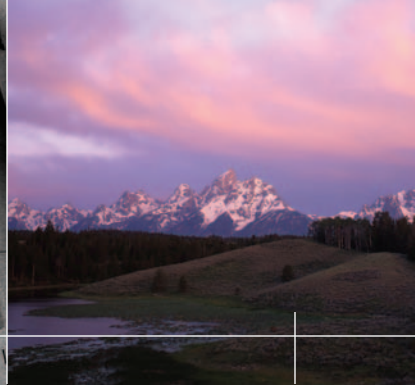
National Parks Conservation Association®
Protecting Our National Parks for Future Generations®

Turning Point

Will we continue to protect against air pollution threats to the Habitats, Health, Heritage, and Horizons of our national parks?

Or will we fail to save them for future generations?



PHOTOS FROM LEFT TO RIGHT: BIG STOCK PHOTO, NATIONAL PARK SERVICE, SCOTT KIRKWOOD, BIG STOCK PHOTO

National Park Sites Located in Poor Air Quality Areas as Designated by the EPA

(continued on inside back cover)

ALABAMA
Russell Cave NM

ARIZONA
Casa Grande Ruins NM
Chiricahua NM
Coronado NMEM
Fort Bowie NHS
Grand Canyon NP
Hohokam Pima NM
Organ Pipe Cactus NM
Saguaro NP
Tonto NM
Tumacacori NHP

CALIFORNIA
Cabrillo NM
Channel Islands NP
Death Valley NP
Devils Postpile NM
Eugene O'Neill NHS
Fort Point NHS
Golden Gate NRA
John Muir NHS
Joshua Tree NP
Kings Canyon NP
Manzanar NHS
Mojave NPRES
Muir Woods NM
Point Reyes NS
Rosie the Riveter NHP
San Francisco Maritime NHP
Santa Monica Mountains NRA
Sequoia NP
Yosemite NP

COLORADO
Rocky Mountains NP

CONNECTICUT
Appalachian NST
Weir Farm NHS

DISTRICT OF COLUMBIA
Chesapeake & Ohio Canal NHP
Carter G. Woodson NHS
Constitution Gardens
Franklin Delano Roosevelt MEM
Ford's Theatre NHS
Frederick Douglass NHS
Korean War Veterans MEM
Lyndon Baines Johnson Memorial Grove
Lincoln MEM
Mary McLeod Bethune House
National Capital Parks
National Mall
National World War II MEM
Pennsylvania Avenue NHS
Potomac Heritage NST
Rock Creek Park
Theodore Roosevelt Island
Thomas Jefferson MEM
Vietnam Veterans MEM
Washington Monument
White House

GEORGIA
Chattahoochee River NRA
Chickamauga & Chattanooga NMP
Kennesaw Mountain NBP
Martin Luther King, Jr. NHS
Ocmulgee NM

INDIANA
Indiana Dunes NL
Lincoln Boyhood NMEM

MAINE
Acadia NP

MARYLAND
Antietam NB
Appalachian NST
Chesapeake & Ohio Canal NHP
Catoctin Mountain Park
Clara Barton NHS
Fort McHenry NM & Historic Shrine
Fort Washington Park
Greenbelt Park
George Washington Memorial PKWY
Hampton NHS
Harpers Ferry NHP
Monocacy NB
National Capital Parks
Piscataway Park
Thomas Stone NHS

MASSACHUSETTS
Cape Cod NS
Adams NHP
Appalachian NST
Boston African-American NHS
Boston Harbor Islands NRA
Boston NHP
Frederick Law Olmsted NHS
John Fitzgerald Kennedy NHS
Longfellow NHS
Lowell NHP
Minute Man NHP
New Bedford Whaling NHP
Salem Maritime NHS
Saugus Iron Works NHS
Springfield Armory NHS

Abbreviations

NB	National Battlefield	NM	National Monument	NRA	National Recreation Area
NBP	National Battlefield Park	NMEM	National Memorial	NS	National Seashore
NHP	National Historic Park	NMP	National Memorial Park	NSR	National Scenic River
NHS	National Historic Site	NP	National Park	NST	National Scenic Trail
NL	National Lakeshore	NPRES	National Preserve	PKWY	Parkway

Table of Contents

Executive Summary

*Air pollution affects nearly everything we value about America's national parks. It can degrade **habitat** for the plants and animals that call the parks home, put the **health** of park visitors and staff at risk, cause physical damage to symbols of our **heritage**, and mar the scenic **horizons** that reveal the grandeur of our land.*

Nearly 30 years ago Congress passed landmark amendments to the Clean Air Act meant to rid our national parks of harmful air pollution and leave them unimpaired for future generations. Although stronger clean air laws have helped lessen the pollution problem overall, reducing levels from near-crisis conditions that existed in many parts of the country in the 1960s and 1970s, much more remains to be done. Today, millions of Americans — more than two in three — live in areas where pollution exceeds limits set by the Environmental Protection Agency to protect health and the environment.

And the challenges of cleaning up air pollution will merely intensify in the coming months and years as demand for energy increases, instability in oil-producing regions abroad continues, and the nation maintains its keen focus on highly polluting fossil fuels.

Most of the four major pollutants affecting the parks — sulfur dioxide, nitrogen oxides, carbon dioxide and mercury — are a byproduct of fossil fuel use. And much of the pollution is generated by coal-fired power plants. Currently throughout the country, more than 150 new coal-fired power plants are in various stages of planning and development. Unfortunately, state and federal regulators are not requiring that these plants use the most effective pollution control technologies available today.

The national parks are at a critical turning point. The decisions we make today about how we meet growing energy demand will affect park air quality for generations to come. We will either remain on the slow but steady path of cleaning up the air in our parks and communities or further impair the habitat, health, heritage and horizons of the nation's treasured parks.

Through individual stories from parks around the country, this report describes how air pollution harms our national treasures. The report also recommends ten specific steps that our government representatives and all of us can take to clean up harmful air pollution and protect our national parks for future generations.

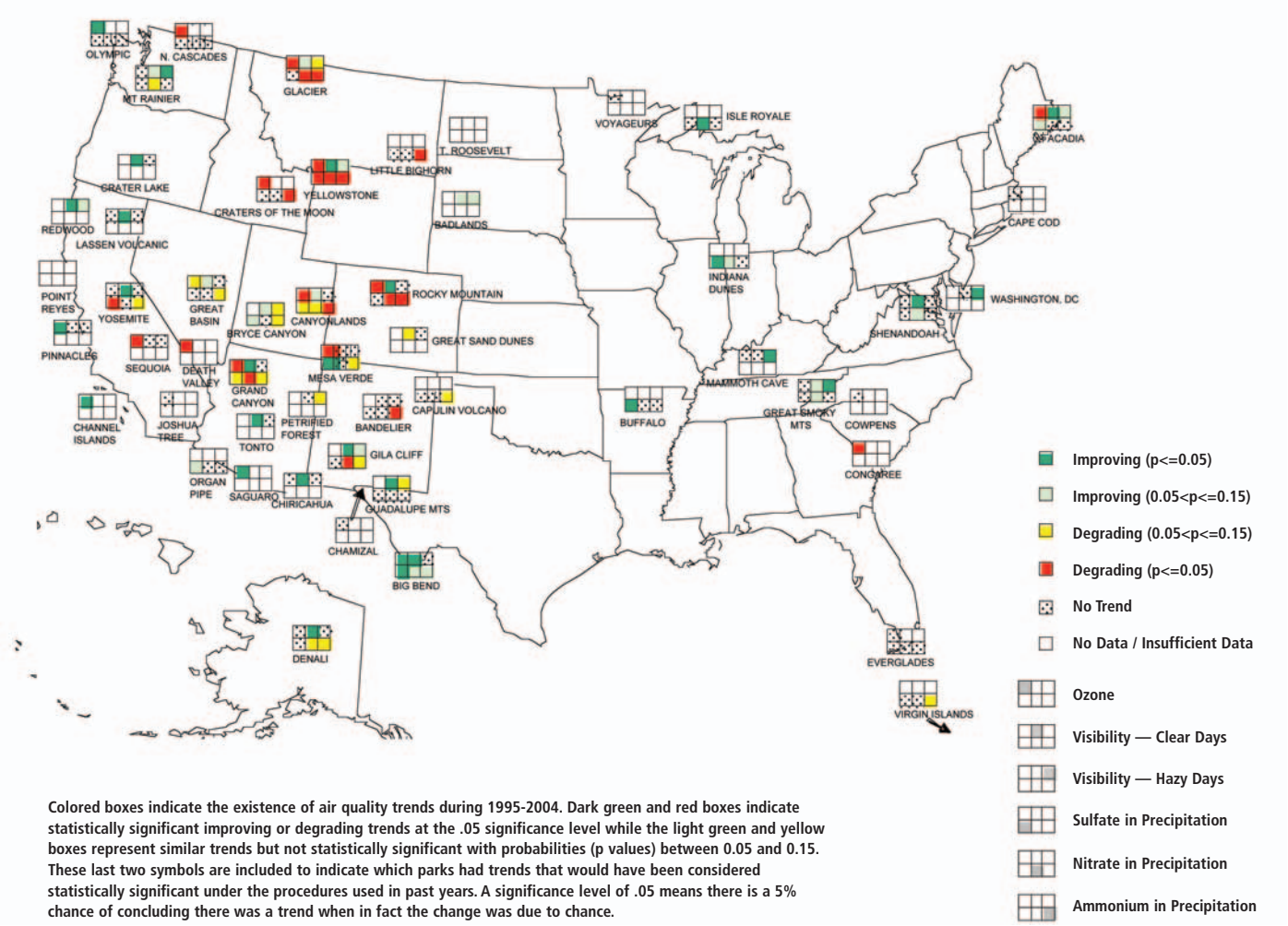
National Parks at a Turning Point

A recent National Park Service analysis shows that air quality in many national parks improved over the past decade. Many serious problems remain, as the stories in this report attest, but the overall trend suggests that if we keep on the path of reducing pollution, the parks will eventually achieve clean air and healthy ecosystems.

Air Quality Trends in National Parks, 1995-2004

SOURCE: NATIONAL PARK SERVICE

FY2005 Annual Performance Report for NPS Government Performance and Results Act (GPRA) Air Quality Goal



Colored boxes indicate the existence of air quality trends during 1995-2004. Dark green and red boxes indicate statistically significant improving or degrading trends at the .05 significance level while the light green and yellow boxes represent similar trends but not statistically significant with probabilities (p values) between 0.05 and 0.15. These last two symbols are included to indicate which parks had trends that would have been considered statistically significant under the procedures used in past years. A significance level of .05 means there is a 5% chance of concluding there was a trend when in fact the change was due to chance.

Introduction

TOP: TOM MARQUIS

OTHERS: NATIONAL PARK SERVICE

Air pollution is among the most serious and wide-ranging problems facing the parks today. Of the 390 parks within the National Park System, 150 are located in parts of the country that fail to meet one or more national healthy air standards. In spite of a 30-year congressional mandate to restore pristine air to the parks for current and future generations, many of America's national parks remain plagued by airborne hazards.

Increasingly, haze diminishes once-majestic views of 100 miles or more to just a few miles. In some parks smog levels rival those in America's most polluted cities. Air pollutants can upset the balance of plant and animal life, while mercury and other toxins poison wildlife. Climate change, driven by emissions of greenhouse gases, threatens to cause some of the most profound and irreversible damage to the parks ever seen: Glaciers will disappear from Glacier National Park, and Joshua trees will disappear from Joshua Tree National Park.

We've made some important advances toward clearing the air. The Clean Air Act's 1990 acid rain program reduced some of the pollution that impairs park vistas and acidifies park streams. Environmental Protection Agency (EPA) limits on emissions from autos and power plants has cut some of the pollutants that cause unhealthful smog and damage trees and plants.

But much more remains to be done. In each of the four major categories described in this report, our national parks show the dire effects of decades of air pollution. More than 30 species of trees found in Great Smoky Mountains National Park show some signs of ozone damage, and not surprisingly this same park has experienced nearly a year's worth of unhealthy air days since 1990. In the national parks of northwest Alaska, some of the most remote of the park system, toxic air pollutants contaminate vital foods for native peoples. And pollution has cut summertime visibility at Blue Ridge Parkway by a whopping 80 percent.

America's national parks are at a turning point. Decisions being made now by our elected officials about which energy resources are developed, and how cleanly those resources are used, will determine whether we advance on the path toward improving air quality or whether we continue to degrade the environment and values of our parks.

Greatest Pollution Threats to National Parks

This report focuses on the four pollutants that play the largest role in threatening habitat, health, heritage, and horizons in the parks: sulfur dioxide, nitrogen oxides, carbon dioxide, and mercury. Each pollutant presents a unique challenge to the parks, the visitors who enjoy them, and the wildlife and cultural history they protect.

All four of these pollutants are released into the air by the combustion of fossil fuels such as coal, oil, and natural gas. Power plants and motor vehicles are by far the largest sources.

	HABITAT	HEALTH	HERITAGE	HORIZONS
SULFUR DIOXIDE - *Acid rain* - *Fine sulfate particles*	Acid rain weakens and kills plants and fish	Sulfates cause lung and heart damage, and even premature death	Acid rain damages historic structures and monuments	Sulfates cause hazy air that obscures park vistas
NITROGEN OXIDES - *Ozone* - *Fine nitrate particles*	Ozone weakens and kills plants and trees	Ozone causes respiratory illness and asthma attacks	Nitrates damage historical structures and monuments	Nitrates cause hazy air that obscures park vistas
CARBON DIOXIDE - *Leading greenhouse gas responsible for global warming*	Global warming is driving some species out of the parks and near extinction	Global warming is accelerating the release of toxins in the food chain	Rising sea levels and stronger storms caused by global warming damage cultural treasures	
MERCURY - *A toxic metal found in coal*	Mercury poisons park streams and the animals who depend on them	Consumption of mercury-laden fish by pregnant women can cause developmental delays in their children	Mercury-laden wildlife threatens traditional subsistence fishing and hunting	

BIG STOCK PHOTO

POWER PLANTS

According to the Energy Information Administration, there are 3,200 electric utility power plants in the United States, the majority of them fueled by coal.[1] Together, they represent the single largest industrial source of the four major pollutants that threaten our parks, emitting 35 percent of the nation's carbon dioxide, 37 percent of its mercury, 23 percent of its nitrogen oxides, and 67 percent of its sulfur dioxide.[2] National parks downwind from large numbers of pollution-belching power plants, such as Great Smoky Mountains, Mammoth Cave, and Shenandoah, are plagued by dirty air that degrades habitat, threatens visitor health, and mars scenic horizons.

