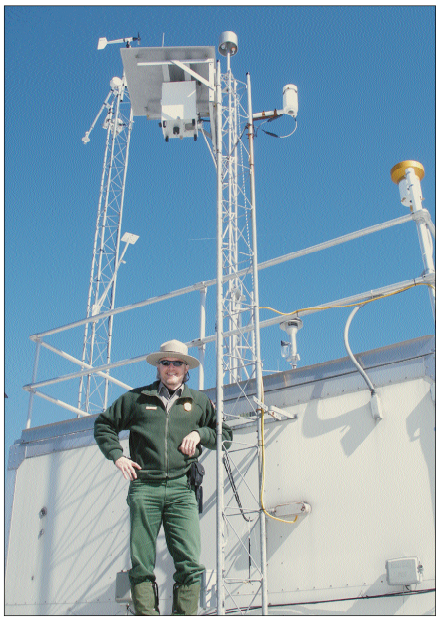
GREAT SMOKY MOUNTAINS NATIONAL PARK HAS BEEN DESIGNATED A "CLASS ONE" AREA WORTHY OF THE GREATEST DEGREE OF AIR QUALITY PROTECTION UNDER THE CLEAN AIR ACT.

The Smokies were named for the natural blue mist-like clouds.

respectively, by 2015. Pollution would be capped at the reduced levels providing long-term protection against air quality deterioration.

• TVA announced in 2001 that they will be installing sulfur dioxide controls (scrubbers) on the two power plants closest to the park by 2010, which will reduce sulfur dioxide emissions from those plants by over 90% and improve the park's air quality by lessening haze, particle pollution, and acid rain.

• The EPA issued the Clean Air Diesel Rule in 2005 that will cut nitrogen oxide emissions from non-road construction and agricultural and industrial diesel-powered equipment by more that 90% by 2015. This rule will also remove 99% of the sulfur in diesel by 2010.



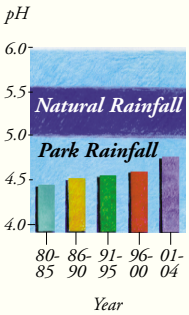
The National Park Service has been monitoring air quality in the park for more than 26 years.

• The Park Service is collaborating with various regulatory agencies to develop visibility, particle, and ozone protection plans for the park by 2007-2008. These plans will ensure that public health standards are attained by 2009-2010 and reasonable progress goals for visibility improvements are achieved by 2018.

PARK SERVICE POSITION

It is the position of the National Park Service that new emission permits for industries and utilities in the region that will adversely impact the park should be granted only when "best available control technology" is planned and when offset reductions are taken to prevent any net increase in pollutants and impacts. The Park Service also supports the strictest possible regulations on vehicle and other emissions which contribute to the problem.

The Park Service is working with state and local agencies, EPA, TVA, industry, and public interests to monitor air quality, increase public awareness, and develop a comprehensive plan to remedy existing and prevent future adverse impacts. Measures include emission offset programs, improved control technology, and determination of emission caps and government health and welfare standards for multiple pollutants. To remedy air pollution problems and restore resources at the park, additional reductions of nitrogen and sulfur emissions are necessary.



Five-year average acidity of park rainfall shows steady improvement since the 1980s.

WHAT YOU CAN DO:

• Conserve electricity at home and at work

• Use energy-efficient appliances and cleaner forms of transportation and fuels

• Keep your vehicles in good operating condition and drive less.

For more information, contact: Superintendent, Great Smoky Mountains National Park, 107 Park Headquarters Road, Gatlinburg, TN 37738 (865) 436-1200, or http://www2.nature.nps.gov/air/WebCams/parks/grsmcam/grsmcam.cfm

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