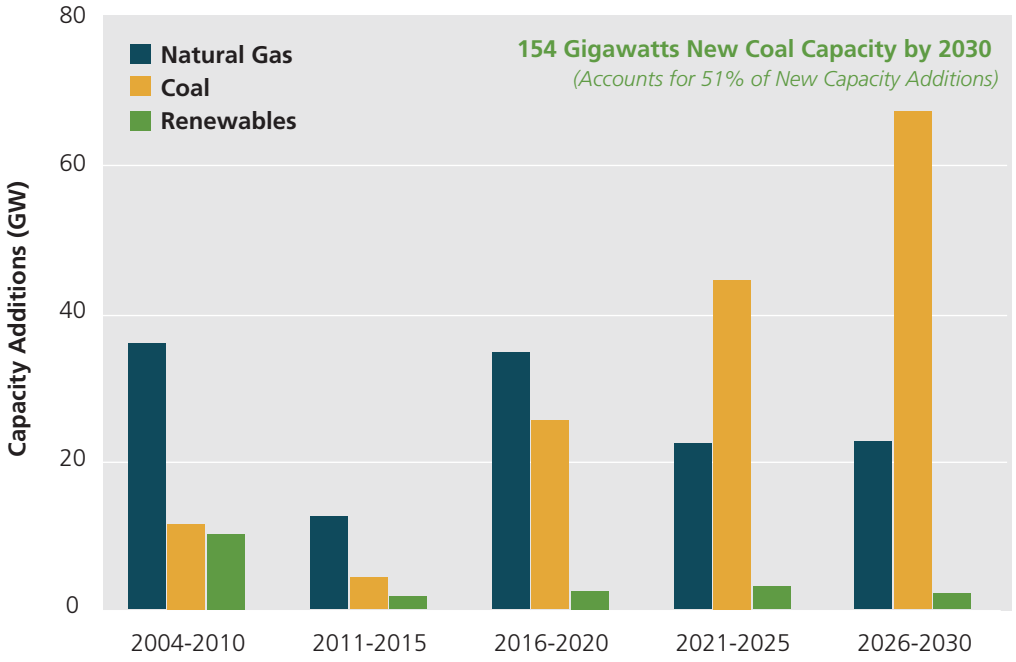
Coal-fired power plants are poised to become an even bigger source of park air pollution in the years ahead. According to the U.S. Department of Energy, there are 154 coal-fired power plants in various stages of development. As discussed later in this report (p. 55), most will fail to use the latest technologies that could cut pollution by more than half.[3]

Coal's resurgence

SOURCE: USDOE

New Electricity Capacity Additions

(EIA Reference Case)



MOTOR VEHICLES

In some areas of the country, particularly California, motor vehicles collectively are the greatest polluters of the parks. While vehicle emissions have been significantly cleaned up over the years, cars, trucks, and buses are still the leading sources of nitrogen oxides. And motor vehicles account for nearly half of the greenhouse gas emissions in the United States.[4] Trucks and buses also emit fine particles from the sulfur in diesel fuel. Nearly every major national park in California — from Yosemite in the north, to Sequoia and Kings Canyon in the Central Valley, to Joshua Tree in the south — suffers from polluted air caused by motor vehicle emissions.

OIL AND GAS DRILLING

While oil and gas drilling is not a major source of the four pollutants on a national scale, it is increasingly a major threat to the pristine and sensitive ecosystems of the Rocky Mountain West, an area that includes some of the nation's premier national parks. Drilling for oil and gas releases significant amounts of nitrogen oxides and particulate matter, adding to the background pollution caused by area power plants and motor vehicles. When drilling occurs on public lands adjacent to national parks, as is happening near Rocky Mountain National Park in Colorado, Yellowstone in Montana, Idaho, and Wyoming, and Grand Teton in Wyoming, habitat and horizons are increasingly degraded.

*Our national parks embody so much that Americans hold dear. They provide **habitat** for plants and wildlife, provide numerous opportunities for **healthful** outdoor activities, celebrate the **heritage** of our nation, and inspire us with scenic **horizons**. Yet each of these values is threatened in some way by air pollution. Restoring and protecting these values is critical to ensuring America's natural and cultural legacies are passed unspoiled to future generations.*

BIG STOCK PHOTO

Recommendations

1. Finish the job of cleaning up outdated power plants

Older coal-burning power plants are the leading park polluters. Current policies will leave half of the nearly 1,200 outdated plants without effective pollution control devices. Congress and the states should make all of these outdated plants install modern pollution controls for nitrogen oxides and sulfur dioxide.

2. Require new power plants to use the most effective pollution controls available

The National Park Service, U.S. EPA, and the states have a legal duty to ensure that new power plants use the best available pollution controls and do not degrade park air quality. They must enforce the laws enacted by Congress to protect the national parks.

3. Protect wildlife by limiting the amount of air pollution deposited in the parks

The Park Service and EPA should determine at what level air pollution begins to damage park wildlife, and should adopt policies to prevent pollution from reaching that level.

4. Ensure that legal limits on park air pollution are not exceeded

States are obligated under the Clean Air Act to periodically measure air pollution levels in the parks to ensure they do not exceed limits set by Congress. Few states have ever done so. EPA must ensure that states do their part to keep park air pollution below legal limits.

5. Eliminate toxic "hot spots" by enacting stronger power plant mercury controls

Current policies will allow many power plants to continue spewing large quantities of toxic mercury. Congress and the states should require maximum limits on toxic mercury pollution from each and every coal-fired power plant.

6. Address climate change by reducing carbon dioxide emissions

Carbon dioxide is the main cause of climate change, but unlike other major pollutants that harm the parks, there is no limit to the amount that may be emitted into the atmosphere. Congress and the states should require meaningful reductions in carbon dioxide emissions, especially from the two largest emitters — coal-fired power plants and motor vehicles.

7. Expand programs to monitor and reduce air pollution in the parks

The National Park Service has many innovative programs to monitor and reduce air pollution, but comprehensive monitoring exists in only a handful of parks. The Park Service should monitor all major pollutants at every park protected under the Clean Air Act. In addition, all parks should adopt the most effective in-park pollution reduction programs.

8. Promote clean, renewable domestic energy supplies

We can meet America's growing energy needs and still have clean and healthy parks. Congress and the states should adopt policies that maximize the use of clean and renewable energy for transportation and electricity generation.

9. Fully fund the National Park System

The national parks lack the personnel and financial resources needed to protect park air quality and combat air pollution-related damages. The administration and Congress should eliminate the Park Service budget shortfall (more than $800 million per year) and ensure full funding of the National Park System.

10. Act as concerned citizens to help clean the air in the parks

As concerned citizens, we can all help improve park air quality by using energy more efficiently in our homes and cars, and by minimizing our contribution to air pollution within the parks.

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Habitat

National parks protect some of the best homes for plants and animals, including endangered and threatened species. Many of these species — like the mangroves and manatees of Florida, grizzly bears of the Rocky Mountains, and giant sequoias of California — uniquely identify America's natural landscape.

Air pollutants such as sulfates, nitrates, and mercury produced by the burning of fossil fuels have been deposited in national parks over many years, creating conditions that weaken and kill some species while harming other wildlife that depend on their existence. Air pollution has made some streams so acidic that species like brook trout are disappearing.

PHOTOS FROM LEFT TO RIGHT: BIG STOCK PHOTO, NATIONAL PARK SERVICE, BIG STOCK PHOTO, BIG STOCK PHOTO

PARK STORIES:

Great Smoky Mountains (TN & NC)

30 species of plants, including 90 percent of black cherry trees, show damage from ozone pollution. The Smokies has the highest levels of sulfur and nitrogen deposition of any monitored park. High elevation red spruce are damaged by acid rain.

Mammoth Cave (KY)

High levels of mercury are found in rare park animals. Endangered Indiana bats have 2-3 times EPA's recommended mercury limit for humans. New power plants could cause even more mercury contamination in the park.

Joshua Tree (CA)

Climate change could eliminate more than 90 percent of the Joshua trees within this century, and contribute to the park being overtaken by invasive grasses.

Rocky Mountain (CO)

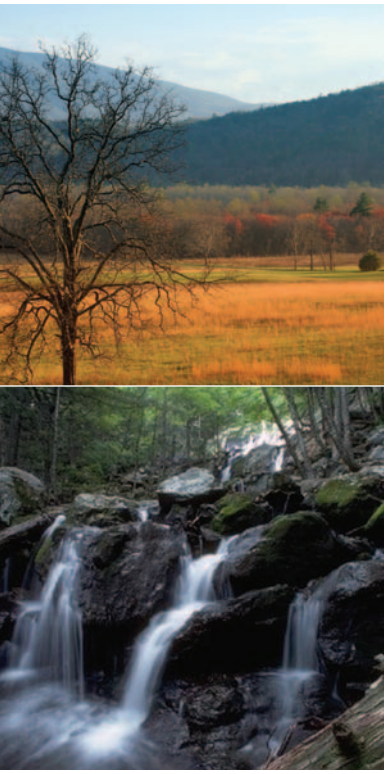
More than 20 years of study have linked nitrogen deposition in the park to changes in the chemistry of water and soils, which in turn harm park plants and animals. Research shows nitrogen pollution is on the rise in the park.

OVERVIEW:

Air pollution can harm animals, vegetation, water quality, and soils in the national parks. Ozone (a product of nitrogen oxide emissions) can break down cellular components of plant foliage, causing injury or death. It can also cause reduced growth in some sensitive plant species. Nitrogen and sulfur compounds can decrease the acid neutralizing capacity in water and soils, which in turn can lead to the death of aquatic animals. Metals such as mercury, as well as other toxic compounds, can bioaccumulate in the food chain, causing neurological and reproductive effects in fish and wildlife.

PHOTO ON FACING PAGE: BIG STOCK PHOTO

Great Smoky Mountains Nati



TOP: BIG STOCK PHOTO

Bottom: Ten percent of streams in the Smokies sampled over an eight-year period were so acidic that they threatened the viability of brook trout populations.

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Great Smoky Mountains National Park contains some of the oldest mountains in the world, formed 200-300 million years ago. The park itself encompasses more than 800 square miles of the Southern Appalachians in Tennessee and North Carolina and features elevations ranging from 875 feet to 6,643 feet.

Abundant rainfall (averaging 55 inches a year in the valleys and 85 inches on some peaks) and high summertime humidity provide excellent growing conditions for an amazing variety of plants: approximately 100 species of native trees, more than 1,400 additional flowering plant species, and at least 4,000 species of non-flowering plants. Forests blanket almost 95 percent of the park; 25 percent is old-growth forest. The park also contains 74 percent of the spruce-fir forests in the southern Appalachians, and is home to the largest remnant red spruce-Fraser fir ecosystem in the world.[5]

The Smokies support an astonishing array of animal life as well. The park is home to more than 200 species of birds, 66 types of mammals, 50 native fish species, 39 varieties of reptiles, 43 species of amphibians, and one of the most diverse populations of lungless salamanders. Mollusks, millipedes, and mushrooms also are found in record variety.

Because of its incredible biodiversity, Great Smoky Mountains National Park has been designated by the U.S. and United Nations as an International Biosphere Reserve.[6] Biosphere reserves are living laboratories for developing the best practices to manage the land in ways that conserve biodiversity.

"Certain high elevation soils are receiving so much atmospheric nitrogen that they are suffering from advanced stages of nitrogen saturation. This condition limits the availability of forest nutrients to plants and causes the release of toxic aluminum that can harm vegetation and stream life."

— NPS, Air Quality in the National Parks, 2nd Edition

Air Pollution & Park Habitat

Great Smoky Mountains National Park has the highest rates of nitrogen and sulfur deposition of any monitored location in North America. As a result, rainfall in the park is 5-10 times more acidic than natural rainfall, and 90 percent of clouds have been found to be unnaturally acidic. Acidic clouds bathe the park's high elevation forests during much of the growing season.[7]

Acidification occurs when nitrogen and sulfur released into the atmosphere from the burning of coal, oil, and gasoline fall to the ground as dry gases and particles, acid rain and snow, and moisture from fog and clouds. Acid deposition changes the chemistry of lakes, streams, ponds, and surrounding watersheds, which in turn affect the algae, vegetation, aquatic invertebrates, amphibians, and fish that live there. The impact is felt all the way up the park's food chain.

Acids in the soil poison microorganisms, as well as trees and other plants.[8] Research shows that some high elevations in Great Smoky Mountains National Park are receiving so much airborne nitrogen that the soil suffers from advanced nitrogen saturation, a condition damaging to the red spruce prevalent in higher regions of the park.[9]

The Smokies also suffer from high levels of ozone pollution — among the highest in the Eastern U.S. Since 1990, ozone levels have exceeded legal limits set to protect health and the environment on more than 300 days.

Studies indicate that 30 species of plants experience leaf damage when exposed to controlled ozone levels similar to those that occur in the Smokies. Up to 90 percent of black cherry trees and tall milkweed plants in numerous park locations show symptoms of ozone damage. In general, researchers have found that ozone exposure and damage are worse at higher elevations.[10]

Left: Example of healthy tall milkweed plant. Milkweed provides essential habitat for eastern swallowtail and monarch butterflies, among other wildlife.

Right: Example of ozone-damaged tall milkweed plant. Ozone enters plant leaves, causing cells to collapse and die.

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NPS Air Resource Management Specialist Jim Renfro discusses the effects that air pollution is having at the park with former NPS Director Fran Mainella and NPCA staff.

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What's Being Done?

Great Smoky Mountains National Park has among the most comprehensive air quality monitoring and research programs of any park within the National Park System. Described as an "outdoor laboratory," the park conducts extensive monitoring and research to determine the status, trends and sources of air pollution in the park, and its effects on park wildlife.

Researchers have been investigating the effects of ozone on plants in the park since the 1970s, and an extensive network of air and water quality monitoring stations has been in operation since the early 1980s. Pollutants monitored by the park include ozone, sulfur dioxide, carbon monoxide, nitrogen oxides and mercury. Long-term operation of these pollutant monitors allows the park to document pollution trends over time, which in turn helps the park develop the most effective strategies to protect critical wildlife habitat.

Rangers maintain exhibits within the park that tell the story of how air pollution harms park resources, where the pollution comes from, and what can be done to protect the park. As capacity allows, they also reach out through ranger-led talks in the park and by participating in regional and national clean air policy forums.

The Park Service also works with students on issues related to air pollution habitat damage. The high elevation site at Purchase Knob is home to the Park Service's Appalachian Highlands Science Learning Center, where middle school, high school, and college students and teachers from many states participate in ozone monitoring. After completing an online training program on how to recognize and rate symptoms of ozone damage in plants, the students and teachers visit the garden site to collect data that is then entered into an Internet database.[11]

Since 2001, more than 300 teachers have been trained to recognize and record plant damage from ozone, and some 450 students have collected data at the Purchase Knob site.

Mayors of 11 counties surrounding the Smokies have created the Regional Clean Air Coalition, with representatives from the federal government, industry, educational institutions, and non-governmental organizations (including NPCA), to help improve air quality in East Tennessee. The coalition educates government, industry, and the public about air quality

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issues, promotes coordination among air quality officials, assists governments in developing and implementing air pollution control strategies, and advises state agencies and legislators on new laws to improve air quality.[12]

"Using students to collect data has been a win-win situation. We have better information to pass onto the researchers who are often only in the park for a couple of weeks each year, and the students gain an in-depth understanding of one of the effects of air pollution in their community."

— Susan Sachs, education coordinator at the Appalachian Highlands Science Learning Center

Mammoth Cave National Park

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Located in central Kentucky, Mammoth Cave National Park protects the world's longest known cave system, which includes five levels of subterranean rooms, narrow passageways, deep shafts, and underground rivers, all some 400-feet underground.

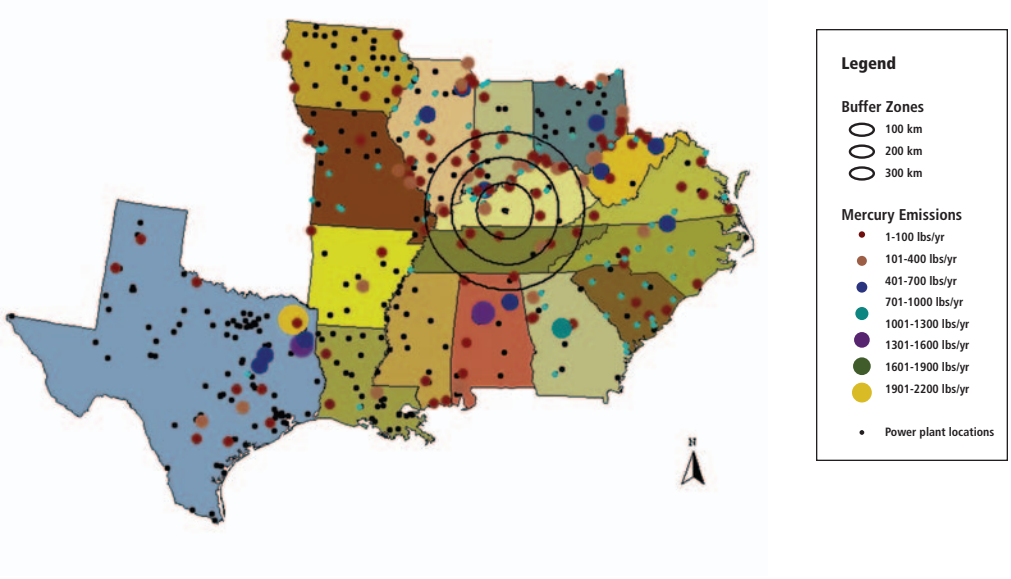
So far, 360 miles of the cave have been surveyed; it may actually extend for 1,000 miles.

The park also protects more than 52,000 acres of land, including rolling hills, prairie, sinkholes, forest-covered ridges, deep valleys, scenic bluffs, and the Green and Nolin Rivers. It is home to 1,200 species of flowering plants, 84 species of trees, and 70 threatened or endangered species. The Green and Nolin rivers boast some of the most diverse fish and freshwater mussel populations in North America. From eyeless cave fish, crayfish, and bats to 200 species of birds, turtles, whitetail deer, bobcats and soon-to-be-reintroduced river otter, Mammoth Cave National Park supports an incredible diversity of life both below and above ground.[13]

Air Pollution & Park Habitat

One of the greatest threats to the park is mercury emitted into the air by coal-burning power plants. When mercury falls to earth, it accumulates in the food chain, damaging the neurological and reproductive systems of fish, birds, and mammals.

Power Plants Near Mammoth Cave



With more than 150 coal-fired power plants in states surrounding the park, Mammoth Cave's wildlife is under serious assault.

SOURCE: NATIONAL PARK SERVICE

Researchers have found that mercury levels in the hair of endangered Indiana bats collected from the cave are two to three times EPA's recommended limit for humans.[14] They believe that the mercury contamination is likely the result of emissions from coal-fired power plants.

The connection between large coal-fired power plants and elevated mercury levels found in areas downwind of those plants was recently confirmed by an EPA study. The most comprehensive analysis of mercury air emissions to date, the study found that 70 percent of the mercury in rain collected at an Ohio River Valley monitoring site originated from coal-burning plants no more than 400 miles away and had been emitted no longer than three days earlier.[15]

To make matters worse, Peabody Energy Corporation, the world's largest coal company, plans to build a 1,500-megawatt coal-burning power plant just 50 miles west of Mammoth Cave National Park. Known as "Thoroughbred," this will be one of the largest coal plants in the region, and will emit an estimated 200 to 300 pounds of mercury a year into the air. The State of Kentucky has recently approved construction of the plant.

What's Being Done?

Mammoth Cave maintains high-sensitivity air monitoring equipment within the park, which Park Service scientists use to assess both the sources and impacts of air pollution. The park also monitors water quality, and investigates how air pollutants are contributing to contamination found in the park's rivers.

Park staff, in cooperation with Western Kentucky University and the U.S. Geological Survey, has launched a three-pronged study of mercury in the park ecosystem. During the first phase, scientists regularly sampled mercury levels in surface and underground water and sediments at 14 locations throughout the park. Now, in the second phase, they are investigating bioaccumulation of mercury in bats, fish, mussels, clams, crayfish, snapping turtles, and insects.

In the third and final phase, they plan to establish the Total Maximum Daily Load of mercury for Mammoth Cave National Park — that is, the maximum amount of mercury the park can receive annually and still protect wildlife and other sensitive resources.[16]

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Joshua Tree National Park

BIG STOCK PHOTO

Two desert ecosystems converge dramatically in Joshua Tree National Park: the dry cactus gardens of the Colorado Desert and the Joshua tree forests of the cooler Mojave Desert. Together, the dramatic landscape hosts more than 700 plant species and a diversity of animals including bighorn sheep, desert tortoise, and more than 200 species of birds.

People of the early Pinto Culture once settled the now-dry Pinto Basin; later, indigenous Indian cultures lived in and traveled through the area, leaving behind rock paintings, pictographs, and pottery. The Lost Horse and the Desert Queen mines are reminiscent of the self-reliant homestead desert life from the late-1800s to mid-1900s.

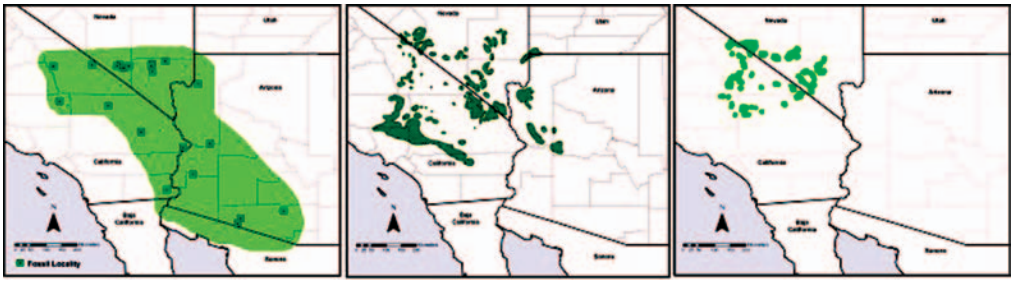
Because of its vast biodiversity, the park has been designated an International Biosphere Reserve. Joshua Tree attracts more than 1.2 million visitors annually.

Air Pollution & Park Habitat

Global climate change is endangering the park's biodiversity and especially the flagship species for which it is named. According to U.S. Geological Survey (USGS) scientists, if warming trends continue over the next 100 years, more than 90 percent of the Joshua trees in the park could be wiped out with no chance of regrowth. The climatic range of the trees will have shifted north, and the rapid rate of change will outpace their ability to reproduce (see maps below).[17]

Past, Present and Future Distribution of Joshua Tree Communities in California, Nevada, Arizona and Mexico.

SOURCE: USGS



A. Ice-age Joshua Tree distribution (Green). Fossils from 11,600 to 20,000 year old packrat middens are shown as squares.

B. Twentieth Century Joshua Tree distribution (Green).

C. Likely twenty-first century Joshua Tree distribution (Green). In order that these future stands remain visible at this scale, future migration rates were assumed to be 10 times actual observed rates.

In place of the trees, invasive grasses and weeds, which grow aggressively with the aid of carbon dioxide and nitrogen from motor vehicle emissions, would dominate the landscape and further reduce diversity of plant and animal life in the park.[18] Unless current trends change, we may need to rename Joshua Tree National Park because Joshua trees will no longer grow within its boundaries.

What's Being Done?

The USGS Biological Resources Division in conjunction with the National Park Service is leading a project to inventory, monitor, and map vegetation in several national parks, including Joshua Tree. In addition, scientists at the Southwest Biological Science Center of the USGS are chartered with the responsibility to evaluate the status of plant and animal species at risk and provide scientific guidance for their conservation and management.

USGS has performed the initial research on the climate change threats to Joshua Trees. Their field work should continue to achieve a deeper understanding of the future Joshua Tree distributions throughout the Mojave Desert. However, the implementation of new research projects, and continuation of existing ones, is dependent upon funding that is currently unavailable from the NPS.

The department of biological sciences at the University of Idaho has several projects underway to better understand and classify the various subspecies of Joshua Trees and the mechanisms of their propagation. This work, combined with ongoing research by USGS, should provide information on how to preserve the Joshua Trees within the park.

Rocky Mountains National Pa

BIG STOCK PHOTO

Established in 1915, Rocky Mountain National Park lies at the highest elevation of any park in the United States. The "lowest" areas in the park are wet, grassy valleys at 8,000 feet, and the tallest peaks reach over 14,000 feet.

The varied landscape of Rocky Mountain National Park creates an amazing range of ecological zones that support a wide variety of wildlife. Elk, mule deer, moose, bighorn sheep, black bears, coyotes, cougars, eagles, hawks, and scores of smaller animals call the park home. Numerous flowering alpine plants create a colorful backdrop to the spectacular mountain peaks and valleys.[19]

Air Pollution & Park Habitat

To the casual observer, Rocky Mountain National Park appears to be a pristine ecosystem, undisturbed by human activities. But the unfortunate fact is that airborne pollutants from power plants, motor vehicles, and agricultural activity are having major adverse impacts on the park environment. Pollutants are altering soil and water chemistry in ways that affect biological communities such as algae, aquatic invertebrates, and soil microorganisms — eventually leading to changes in food chains and forest health.[20]

The most significant harm is occurring on the east side of the park, where winds carry pollution from the valleys below up into the mountains. Pollutants transported into the park include nitrates, mercury, ozone, sulfates, and other compounds.[21]

Of particular concern to the park is nitrogen from power plants, factories, oil and gas wells, fertilizer, and animal feedlots. More than 20 years of study have linked changes in the chemistry of the park's water and soils, as well as damage to park species like the Engelmann spruce, to rising nitrogen levels in the park.[22]

rk

Nitrogen harms native plant communities by acting as a growth enhancing fertilizer in some plants, and by causing toxic effects in others. This creates an imbalance in natural ecosystems as some plants are strengthened and others are weakened. Ultimately, this imbalance can lead to profound changes in the park, including species shifts and disruption of vital ecosystem processes.[23]

High-elevation ecosystems at Rocky Mountain National Park are particularly vulnerable to nitrogen deposition because the park's granite bedrock and shallow soils do not provide much chemical buffering, and the short growing seasons at high-elevations limit the amount of time plants have to absorb nitrogen during the year. These alpine plants evolved under very low nitrogen conditions, so they are less tolerant of excess nitrogen added to the environment by air pollution.[24]

BIG STOCK PHOTO

"In lakes and streams, the impacts of nitrogen deposition grow worse over time as the natural buffering capability of the soil and rock is used up. Eventually, chronic acidification can lead to the loss of many aquatic organisms and entire fish populations. As experience in the northeastern U.S., Canada, and Europe has shown, these changes can be almost impossible to reverse."

— National Park Service, Rocky Mountain National Park, Air & Water Quality

A recent analysis by the National Park Service shows that Rocky Mountain National Park is one of a handful of parks where nitrogen and ammonium pollution are actually getting worse. Concentrations of ammonium, nitrates and ozone (a pollutant linked to nitrogen oxide emissions) in the park increased between 1995 and 2004.[25]

What's Being Done?

Rocky Mountain National Park is taking a proactive approach to understanding pollution problems in the park and developing solutions. The park is a founding member of the Rocky Mountain National Park Air Quality Initiative, which was formed to study and recommend action on air quality issues facing the park. Other members include the Colorado Department of Public Health and Environment, U.S. EPA, and air quality specialists within the National Park Service and National Forest Service.[26]

Working together, scientists from the federal and state agencies, and others from academia, have built a solid foundation of knowledge about nitrogen deposition in the park and how it affects the ecosystem. Their efforts are leading to the development of science-based methods that can serve as a model to protect park habitats from air pollution.

In December 2005 the National Park Service entered into an agreement with the Colorado Department of Public Health and Environment and the U.S. EPA to develop and implement air management policies and programs to reverse the trend of nitrogen-related damage in the park.[27] The agreement called upon the parties to establish by June 2006 a nitrogen deposition goal to protect park habitat.

NATIONAL PARK SERVICE

NPS scientists collect snow samples in the park to determine the amount of air pollution deposited throughout the winter.

NATIONAL PARK SERVICE

Ahead of schedule, in May 2006, the National Park Service announced a "critical load" standard for nitrogen deposition in Rocky Mountain National Park.[28] The term "critical load" refers to the amount of pollution an ecosystem can tolerate before habitat damage begins to occur and is a sound scientific way of determining what level of emissions is sustainable for an area. As per their December 2005 agreement, the state and federal regulators are now expected to work together to seek emissions reductions necessary to meet the nitrogen "critical load" standard for the park.

Health

National parks have thousands of miles of trails for hiking, scenic roads for biking, challenging peaks for climbing, and pristine rivers and lakes for boating. Park visitors routinely rank the opportunity for such outdoor activities as one of the aspects they value most about the parks.

But when people engage in vigorous exercise they breathe deeply and take in more air, which makes them more vulnerable to the effects of air pollution. Children, older adults, and those with respiratory conditions like asthma have the greatest risk. On many summer days when air pollution reaches unhealthy levels, prolonged exercise is actually unsafe in some parks.

NATIONAL PARK SERVICE

PARK STORIES:

Sequoia and Kings Canyon (CA)

Average 61 days per year with unhealthy ozone levels, the most of any national park, which limits healthful outdoor activities for many park visitors.

Joshua Tree (CA)

Experiences chronic unhealthy air, and recorded the highest ozone pollution level of any park in 2004.

Shenandoah (VA)

More than 100 unhealthy air days since 1983. Portions of the park have failed to meet federal clean air standards for ozone pollution — a powerful lung irritant.

Air quality information for all park visitors

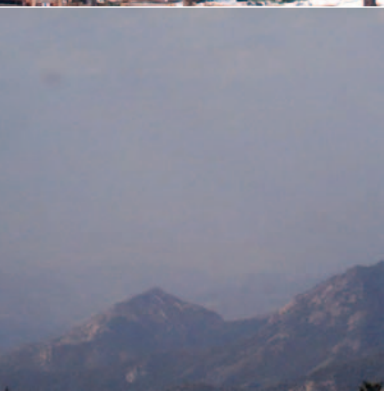
There are 150 national park sites located in areas that fail to meet one or more U.S. EPA air quality standards.

OVERVIEW:

Ozone is a powerful respiratory irritant at the levels often found in some of our national parks during summer months. It can cause shortness of breath, chest pain when inhaling deeply, wheezing and coughing, asthma attacks, and increased susceptibility to respiratory infections. Particle pollution can also exceed federal health limits in some parks. It can cause inflammation of lung tissue, increased hospitalizations and emergency room visits, increased severity of asthma attacks among children, and even heart attacks in some cases.

PHOTO ON FACING PAGE: NATIONAL PARK SERVICE

Sequoia and Kings Canyon Na



TOP: NATIONAL PARK SERVICE

Bottom: "If you can see it, you're breathing it!" Dirty air clouds the view from Giant Forest.

NATIONAL PARK SERVICE

Separately established but administered as one park, Sequoia and Kings Canyon National Parks together make up more than 860,000 acres of continuous parkland in central California. Sequoia, America's second oldest national park, is home not only to the world's largest trees, the giant sequoia, but also to Mt. Whitney, the highest peak in the lower 48 states. It includes superior examples of environments ranging from Mediterranean chaparral to arctic tundra.

Kings Canyon, which covers the most rugged portion of the Sierra Nevada, contains magnificent examples of Sierra glacial canyons and ice-sculpted summits. Together, the parks have been designated an International Biosphere Reserve.

Air Pollution & Park Health

Unfortunately, Sequoia and Kings Canyon are destinations for some of the nation's dirtiest air. The San Joaquin Valley, west of the Sierra Nevada, is a trap for pollutants originating in the valley as well as those that travel on prevailing winds from cities along the central California coast. Frequent weather conditions trap polluted air over the valley at night. Rising daytime air currents then carry the trapped pollutants to the parks, producing some of the worst air quality found anywhere in the National Park System.

Of chief concern are ozone and fine particulate matter, which can impair lung function even in healthy people and especially in those with lung and heart problems. When inhaled, ozone irritates the respiratory system, causing coughing, sinus inflammation, chest pain, and scratchy throat. Repeated short-term exposure to unhealthy levels of ozone may damage children's developing lungs and accelerate the natural decline in lung function that occurs with age. Those most sensitive to ozone include children, the elderly, pregnant women, people with heart disease, people with asthma or other respiratory diseases and, anyone who engages in vigorous outdoor exercise.[29]

In the past six years, Sequoia and Kings Canyon have had the most days exceeding the national health standard for ozone of any unit in the National Park System. During the summer months, these parks have experienced on average 61 days of unhealthy ozone levels. In 2005 the parks saw a small step in the right direction with 54 days of high ozone levels.

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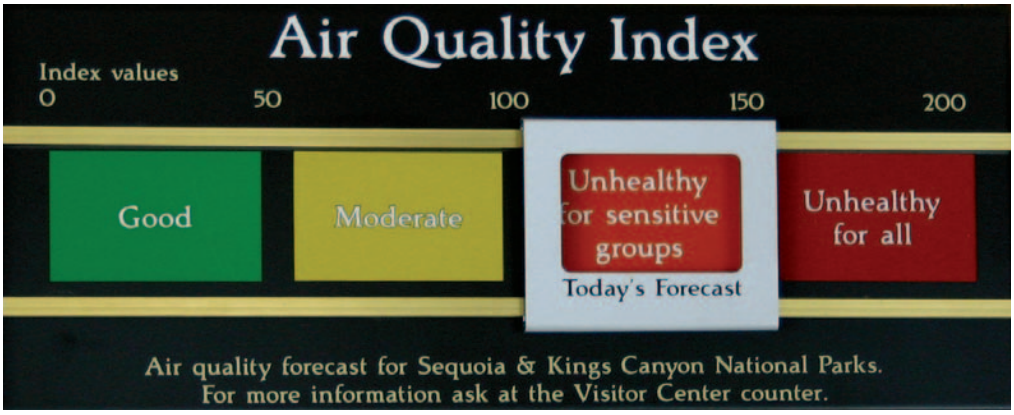


ALAN SPEARS

What's Being Done?

The Park Service has been monitoring ozone in Sequoia and Kings Canyon for more than 20 years and in 2000 began issuing a daily air advisory to warn visitors and employees of unhealthful air. It is part of a larger campaign to educate both employees and visitors about air quality issues in these parks.

This campaign includes exhibits throughout the parks, an educational brochure, regular naturalist presentations that focus on air quality, and outreach to schools. The recently renovated Kings Canyon Visitor Center also has a display dedicated to air quality and global climate change.

The parks also work closely with the San Joaquin Valley Air Pollution Control District, participating with the air district's Spare the Air program, which provides examples of how the public can reduce emissions during unhealthy air days. Park officials have been sharing data and discussing strategies where the parks can be involved in regional efforts to reduce emissions.

Joshua Tree National Park

TOP: BIG STOCK PHOTO

BOTTOM: NATIONAL PARK SERVICE

Joshua Tree National Park is a major recreational resource for Southern Californians, and its spectacular geology attracts rock climbers from around the world. More than 4,500 established climbing routes are a major draw for the over one million visitors to Joshua Tree each year. The park's back roads are popular among mountain bikers, and hikers enjoy ten mountains over 5,000 feet in elevation as well as treks between the desert oases.

Air Pollution & Park Health

Air pollution in Joshua Tree National Park is generated in the South Coast Air Basin, an area that includes the urbanized portions of Los Angeles, Orange, Riverside, and San Bernardino counties. As pollutant levels decrease in the basin through strict emission controls, a corresponding decrease in the national park would be expected. However, due to the transport effect, rapid population growth in the Coachella Valley, and construction of power plants nearby, pollutants may still rise in the park and pose continued threats to visitor and staff health.

As in Sequoia and Kings Canyon, ozone poses the greatest health threat. In 2004, Joshua Tree had the highest peak levels of ozone ever recorded at a national park.[30] Ozone reached unhealthy levels on 31 days, about half as many as at Sequoia and Kings Canyon, but this is still one of the highest rates of unhealthy air days within the park system.

"Although the Environmental Protection Agency has mandated that the skies above our national parks be subject to the most stringent level of protection, Joshua Tree National Park consistently exceeds the ozone concentration levels set by the EPA for human health."

— National Park Service, Joshua Tree National Park Air Quality

DEBORAH DEMEO

The Cottonwood pump station and other solar powered projects have helped make Joshua Tree the leading generator of solar energy in the National Park Service.

NATIONAL PARK SERVICE

What's Being Done?

Ozone pollution is measured inside the park at a permanent installation adjacent to the Black Rock Campground. A new, solar-powered monitoring station near the Cottonwood visitor center on the south side of the park is scheduled to be operating by fall 2006.

Joshua Tree National Park also is installing signs at three of the park's entrances to alert visitors and staff daily about the severity of health threats from poor air quality — the first time such a warning system has been used at any of California's desert national parks.

Park managers are doing what they can to help reduce emissions by switching to alternative energy sources. For instance, the park has recently replaced a diesel-powered water pumping station with a solar powered pump at its Cottonwood campground.[31] The solar pump system can produce 10,000 gallons of water a day for an 80,000-gallon storage tank, which serves the campground's daily needs of 2,500 gallons.

Joshua Tree also relies on clean vehicles to help reduce in-park emissions. It currently operates four electric vehicles for rangers and maintenance personnel in several campgrounds and in the headquarters area, as well as eleven compressed natural gas (CNG) vehicles.[32]

Shenandoah National Park

NATIONAL PARK SERVICE

Shenandoah National Park lies within 300 square miles of the Blue Ridge Mountains in the southern Appalachians. It's heavily forested, steep mountainous terrain rises above the Shenandoah River which flows through the valley to the west.

The park is home to a large variety of wildlife, including deer, black bears, and wild turkeys. Surrounded by increasingly developed lands, the park is also a refuge for many resident and transient bird species.

Its close proximity to large population centers also makes Shenandoah a popular retreat for those looking to escape the nearby cities for healthful outdoor activities. With the 105-mile long Skyline Drive traversing the spine of the park, and more than 500 miles of trails, including 101 miles of the Appalachian Trail, the park is a major destination for hikers and bikers from the metropolitan areas of Washington, DC, Baltimore, Maryland, and Richmond, Virginia.

Air Pollution & Park Health

The many opportunities for healthful outdoor exercise at Shenandoah National Park unfortunately also carry some risks. Like Great Smoky Mountains to its south, Shenandoah National Park lies downwind of a great many coal-fired power plants. There are also major population centers and highways near the park. As a result, Shenandoah has some of the least healthy air of any park within the National Park System.

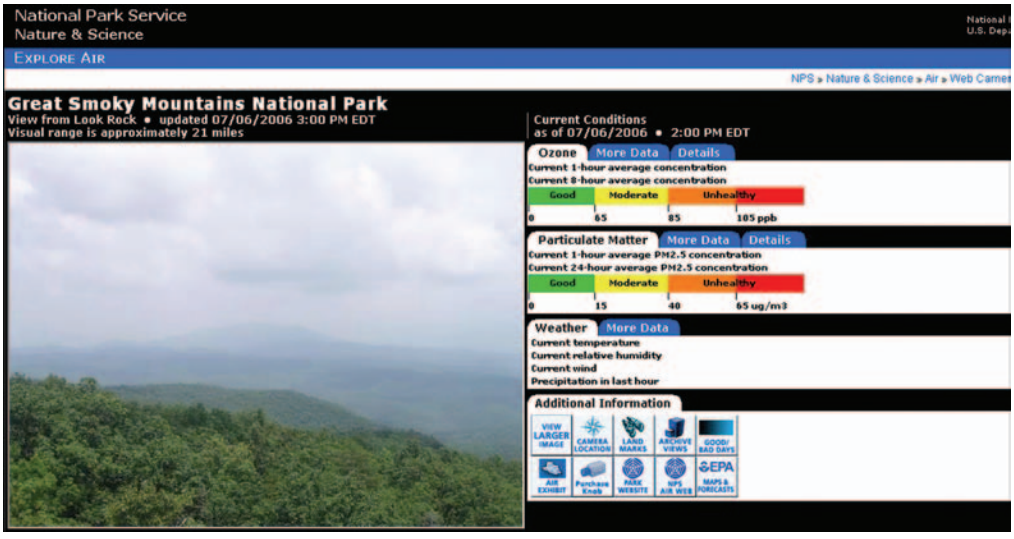
Ozone has reached unhealthy levels in the park on more than 130 occasions since 1983. Some years there are as many as 24 bad air days and other years none, because ozone is highly weather dependent. Levels drop during cooler summers and rise during warmer ones.

> *"The park does not currently meet ground-level ozone standards set by the U.S. Environmental Protection Agency to protect public health and welfare. The park registers some of the highest ground-level ozone measurements recorded at all national parks,"*
>
> — National Park Service, Shenandoah National Park Air Quality

What's Being Done?

The Park Service's Air Resources Division operates a network of air quality monitoring stations that measure meteorological conditions and ozone. Ozone monitoring in Shenandoah National Park began in 1983 at the park's "Big Meadows" site. The park also monitors particulate matter to determine whether federal healthy air limits are being exceeded. Unfortunately, due to budget cuts, Shenandoah no longer operates an air quality web camera to inform prospective visitors of current air pollution conditions. The park's air resources specialist position was also lost to budget cuts.

While the great majority of air pollution in Shenandoah comes from power plants and motor vehicles operating outside the park, efforts are being made to reduce in-park emissions to the greatest extent possible. As a result of the settlement of a Clean Air Act enforcement lawsuit against Dominion Power, the largest utility in Virginia, Shenandoah received funding to purchase five hybrid-electric vehicles. The park is also replacing inefficient appliances with energy-saving appliances, and replacing incandescent lights with compact fluorescent bulbs.



Air quality web cam maintained by Great Smoky Mountains National Park. Shenandoah's web cam fell victim to budget cuts. As one of the most polluted parks in the country, and with high visitorship, Shenandoah and the public would benefit from an NPS air quality web cam.

Air quality information for all

NPS Ranger Jim Renfro, Air Quality Branch Chief at Great Smoky Mountains National Park, with air quality monitoring station at Look Rock.

NATIONAL PARK SERVICE

There are 150 units of the National Park System located in areas with unhealthy air. Because the parks are a major destination for people seeking healthful outdoor exercise, special precautions have been taken to warn park visitors when air quality conditions could make vigorous exercise risky.

Both the National Park Service and EPA have developed resources that help visitors to many of our national parks learn about park air pollution conditions before they visit so they can plan accordingly. EPA's **Air Quality Index (AQI)** is a color-coded system for informing and alerting the public when air quality is poor.

ENVIRONMENTAL PROTECTION AGENCY

EPA provides air quality forecasts for most areas of the country, including some national parks at **www.epa.gov/airnow**.

NATIONAL PARK SERVICE

National Park Service posts health advisories at many parks and online when ozone is forecasted to be unhealthy at **www2.nature.nps.gov/air/data/current/advisory.cfm**.

WEB CAMS

The Park Service maintains a network of digital cameras at many parks to help educate the public on air quality issues. Along with real-time photos, the camera web pages often display current levels of ozone, particulate matter, or sulfur dioxide air pollutants, visual range, and weather conditions at **www2.nature.nps.gov/air/WebCams/index.cfm**

NATIONAL PARKS CONSERVATION ASSOCIATION AND THE AMERICAN LUNG ASSOCIATION

National Parks Conservation Association and the American Lung Association have teamed up to produce a guide for national park visitors to learn about air pollution conditions in the parks and take appropriate actions to protect their health. The free guide is being made available at several park visitor centers, including Great Smoky Mountains, Joshua Tree, Sequoia and Kings Canyon, and Shenandoah. It is also available at **www.npca.org/cleanair**.

park visitors

"Millions of Americans live in areas where the air carries not only life-giving oxygen, but also noxious pollutants that reach unhealthful levels. You can minimize your exposure to air pollution by being aware of pollution and by following some simple guidelines."

— American Lung Association

NPCA-ALA health brochure

GREEN = Good

Air quality is considered satisfactory, and air pollution poses little or no risk.

YELLOW = Moderate

Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.

ORANGE = Unhealthy for Sensitive Groups

Members of sensitive groups (e.g., people with lung or heart disease) may experience health effects. The general public is not likely to be affected.

RED = Unhealthy

Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.

PURPLE = Very Unhealthy

Health alert: everyone may experience more serious health effects.

MAROON = Hazardous

Health warnings of emergency conditions. The entire population is more likely to be affected.

Heritage

In addition to protecting natural wonders, parks conserve our national heritage. Parks along the Atlantic and Gulf coasts contain dozens of centuries-old forts and settlements that tell the story of America from its earliest days. Throughout the mid-Atlantic region, national historic parks and monuments preserve the rich history of the Civil War. Unique within the park system, Alaska's national parks protect the culture of native inhabitants.

Acid rain caused by pollution from cars and power plants is literally dissolving away much of America's heritage, necessitating frequent and costly repairs to keep buildings and monuments from crumbling into ruins. Toxic air pollutants may endanger the culture of native Alaskans whose lives are intricately connected to the parks. And climate change, driven by greenhouse gas emissions, threatens to erase parts of our natural and cultural heritage altogether.

PHOTOS FROM LEFT TO RIGHT: NATIONAL PARK SERVICE, BIG STOCK PHOTO, USFWS, SCOTT KIRKWOOD

PARK STORIES:

Gulf Islands (MS & FL)

Historic forts damaged by recent hurricanes like Ivan and Katrina are at risk of total destruction as climate change drives stronger storms and higher sea levels.

Glacier (MT)

Glaciers have already shrunk by up to 77 percent since the mid-19th century due to warmer climate, and will be gone completely by 2030.

Gates of the Arctic, Kobuk Valley & Noatak (AK)

Toxic air pollutants blown in from outside Alaska contaminate vital foods for native peoples in the parks, jeopardizing their traditional ways of life.

National Mall (DC)

Acid rain continues to damage to our nation's most precious symbols, eroding iconic structures like the Lincoln and Jefferson memorials.

OVERVIEW:

Air pollution damages historic structures in the national parks in many ways. Acidic compounds like nitrogen and sulfur can eat away at stone structures and monuments. In coastal parks, rising sea levels and increasingly more powerful hurricanes, driven by emissions of man-made greenhouse gases, threaten to obliterate historic structures that have withstood centuries of exposure to the elements. Toxic pollutants are encroaching even on the Alaskan Arctic, endangering the way of life for native peoples who have subsisted on the land for thousands of years.

PHOTO ON FACING PAGE: SCOTT KIRKWOOD

Gulf Islands National Seashor

NATIONAL PARK SERVICE

Stretching 160 miles from Cat Island in Mississippi to the eastern tip of Santa Rosa Island in Florida, Gulf Islands National Seashore encompasses 136,000 acres of snowy-white beaches, sparkling blue waters, fertile coastal marshes, and dense maritime forests. It is one of the richest repositories of 18th and 19th century maritime history in the Gulf and includes many forts from that period.[33] Among the most notable are Fort Pickens, Fort Barrancas, and Fort Massachusetts.

Fort Pickens, the largest of four forts built to defend Pensacola Bay and its navy yard, was completed in 1834 and used until the 1940s.[34]

Fort Barrancas sits on a bluff overlooking the entrance to Pensacola Bay, a site where various nations have constructed forts since 1763. Completed in 1844, the masonry fort is connected by a tunnel to the water battery. It underwent an 18-month, $1.2 million restoration in 1979-80.

Fort Massachusetts, on Ship Island off the coast of Mississippi, was one of many fortifications planned after the War of 1812 to defend Gulf Coast cities. During the Civil War, it was home to one of the first black regiments in the United States Army.[35] Admired for its beautiful brick arches, Fort Massachusetts currently is losing a battle with beach erosion, but because of its brick and concrete construction, it cannot be moved.

Air Pollution & Park Heritage

Hurricanes have always plagued the Gulf Coast, but global climate change linked to greenhouse gas emissions is likely making them more destructive. Carbon dioxide is the air pollutant most directly linked to climate change, and in the U.S., coal-fired power plants and motor vehicles are responsible for the overwhelming majority of carbon dioxide pollution. In fact, U.S. power plants emit about 10 percent of worldwide carbon dioxide pollution.

Climate change is making sea levels rise by melting polar ice and by warming the oceans (warmer water occupies more volume than cooler water). According to the EPA, the sea level is rising more rapidly along the U.S. coast than worldwide. A two-foot rise is most likely along the Gulf and Atlantic coasts within the next century, but a four-foot rise is possible.[36]

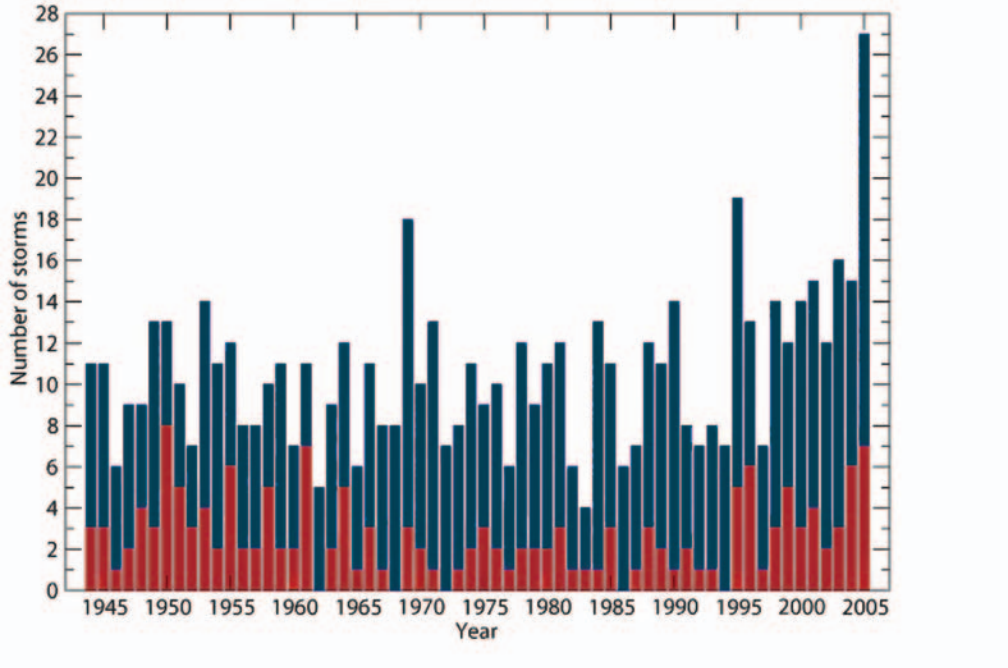
Warmer oceans also can spawn more powerful storms. As the sea and atmosphere warm, more water evaporates from the ocean surface, fueling stronger storms. Sea temperature changes in the Gulf region are several times greater than the global average.[37]

The number of category 4 and 5 hurricanes has doubled in the past 35 years,[38] and many scientists now believe that climate change has played a role in this increase. In 2005, the most

Annual Number of Named Storms and Major Hurricanes

Atlantic, 1944-2005

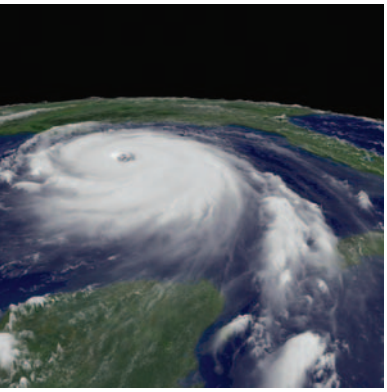
SOURCE: NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION



destructive hurricane season ever recorded, there were 27 named storms, including an unprecedented four category 5 hurricanes,[39] many of which caused significant park damage.

For 2006, the National Oceanographic and Atmospheric Administration (NOAA) is predicting 13 to 16 named storms, of which four to six could become 'major' hurricanes of Category 3 strength or higher.[40]

> *"The hurricanes we are seeing are indeed a direct result of climate change and it's no longer something we'll see in the future; it's happening now. The large bulk of the scientific community says what we are seeing now is linked directly to greenhouse gases."*
>
> **— Greg Holland, National Center for Atmospheric Research in Boulder, Colorado[41]**



Hurricane Katrina satellite image

NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION

Gulf Islands National Seashore has suffered significantly from recent monster storms. In 2004, Hurricane Ivan caused $30 million in damages to the Florida portion, washing out several miles of roads, flooding historic buildings, a visitor center, and parking lots, and destroying pavilions.[42] Before the park could recover, it was hit by Hurricanes Cindy, Dennis, Katrina, and Rita and Tropical Storm Arlene in 2005. Major portions of park roads on Santa Rosa Island under repair from Ivan were washed out again.[43] With the only road to Fort Pickens destroyed, visitors must now walk or bike across seven miles of hot, exposed terrain to reach the fort from the park entrance gate.

When Hurricane Katrina struck Gulf Islands in August 2005, a storm surge of up to 35 feet, driven by 130 mph winds, flowed over the park, redistributing barrier island sands, removing much of the park's vegetation, denuding trees, submerging part of East Ship Island, slicing West Ship Island in half, and truncating Horn Island.[44] The ramparts at Fort Massachusetts were breached, and the fort filled with mud and debris several inches thick. Its earthen berm was wiped out, and large granite blocks were dislodged and deposited in the moat. The reconstructed Ship Island lighthouse was totally destroyed, and museum collections at Davis Bayou Visitor Center sustained damage from floodwaters.[45]

"All the infrastructure, park buildings and decks are unusable or are gone. It will be a long time before the people will be able to enjoy the park the way they used to,"

— Shauna Dyas, information officer for the National Park Service incident management team[46]

An NPS official surveys damage to Fort Massachusetts caused by Hurricane Katrina in 2005.

NATIONAL PARK SERVICE

What's Being Done?

In 2004, teams of Park Service preservationists used boats to get to 300,000 artifacts in the Fort Pickens museum following Hurricane Ivan. After Katrina, more than 200 Park Service employees worked to restore Gulf Islands National Seashore and get it ready for the public. A Park Service emergency response team, including archaeologists and historians from its Museum Resource Center, also went to New Orleans to salvage that city's centuries of priceless historical artifacts.[47]

Based on its experiences in responding to hurricanes in recent years, the National Park Service has begun to institute additional measures to safeguard our national heritage from future storms. The National Center for Preservation Technology and Training (NCPTT) has worked with the Federal Emergency Management Agency (FEMA), the affected states, and other partners such as the Heritage Emergency National Task Force to develop standard assessments of building and site conditions, as well as instruction guides and other tools to help speed protection and recovery of cultural resources. NCPTT is preparing guidance on the best practices and concerns inherent in the survey of impacted cultural resources.[48]

In addition, the Park Service is now completing plans to move historical collections out of coastal parks to inland locations less susceptible to storm damage. While this is a prudent and necessary step, it is unfortunate that visitors to Gulf Islands and other parks along the Gulf and Atlantic coasts will no longer have the benefit of original historical artifacts and documents to help tell the story of the places they are visiting.

Glacier National Park

BIG STOCK PHOTO

Our national heritage includes not only man-made features such as forts, battlefields and settlements, but also the landscapes that interpret America's natural history. Glacier National Park is one area established specifically to protect and preserve unique biological and geologic features of our natural heritage.

Encompassing approximately 1.4 million acres on the U.S.-Canada border in northwest Montana, Glacier National Park is a rare landscape of alpine mountain and grassland habitats that host a community of carnivores, including mountain lions, grizzly bears, wolverines, and lynx, found nowhere else in North America. The park is home to more than 70 species of mammals and 30 species of native plants, including many alpine varieties that are remnants of the glacial age.

The park is most famous, of course, for the glaciers that dot the alpine regions. Accumulations of snow and ice formed more than 11,000 years ago, the glaciers have slowly migrated over time, sculpting mountains, carving deep valleys, and creating spectacular waterfalls.

Air Pollution & Park Heritage

Climate change is taking a dramatic toll on the glaciers at Glacier National Park. As a result of warmer winters and less snow, glaciers now cover only two-thirds of the area covered in 1850, and nearly all of the glaciers have shrunk in size.

Analysis of maps and photographs dating from the mid-19th century shows that individual glaciers in the park have decreased by up to 77 percent, and several glaciers have become inactive. Scientists predict that if current warming trends persist, all of the glaciers in Glacier National Park will be gone by 2030.[49]

What's Being Done?

In early 2006, a coalition of organizations petitioned the United Nations World Heritage Committee to declare Glacier National Park and Waterton-Glacier International Peace Park a "World Heritage in Danger," because of the impact of climate change. The petition specifically cited the loss of glaciers, effects on rivers, wetlands and lakes, disturbance to the ecosystem balance, re-distribution of the unique plants and animals of the park, and loss of scenic and cultural values.[51] The Committee met in July 2006, and while it officially recognized global warming as a threat to natural and cultural heritage sites, it failed to rule on the Glacier National Park petition.

"Scientific data collected in Glacier indicates that park glaciers have shrunk dramatically over the past century. The ecological significance of losing the park's glaciers is likely affecting stream baseflow in late summer and increasing water temperatures thus influencing distribution and behavior of aquatic organisms and food webs."

— U.S. Department of the Interior and Parks Canada, Report to the United Nations World Heritage Committee, July 2005.[50]

Recognizing that Glacier National Park is an ideal laboratory to study climate change, scientists from the U.S. Geological Survey, National Park Service, U.S. Forest Service, and the University of Montana are collaborating on long-term research on the effects of climate change on the park's unique ecosystem. For example, they are studying changes in the alpine forests and comparing historic and contemporary photos to track the size of glaciers over time.[52] The research team also conducts extensive on-the-ground monitoring and has developed a computer-based model to predict how the park ecosystem might respond to varying changes in climate.[53]

Glacier is also one of the first national parks to produce a greenhouse gas inventory and reduction plan. As part of the plan, the Park Service is using alternative fuels in buses and employee shuttles and is increasing energy efficiency in park buildings.

Montana Governor Brian Schweitzer has created an advisory group charged with producing by 2007 a Climate Change Action Plan for reducing greenhouse gas emissions. With the largest coal reserves in the nation, Montana is assessing its contribution to global climate change and looking at how to develop its fossil fuels without compromising the natural heritage of Glacier National Park.

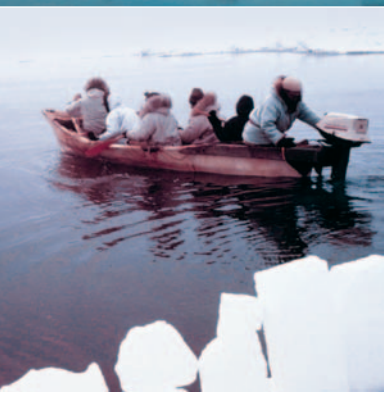
USGS and Glacier National Park, Repeat Photography Project, depicting the decrease in Shepard Glacier between 1913 and 2005, Glacier National Park

Left: Shepard Glacier in 1913

Right: Shepard Glacier in 2005

USGS

Alaska's Northern Parks



TOP: NATIONAL PARK SERVICE

BOTTOM: PHOTOS.COM

North of the Arctic Circle in Alaska, three contiguous parks span 16.6 million acres of wilderness. Gates of the Arctic National Park and Preserve, Kobuk Valley National Park, and Noatak National Preserve were created by the 1980 Alaska National Interest Lands Conservation Act (ANILCA), a federal law that more than doubled the size of the National Park System. Alaska's national parks now encompass more than 54 million acres, or roughly two-thirds of the nation's park lands, protecting some of America's last intact ecosystems.

The law that created the parks guarantees "the opportunity for rural residents engaged in a subsistence way of life to continue to do so."[54] The Nunamiut Eskimos of Anaktuvuk Pass, the Kobuk Eskimos, and the Koyukon Indians who live in or near these three Arctic parks have lived off the land for centuries and continue to depend on resources within the parks to sustain their subsistence lifestyle and cultural traditions. But increasingly, those resources may be endangering the health of native Alaskans.

Air Pollution & Park Heritage

The Alaskan Arctic, like other northern regions of the world, is becoming a collecting area for airborne toxins, which are showing up throughout the food chain. Persistent organic pollutants (dangerous chemicals that bioaccumulate through the food web and pose a risk to human health), rarely if ever used in the Arctic, have been detected in Alaska's air, water, soil, plants, fish, and wildlife. Likewise, heavy metals such as mercury, cadmium, selenium, arsenic, and lead are being measured at levels that cannot be explained by natural releases.[55]

Once in the Arctic environment, persistent organic pollutants and heavy metals remain for a long time in snow, ice, and frozen soil. Though present in relatively small amounts, they tend to become more concentrated at higher levels of the food chain.[56]

Evidence of persistent organic pollutants and heavy metals in the Alaskan Arctic is mounting. Scientists who recently analyzed samples from a lake in Noatak National Preserve found that concentrations of a chemical used in pesticides were higher than in parks close to urban and agricultural areas in the lower 48 states. Peregrine falcons in Alaska are contaminated with mercury at levels known to be harmful to reproduction,[57] and numerous pesticides have been found in lake trout and Arctic grayling from an Arctic Alaskan lake.[58] A study by the Alaska Native Epidemiology Center found the highest levels of DDE (a breakdown product of DDT, once widely used as an insecticide) in infants from the Yukon-Kuskokwim area compared to any other group of infants in the circumpolar region.[59]

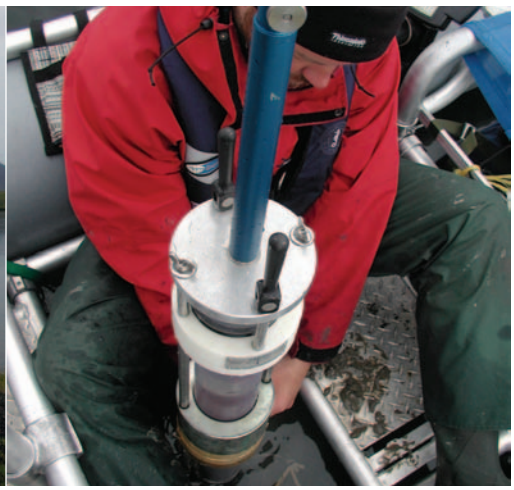
Climate change may be making the situation worse. Rapid warming of the Arctic region releases pollutants stored in snow, ice, and frozen soil. Contaminants accumulated in plant tissue also escape when vegetation burns during the larger and more frequent wildfires that result from warmer temperatures.[60]

USFWS

While the benefits of a subsistence diet currently outweigh any risks associated with ingesting meat, fish, and plants tainted by airborne pollutants, the presence of toxins in the subsistence foods of Alaska's Arctic region is a warning signal to all of us. Will we choose to listen? The people who live in or near Gates of the Arctic, Noatak, and Kobuk Valley cannot buy fresh, affordable and nutritious food as can most Americans at a local grocery store, and so they rely on the resources at hand. Hunting, fishing, gathering, and sharing subsistence foods are practices integral to the native Alaskans who have lived in this region for thousands of years.

What's Being Done?

In 2007, the National Park Service is expected to release a multi-year study of the impact of airborne contaminants on ecosystems and food webs in western national parks, including Gates of the Arctic and Denali. The "Western Airborne Contaminants Assessment Project" (WACAP) seeks to identify contaminants that are present, their sources, and which ones pose a threat to wildlife and people.[61] WACAP is an important first step toward protecting the native people who subsist on the fish, wildlife, and plants in our vast system of Arctic national parks. But the National Park Service will need reliable funding in order to continue sampling and monitoring subsistence foods in Gates of the Arctic National Park and Preserve, Kobuk Valley National Park, and the Noatak Preserve.



NATIONAL PARK SERVICE

Our Nation's Capital: National

TOP: SCOTT KIRKWOOD

Bottom: Part of one of the column capitals at the Jefferson Memorial broke off and fell onto the portico in 1990.

USGS

Much of our nation's capital is a national park. The National Mall and its many memorials — even the White House — are units of the National Park System. Officially established in 1965, the National Mall & Memorial Parks contain some of the oldest protected lands in the National Park Service, as well as the most cherished symbols of our nation. Included as well are some 156 reservations, circles, fountains, and other open spaces, which according to the Park Service, "serve as the nation's front yard."[62]

Air Pollution & Park Heritage

Unfortunately, air pollution in the form of acid rain is literally eating away at our nation's heritage. Decades of manmade air pollution has led to changes seen on historic stone monuments, buildings, and grave markers in our national parks. Metal statues, such as bronze war memorials or public art, can be affected over relatively short time periods — months to years. Stones, such as limestone and marble, show signs of deterioration over longer time periods — years to decades.

Sulfur and nitrogen oxides emitted by vehicles and coal-fired power plants react with water in the air to form strong acids that are deposited on monuments by snow, fog, dew, and dry particles, as well as rain.[63] Acidity is especially a problem in the northeastern states because of their high concentration of cities, motor vehicle traffic, power plants, and other industries. Much of the pollution from large numbers of coal-fired power plants in the Midwest also ends up in the Northeast.

Acid rain is accelerating stone deterioration to the extent that we may prematurely lose buildings and sculptures of historic or cultural value. Marble and limestone structures are most vulnerable, because sulfuric and nitric acids in polluted air can dissolve the calcite in these stones. In exposed areas of buildings and statues, surfaces become rough and details are lost. Where dissolving material causes cracks to occur, material can be lost altogether.[64]

Mall & Memorial Parks

What's Being Done?

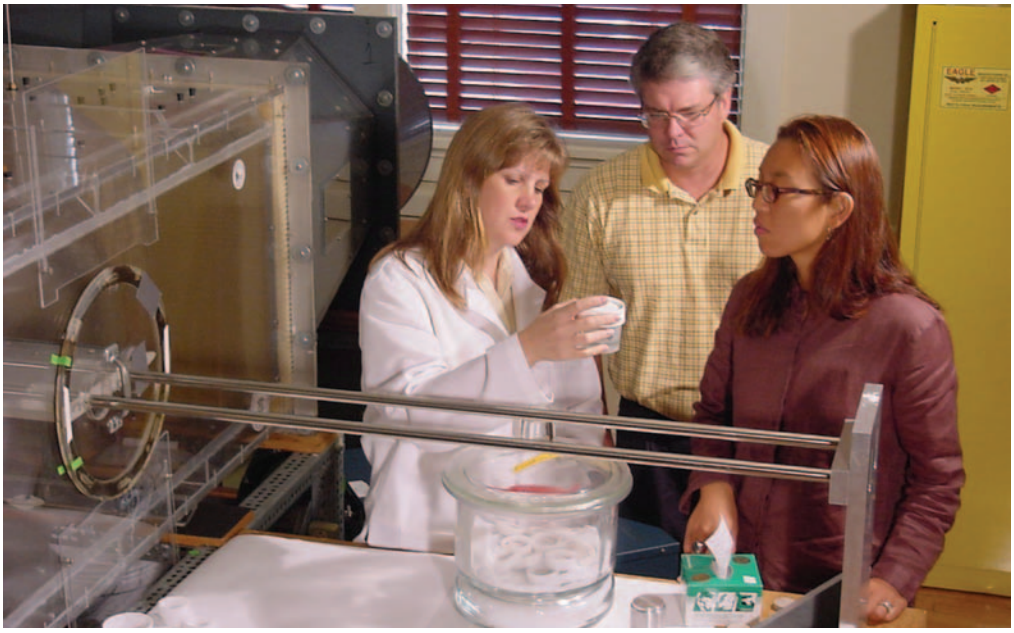
Yearly cleaning and maintenance of monuments and buildings is essential to staving off the destructive force of air pollution. Since the Park Service can't stop the pollution, it has instead focused on developing effective cleaning and restoration methods to protect our nation's heritage from the elements.

For more than 20 years, Park Service scientists associated first with the Acid Rain Program and later with the National Center for Preservation Technology and Training (NCPTT), have been looking for ways to protect our nation's heritage from the effects of air pollution. Since 1995, these efforts have been led by Dr. Mary F. Striegel, a chemist and conservation scientist specializing in artistic and historic materials.[65]

Based in Natchitoches, Louisiana, home to Northwestern State University, NCPTT develops and distributes methods and technologies that enhance the preservation, conservation, and interpretation of prehistoric and historic resources throughout the United States. NCPTT conducts both field and laboratory studies on potential new technologies to protect stone from a wide range of deterioration causes.

NCPTT is conducting research, funded by the Department of Veteran Affairs, into effective commercially available headstone cleaners that minimize stone loss. A major restoration project is underway at Andersonville National Historic Site in Georgia (pictured here), a former Confederate prison camp where 13,000 Union soldiers died. Andersonville serves as a memorial to all American prisoners of war throughout the nation's history.

NATIONAL PARK SERVICE



NCPTT conducts research using a custom built wind tunnel that helps measure pollution uptake on building materials. How quickly a material absorbs pollution is a key first consideration to possible deterioration caused by the pollution.

NATIONAL PARK SERVICE

Horizons

Some of the most inspiring views in America are found in our national parks. Visitors to Yellowstone make the steep ascent to Avalanche Peak to experience a stunning panorama of the park. Yosemite National Park is perhaps best known for the iconic view of Half Dome made famous in the photographs of Ansel Adams. And millions of Americans each year visit the Blue Ridge Parkway and Shenandoah National Park's Skyline Drive for breathtaking views of the surrounding mountains and valleys below.

Polluted haze from coal-fired power plants and auto emissions has seriously dimmed these majestic vistas. Views from national parks in the East should extend upwards of 100 miles, but pollution can cut views to only a few miles during the summer months. In the West, park visitors can take in 160-mile views on the clearest days, but those views can drop to 50 miles when air pollution levels are high.

PHOTOS FROM LEFT TO RIGHT: NATIONAL PARK SERVICE, NATIONAL PARK SERVICE, BIG STOCK PHOTO, NATIONAL PARK SERVICE

PARK STORIES:

Blue Ridge Parkway (VA & NC)

America's premier scenic drive should offer hundred-mile views of surrounding mountains and valleys. But since 1948, pollution has cut average visibility by 40 percent in winter and 80 percent in summer.

Grand Teton (WY)

Air pollutants released by thousands of new gas wells under development near the park will significantly impair park visibility.

Great Smoky Mountains (TN & NC)

Power plant pollution cuts average visibility by more than half. During severe hazy episodes, visibility in Great Smoky Mountains National Park is less than one mile.

Shenandoah (VA)

Visitors to Skyline Drive used to be able to see the Washington Monument, some 70 miles distant. But with an annual average visibility of 24 miles, views must be improved by over 100 miles to reach natural conditions.

Yellowstone (WY, MT, ID)

Emissions from dozens of new coal-fired power plants proposed in the region could degrade what is now some of the cleanest air in the country.

Horizon protection for all scenic lands

There are strong laws to restore and protect scenic horizons in the parks, but they must be enforced.

OVERVIEW:

Air pollutants from electric power plants, oil and gas drilling, and motor vehicles, have cut the average distance of park views in half, and can bring views down to just a few miles on the most polluted days. Visibility is affected by the interaction of light with particles and gases in the atmosphere. These particles and gases can form haze that blocks scenic views altogether, and also makes distant horizons appear less colorful. The leading contributors to visibility impairment in the parks are sulfate and nitrate particles emitted by power plants, other industries, and motor vehicles.

PHOTO ON FACING PAGE: BIG STOCK PHOTO

The Appalachian Parks

NATIONAL PARK SERVICE

The Appalachian Parks: Great Smoky Mountains, Shenandoah and Blue Ridge Parkway

Shenandoah National Park and the Blue Ridge Parkway were created, in part, because of the magnificent views from the tops of Virginia's Blue Ridge Mountains. These parks provide more than 500 miles of protected scenic drives — and join the Great Smoky Mountains in North Carolina to create a virtually uninterrupted chain of spectacular Appalachian scenery.

Shenandoah's Skyline Drive was constructed in the 1930s as a scenic drive along the crest of the Blue Ridge Mountains. The road was designed and constructed to provide scenic views within the park and into the Piedmont plateau to the east and the Shenandoah Valley to the west. Seventy-six overlooks were constructed so motorists could stop at intervals along the drive and enjoy the views.[66]

Sometimes called "America's Favorite Drive," the Blue Ridge Parkway is the most visited unit of America's National Park System. A trip down the Parkway should provide stunning, long-range vistas of the southern Appalachian mountains. Like Skyline Drive in Shenandoah, the 469-mile parkway is designed primarily to facilitate enjoyment of both near and distant horizons.[67]

Great Smoky Mountains National Park also offers stunning views from park roadways. The 33-mile long Newfound Gap Road crosses Newfound Gap at over five thousand feet of elevation and has numerous pullouts for taking in long-range mountain views.[68]

Air Pollution & Park Horizons

The stunning vistas park visitors expect to see in the Appalachian parks are too often marred by unsightly haze that blurs visibility and robs the landscape of color, texture, and form. Most of the mountain haze is made up of microscopic particles of solids and liquids suspended in the air. Coal-burning power plants are the main source of these particle emissions.

Since 1948, according to regional airport records, average visibility in the southern Appalachians has decreased 40 percent in winter and 80 percent in summer. Annual average visibility in the Smokies now is 33 miles, less than one-third the distance that could be seen in pristine conditions. During severe hazy episodes, visibility in Great Smoky Mountains National Park is less than one mile.

Shenandoah has among the highest monitored concentrations of airborne sulfate particles, the primary cause of hazy skies.[69] With an annual average visibility of 24 miles, views must be improved by nearly 100 miles in Shenandoah National Park to reach natural conditions.

According to the National Park Service, "Air pollution, particularly during the summer season, has significantly degraded the distance, color, contrast and landscape details of park views from Skyline Drive, the Appalachian Trail, and high points in the park." [70]

NATIONAL PARK SERVICE

What's Being Done?

In 1979, the National Park Service and EPA began long-term visibility monitoring in selected national parks. In 1985, the two agencies joined with the U.S. Forest Service, Fish and Wildlife Service, Bureau of Land Management, National Oceanic and Atmospheric Administration, and several interstate air quality management organizations to launch the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Its goals include measuring and documenting long-term visibility trends in the national parks.[72]

Through the IMPROVE program, the National Park Service operates a series of web cameras near air quality monitoring sites to help educate the public about the effects of air pollution at **www2.nature.nps.gov/air/WebCams/index.cfm**.[73] The web site displays current visibility conditions and has links to photographs contrasting good and bad visibility days.[74] Unfortunately, Shenandoah's IMPROVE-operated web camera has been inoperable for many years due to lack of funding.

"Visitors have traveled the Parkway for years enjoying majestic views and distant horizons. Increasingly however these views have become less and less majestic as pollution gets in the way and haze blocks the distant scenes."

— National Park Service, Blue Ridge Parkway air quality web page[71]

Left: Shenandoah on a clear day.

Right: Shenandoah on a day with high levels of sulfate pollution.

AIR RESOURCE SPECIALISTS, INC.

The Northern Rockies Parks

TOP: BIG STOCK PHOTO

MIDDLE: NATIONAL PARK SERVICE

Bottom: Photo of gas wells in greater Yellowstone area

GREATER YELLOWSTONE CLEAN AIR PARTNERSHIP

The Northern Rockies Parks: Yellowstone and Grand Teton

Established in 1872 as the world's first national park, Yellowstone National Park covers more than 2 million acres in northwestern Wyoming and portions of Montana and Idaho and protects one of the largest intact temperate zone ecosystems on earth today. Plant communities range from lowland sagebrush and grasslands through pine and fir forests to alpine tundra. Among its wildlife are seven species of ungulates, two species of bears, gray wolves, lynx, and numerous other mammals, birds, and reptiles.

Adjoining Yellowstone to the south, and located wholly within Wyoming, is Grand Teton National Park. The park comprises almost 310,000 acres of diverse habitat from the Jackson Hole valley floor to the high peaks of the Teton Range.

Both parks are renowned for spectacular views from high peaks to distant horizons. The Signal Mountain Summit Road at Grand Teton climbs 800 feet to provide magnificent views of the Teton Range, Jackson Hole valley, and Jackson Lake. The top of the Avalanche Peak trail in the Absaroka Range at Yellowstone affords some of the most stunning panoramas in the park. On a clear day it is possible to see distances up to 160 miles.

In part because of their spectacular scenic views, Yellowstone and Grand Teton receive the highest level of protection under the Clean Air Act.

Air Pollution & Park Horizons

Yellowstone and Grand Teton still have some of the cleanest air and best visibility in the country. Even so, emissions from power plants and other industries, oil and gas processing, coal bed methane wells, agriculture, motor vehicles, snowmobiles, and wild land fires have combined to degrade the air in both parks.[75]

In such a clean environment, even relatively low levels of air pollution create haze that dims scenic vistas and obscures distant mountain ranges. Unfortunately, pollution is on the rise, threatening to make hazy skies as regular a feature of the Northern Rockies as it is of the Appalachians.

Emissions of nitrogen oxides, volatile organic compounds, and particulate emissions from gas fields in the region have increased in recent years. As of 2003, Wyoming had nearly 40,000 active oil and gas wells. More than 10,000 permits to drill new wells were approved from May 2004 through April 2005.[76] In one of the fastest growing regions, Wyoming's Upper Green River Basin, new well permits are being granted at the rate of 200 to 300 per year. Up to 8,700 new wells may be proposed within the area.[77]

Federal land managers predict that visibility will be "significantly" impacted as a result of the massive increase in oil and gas development and planned construction of new coal-fired power plants near the parks.[78]

There are already nearly 100 outdated coal-fired power plants in the Western U.S. that operate without modern pollution controls.[79] These "grandfathered" plants are capable of emitting as much as 10 times more sulfur dioxide and four times more nitrogen oxides than plants built today.

Dozens of new coal plants now in various stages of development throughout the West. One of the largest proposed in recent years is the Roundup plant northeast of Yellowstone in Montana. If built, this plant would emit more than 8 million tons of carbon dioxide, nearly 4,000 tons of sulfur oxides, and more than 2,300 tons of nitrogen oxides every year.[80] NPCA is challenging Roundup's air permit in court in an effort to secure more effective protection of Yellowstone air quality.

Snowmobiles are a major source of pollution within park boundaries. The most polluting are those with traditional two-cycle engines that release high levels of hydrocarbons, carbon monoxide, particulate matter, and other pollutants.[86] In the winter of 2000, visitors made about 75,000 snowmobile trips into Yellowstone. On peak days, more than 1,000 two-stroke snowmobiles used the west entrance, where winter inversions often confine dense, cold, stable air that concentrates pollution.

Top: View of Overlook Mountain at Yellowstone on a clear day.

Bottom: View of Overlook Mountain at Yellowstone on hazy day with high particulate matter pollution.

What's Being Done?

The Greater Yellowstone Clean Air Partnership, an interagency network that includes representatives from Yellowstone and Grand Teton, monitors air quality and meets regularly to identify air pollution problems and map out solutions.

The parks are closely monitoring the expanding oil and gas drilling activities and working with state permitting agencies to ensure that all permits meet Clean Air Act requirements. However, it will be necessary to evaluate the cumulative impacts of all new oil and gas development throughout the region if the National Park Service hopes to effectively protect air quality in these parks.

Within the parks themselves, managers have adopted clean air measures such as limiting numbers of snowmobiles and requiring that they have the cleanest and quietest four-stroke engines available. In addition, Yellowstone is using ethanol blend fuels and low-emission lube oils to further reduce emissions from its own vehicles. NPCA believes that private snowmobiles must ultimately be phased-out of the park in order to create a cleaner, quieted and safer park for visitors and for wildlife.

Horizon protections for all sce

NATIONAL PARK SERVICE

The great value Americans place on inspirational natural views led Congress in 1977 to enact a program to restore clear horizons to our most scenic natural landscapes and preserve them that way for future generations. These scenic lands, known as "class I areas," comprise 156 national parks, national forests, and wilderness areas throughout the United States. Great Smoky Mountains, Shenandoah, Yellowstone and Grand Teton are all "class I" national parks.

> *"Congress hereby declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from man-made air pollution."*
>
> — Clean Air Act of 1977

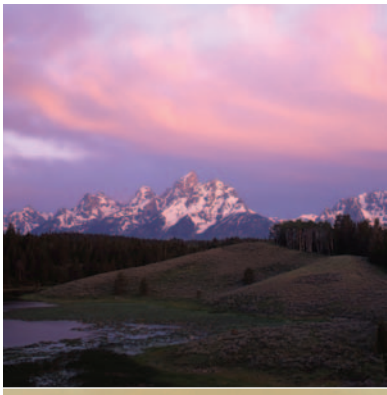
The 1977 Act called upon the EPA and states to develop a program that would eliminate haze pollution in the class I areas. Congress even went so far as to specify which industrial sources must be cleaned up ("each major stationary source which is in existence [between 1962 and 1977], and which … emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any" class I area), and how they should clean up (by installing "the best available retrofit technology," known as "BART").

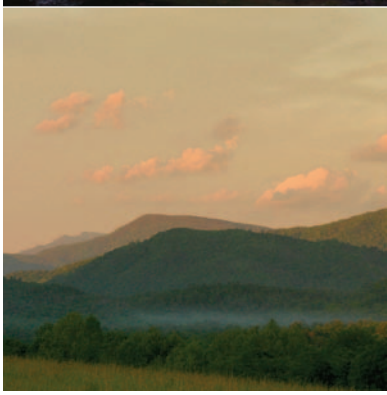
In spite of these explicit mandates, Congresses' ambitious plan for restoring natural horizons was largely ignored for decades. Finally, in 1999, EPA adopted so-called "regional haze" rules requiring the states to develop plans that — in a series of decades-long steps — would ramp down haze pollution so that natural views would be fully restored by 2064. In 2005, EPA adopted rules governing which sources must install BART emissions controls in order to help meet the haze reduction goal.

Unfortunately, EPA's 2005 rules contain a number of loopholes that make it questionable whether even the 2064 deadline can be met. In particular, EPA's rules exempt many hundreds of outdated coal-fired power plant units from having to install modern pollution controls, even though these older coal plants are the leading cause of park haze pollution, and were explicitly targeted by Congress for cleanup. NPCA is challenging EPA's power plant rules in court to force the agency to eliminate these loopholes.

In spite of EPA's weak 2005 BART rule, states remain responsible under the 1999 regional haze rules to achieve haze-free parks by the 2064 deadline. Accordingly, there is an opportunity to stay on course, so long as states develop and implement strong haze plans with minimal exemp-

enic lands





BIG STOCK PHOTO

tions for big pollution sources. The first state haze reduction plans are due to EPA by December 2007, and states are working now to complete them.

In the southeast, a coalition of state and federal agencies, with input from stakeholders like NPCA, is developing a plan to reduce haze pollution at Shenandoah and Great Smoky Mountains national parks, as well as other class I areas in the region. The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) maintains information about its haze plan at **www.vistas-sesarm.org/index.asp**.

Likewise, the Western Regional Air Partnership (WRAP) is developing a haze reduction plan for class I areas throughout the western United States, including Yellowstone and Grand Teton national parks. WRAP's planning documents are available at **www.wrapair.org/**.

The National Park Service plays a key role in helping states keep on track toward meeting the 2064 goal. Citizen participation is also a critical part of the process. NPCA and other national, state and local stakeholders will continue to work with state planners over the coming months and years to ensure that the promise of haze-free parks made by Congress nearly 30 years ago is fulfilled.

Solutions

Air pollution is one of the most widespread environmental problems in the United States today and one that has proven to be among the most challenging to solve.

As a result of the Clean Air Act, we have made great strides in reducing pollution levels from the near-crisis conditions that existed in many parts of the country in the 1960s and 1970s. Even so, millions of Americans, more then 2 out of every 3 people, live in areas where air pollution continues to exceed health standards set by the EPA.

Air pollution in many national parks continues to damage wildlife habitat, put park visitors' health at risk, destroy our natural and cultural heritage, and cloud majestic horizons. And we have not even begun to address the threats to our national heritage posed by climate change.

Significantly reducing the four key pollutants addressed by this report will go a long way to restoring the habitat, health, heritage, and horizons of the parks. There are many policies that will help us get there. Ultimately, all of us working together can create clean and healthy parks for our time and for future generations.

PHOTOS FROM LEFT TO RIGHT: BIG STOCK PHOTO, NATIONAL PARK SERVICE, BIG STOCK PHOTO, BIG STOCK PHOTO

TEN STEPS TO PROTECT PARK HABITAT, HEALTH, HERITAGE, & HORIZONS

1. Finish the job of cleaning up outdated power plants

Older coal-burning power plants are the leading park polluters. Hundreds of plants built in the 1950s, 60s, and 70s continue to operate today without modern pollution controls and remain the largest industrial sources of sulfur, nitrogen, mercury, and carbon dioxide emissions in the country.

Recent rules adopted by EPA will clean up some of these outdated plants but leave many others without modern emissions controls. The Clean Air Interstate Rule (CAIR) caps sulfur dioxide and nitrogen oxide emissions from power plants in 28 eastern states and the District of Columbia. The caps will cause some plants to install modern emissions controls, but others will be able to comply by paying fees to the cleanest plants. According to EPA, of the 1,168 outdated coal-fired power plants currently operating in the eastern U.S., 858 will still lack sulfur dioxide scrubbers and 915 will lack advanced nitrogen oxide controls even after CAIR is fully implemented.[82]

Congress made a bargain with the electric power industry when it amended the Clean Air Act in 1977. Plants in existence when the law passed could continue operating without new emissions controls, but if the plants were ever refurbished, they would have to install the best available pollution controls at that time. Congress reasoned that all of the old plants would eventually need to be refurbished to keep operating, and if they did not, they would simply shut down and be replaced by newer, cleaner plants.

The reality is that many of these older plants have made significant upgrades to extend their operating lives while failing to install required pollution controls. Congress therefore needs to revisit the bargain it made with power plant operators back in 1977. Clearly, the time has come to either clean up or shut down the plants that have not honored their end of the bargain and have operated for decades without modern pollution controls.

There are several bills in Congress that set a date when all outdated power plants would be required to install modern emissions controls. The Clean Air Planning Act (S.2724), introduced in May 2006 by U.S. Senators Tom Carper (D-DE), Lamar Alexander (R-TN), and others,[83] requires that each plant install modern pollution controls for sulfur dioxide and nitrogen oxides by 2020 or upon its 50th year of operation. The Clean Power Act (S.150), originally introduced

PHOTO ON FACING PAGE: BIG STOCK PHOTO

NATIONAL PARK SERVICE

in 2001 by Senator James Jeffords (I-VT) in the U.S. Senate, and by Representatives Henry Waxman (D-CA) and Sherwood Boehlert (R-NY) in the House, would require installation of modern emissions controls by a plant's 40th birthday, or 2014, whichever is later.

In the absence of federal action, several states have adopted laws to clean up their own outdated coal-fired power plants. New Hampshire, Massachusetts, New York, Connecticut, New Jersey, Maryland, North Carolina, and Illinois are a few of the states that have acted in recent years to require power plant cleanup measures that go beyond what is required under federal law.

NPCA supports these state and federal legislative efforts to clean up, once and for all, the outdated power plants that are the leading cause of air pollution in many national parks.

2. Require new power plants to use the most effective pollution controls available

A whole new generation of coal-fired power plants looming on the horizon could undo hard-won air quality improvements that have occurred at some parks. According to the U.S. Department of Energy, 154 coal-fired plants are now in various stages of development.[84] Many of these, like the Roundup plant outside of Yellowstone, are proposed for areas upwind of national parks.

State and federal air quality officials are obligated under the Clean Air Act to require that major new air pollution sources be constructed with the "best available control technology" for limiting emissions (if a proposed plant is located in an area that fails to meet federal clean air standards, it must meet the "lowest achievable" emissions rate).

Too often these officials approve power plants that are substantially more polluting than the law requires.

Of special concern, most states and EPA are continuing to grant permits for traditional "pulverized coal" plants even though newer plant designs can cut pollution by more than half. One such newer technology currently available turns coal into a gas, strips out the pollutants, and burns the clean gas in high-efficiency turbines. (This process is known as "integrated gasification combined cycle" or "IGCC").

As shown in the chart below a coal-fired power plant using the IGCC technology produces far lower emissions of sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter (PM10) than a conventional coal plant.

Coal-fired power plants using IGCC technology are being developed in a handful of states. Unfortunately, the majority of the 154 new coal-fired power plants now under development plan to rely on the more polluting pulverized coal technology (only 24 are considering IGCC technology).[85]

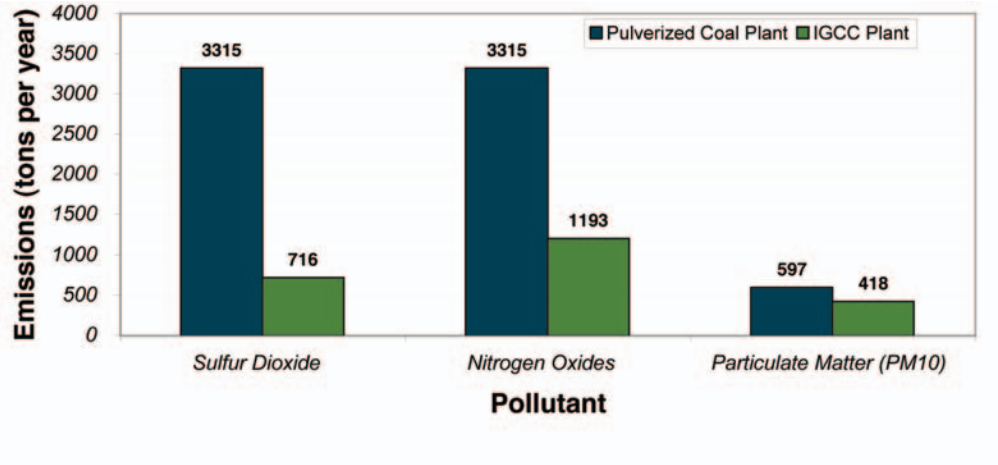
EPA struck a major blow against the possibility of cleaner coal plants in December 2005 when it issued a letter concluding that states need not consider IGCC as the "best available control technology."[86] This action was taken in spite of the fact that EPA, in a recent report, acknowledged that IGCC is "one of the most promising technologies to reduce the environmental impacts of generating electricity from coal," and found that, "for traditional pollutants such as nitrogen oxides, sulfur dioxide, particulate matter and mercury, IGCC is inherently lower polluting than the current generation of traditional coal-fired power plants."[87]

If EPA and states continue to reject IGCC plants as the best available technology to limit air pollutants, a whole new generation of higher-polluting conventional coal plants is likely to be built, vastly increasing the amount of air pollution in our national parks and communities.

NATIONAL PARK SERVICE

1500 Megawatt Coal-Fired Power Plant Emissions

Pulverized Coal vs IGCC



SOURCE: NATIONAL PARK SERVICE

NATIONAL PARK SERVICE

3. Protect wildlife by limiting the amount of air pollution deposited in the parks

When it comes to protecting public health from air pollution, EPA and its scientific advisors first determine what amount of air pollution causes harm to people. Federal and state officials then work to adopt policies that will keep pollution below that level, with an adequate margin of safety.

No such system exists for protecting the health of park plants and animals from air pollution. Park managers must instead rely on pollution prevention policies meant to achieve other goals, such as public health protection. However those programs do not always provide the level of protection that park plants and animals need to survive and thrive.

Fortunately, park managers are beginning to develop the tools they need to protect the parks from air pollution with the same degree of precision that exists for human health protection. Years of air pollution monitoring and impacts analysis allows managers at some parks to determine how much of each pollutant can accumulate in the park before plants and animals begin to experience damage. This amount of pollution is referred to as a "critical load."

A large body of scientific information has been developed in recent years on critical loads of acidic pollutants such as nitrogen oxides and sulfur dioxide. EPA has recently backed the development of pilot projects to establish critical loads for the parks.[88]

In June 2006, Rocky Mountain National Park, which has extensive data on nitrogen damage to its habitat, announced the first critical loads standard for nitrogen pollution. Agreed to by park officials and state and local regulators, the standard will be a voluntary guideline at first but may ultimately become an enforceable means of ensuring that air pollution in the park is not allowed to reach levels that cause ecosystem damage.

Park managers should also develop pollution reduction goals to ensure that their parks do not come dangerously close to triggering ecological harm at the critical load level. Referred to as a "target load," this is the level of air pollution a park should not exceed in order to remain safely below the critical load.

Critical and target loads are sound scientific means of determining what level of emissions is sustainable for an area. Knowing these two variables will help each park take appropriate actions to clean up existing sources of park pollution and evaluate the threat from new sources.

NPCA supports development of enforceable critical and target pollution loads, not only for nitrogen oxides, but also for sulfur dioxide, particulate matter, mercury, and other pollutants known to cause harm. The Park Service and EPA should move now to set standards for parks that already have sufficient pollution monitoring and impact information and should continue or begin monitoring at other parks to put them on course for standards as soon as possible.

NATIONAL PARK SERVICE

4. Ensure that legal limits on park air pollution are not exceeded

In order to keep park air relatively clean in the face of increasing development outside the parks, Congress established ceilings on additional amounts pollution over baseline conditions that existed in 1977.[89] Known as "increments," these pollution ceilings are intended to allow some growth in emissions due to new development near the parks, but not so much as to make park air unacceptably dirty. Increments have been established for sulfur dioxide, particulate matter, and nitrogen oxides.

States are required under the Clean Air Act to periodically evaluate to what extent pollution increments have been used up.[90] With few exceptions, however, states have not done these evaluations. It is quite likely, therefore, that many states have issued and will continue issuing permits for new sources of air pollution that harm the parks even though the pollution ceilings established by Congress have been reached.

For the Clean Air Act to work as intended by Congress, states must periodically analyze emissions from all existing sources. They must determine whether total pollution levels are close to or in excess of the ceilings. If they are, the state should not permit new air pollution sources near the parks. States may always create room for new pollution sources in the park air shed by reducing pollution elsewhere, for instance by cleaning up outdated power plants.

NPCA recommends that states conduct so-called "increment consumption analyses" at least every three years, as contemplated by the Clean Air Act. If states do not conduct these analyses, EPA has the responsibility under the Act to require them to do so.

BIG STOCK PHOTO

5. Eliminate toxic "hot spots" by enacting stronger power plant mercury controls

Clean air regulations now being implemented by EPA will lead to a national cap on power plant mercury emissions, but those regulations create a mercury "market" that allows utilities to pay for reductions at other plants rather than cut their own emissions. As a result, many plants will see no reduction in mercury.

Pollution market trading systems can work well for chemicals like sulfur dioxide, nitrogen oxides, and carbon dioxide, which tend to disperse rapidly over a wide geographic area. These pollutants do not ordinarily concentrate around a plant. But such is not the case with a heavy metal like mercury, which largely remains in the vicinity of its source.

A recent study led by EPA scientist Matthew Landis found that 70 percent of the mercury in rain collected at an Ohio River Valley monitoring site originated from coal-burning plants no more than 400 miles away and had been emitted no longer than three days earlier.[91] This means that parks downwind of power plants that fail to clean up may continue to be inundated with high levels of mercury, even after current EPA rules are fully in effect. Clearly, stronger policies are needed to require every plant to reduce its mercury emissions.

EPA has the authority to subject power plants to a "maximum achievable control technology" (MACT) standard that would effectively require every plant to cut its mercury emissions by at least 90 percent.[92] Thus far, EPA has declined to use this authority, settling instead for laxer standards that will permit many power plants to escape cleanup altogether.

Fifteen states and several health advocacy organizations are suing EPA to force it to apply the MACT standards to power plant mercury emissions,[93] and 47 members of the U.S. Senate voted to invalidate EPA's weaker mercury rules in favor of a MACT standard.[94] If Congress cannot muster enough votes to overturn EPA's mercury rule, other actions will be necessary.

Both the Carper-Alexander Clean Air Planning Act and the Jeffords-Lieberman Clean Power Act now before Congress would require all coal-fired power plants to reduce their mercury emissions by 90 percent and prohibit them from relying on a mercury trading program. In addition, 11 states have proposed or finalized rules requiring an 80 to 90 percent reduction in mercury emissions from their power plants.[95]

Studies confirm that when mercury emissions drop, ecosystems downwind from polluters experience major improvements. Seven years after Massachusetts enacted the nation's toughest mercury emission laws for incinerators, amounts of the toxic metal in a signature freshwater fish caught near some of

those facilities have declined by 32 percent.[96] Likewise, a 2003 study found that concentrations of mercury in fish and wading birds in the Everglades dropped about 75 percent after Florida imposed stringent controls on incinerators and other local sources of mercury emissions in the 1990s.[97]

Because of the serious risk to health and the ecology, power plant mercury emissions should be subject to the MACT standards of the Clean Air Act. NPCA supports efforts in Congress and by the states to adopt policies that seek maximum reductions of mercury from all power plants. Several studies, including some with industry participation, have concluded that a 90 percent reduction in mercury emissions is both affordable and achievable with existing technologies.[98]

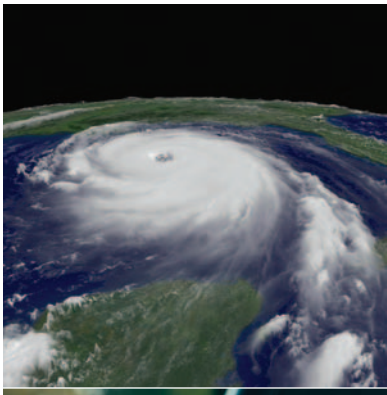
6. Address climate change by reducing carbon dioxide emissions

Currently, no federal law or regulation requires industry to reduce its carbon dioxide pollution, even though climate change is perhaps the greatest environmental threat facing our nation and the world today. As this report has shown, our natural and cultural heritage is especially vulnerable to climate change. NPCA therefore supports strengthening the Clean Air Act so that it can more effectively limit carbon dioxide emissions from major polluters such as power plants and motor vehicles.

Both the Carper-Alexander Clean Air Planning Act and the Jeffords-Lieberman Clean Power Act would amend the Clean Air Act to establish a system for capping and reducing power plant carbon dioxide emissions, along with other key pollutants. State air pollution officials have endorsed this type of "multi-pollutant" strategy as the most cost-effective way to achieve maximum public health and environmental benefits.[99]

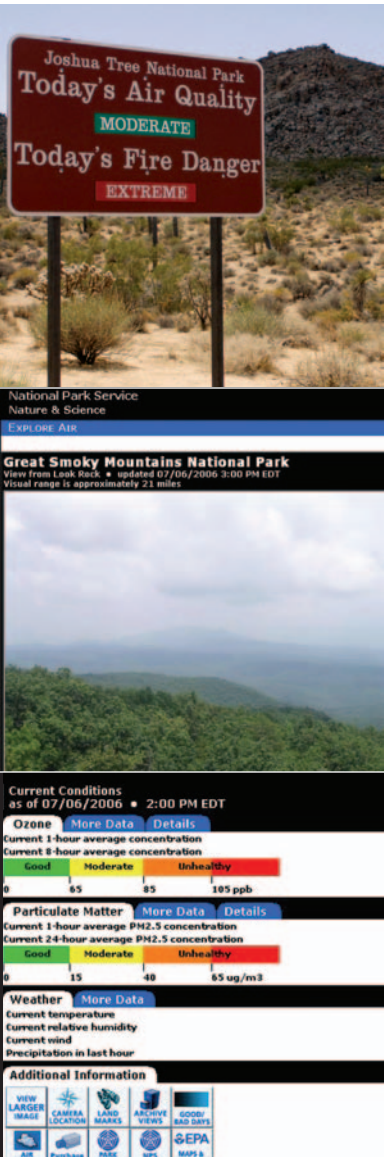
Because fuel-efficient vehicles emit less carbon dioxide, NPCA supports proposals in Congress to increase automobile fuel economy. NPCA also backs measures such as the Climate Stewardship Act, sponsored by Senators John McCain (R-AZ) and Joseph Lieberman (D-CT), which enlist all major sectors of the economy in a market-based program for reducing carbon dioxide emissions.

In the absence of effective federal policy on climate change, the states have stepped in to fill the gap. The northeastern states are currently engaged in a Regional Greenhouse Gas Initiative that includes a market-based cap and trade system for reducing carbon dioxide emissions from power plants.[100] California has adopted regulations to reduce greenhouse gases from motor vehicles, and other states are following suit. A growing number of states, including Maine, Connecticut, New York, Massachusetts, Washington, Oregon, California, New Mexico, Arizona, and North Carolina, are establishing ambitious greenhouse gas reduction goals and creating global warming action plans.



TOP: NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION

BOTTOM: BIG STOCK PHOTO



TOP: DEBORAH DEMEO

BOTTOM: NPS

Given the breadth and complexity of the climate change problem, multiple policies should be pursued at the local, state, federal, and international levels. An effective solution *must* require meaningful reductions in carbon dioxide emissions from the two largest sources — electric power generating plants and motor vehicles.

7. Expand programs to monitor and reduce air pollution in the parks

Although most of the air pollution that damages national parks is created outside park borders, the Park Service is doing what it can to monitor, understand, and reduce pollution within park boundaries. The agency currently monitors one or more key indicators — including ozone, visibility, and atmospheric deposition of sulfur and nitrogen compounds—at just 68 of its 390 parks.[101]

The Park Service relies on this monitoring to determine if air pollution is getting better or worse, to assess pollution's impact on park resources, to guide regulatory decisions, such as establishing critical and target loads for certain pollutants, to evaluate threats from proposed new pollution sources, and to advise visitors when to take precautions against unhealthy air.

Because such information is critical if the Park Service, Congress, and the public are to understand and respond effectively to air pollution threats in the parks, the Park Service should implement monitoring of all major air pollutants at every park that has been afforded special protection under the Clean Air Act (the so-called "Class I" parks).

The Park Service also has developed innovative and effective programs to reduce air pollution from activities within the parks. Many parks now use low-pollution vehicles such as gas-electric hybrids and heavy-duty trucks that run on biodiesel — a blend of conventional diesel fuel and organic-based fuel that produces lower emissions of particulate matter. Yellowstone National Park is experimenting with cleaner-running snowmobiles and is relying on snow coaches to help reduce wintertime emissions.[102]

With support from the EPA, the Park Service has recently developed a "climate-friendly parks" initiative that focuses on "climate change mitigation and energy efficiency and provides park visitors examples of environmental excellence and leadership that can be emulated in communities, organizations, and corporations across the country."[103]

NPCA commends the Park Service for such initiatives and supports efforts to develop new programs and expand current ones to new parks.

8. Promote clean, renewable domestic energy supplies

NATIONAL PARK SERVICE

We can meet America's growing energy demands and still have clean and healthy parks. Developing domestic renewable energy resources, and using energy more efficiently, can help.

Energy sources like wind, geothermal energy, solar power, and energy from farm wastes ("biomass") are a growing source of electricity generation thanks in part to federal incentive programs. In the transportation sector, ethanol is an increasing part of the fuel supply, and hydrogen looms on the horizon as the ultimate clean fuel.

However, these renewable fuels still represent only a small fraction of the power needed to meet America's energy demand. Unfortunately, federal policies continue to favor the most polluting fossil fuels over clean, renewable power, and energy efficiency programs.

Using energy more efficiently remains the largest and most affordable untapped source of "new" energy in the United States. Developing more fuel-efficient autos and energy-efficient appliances like refrigerators, air conditioners, and furnaces, will save consumers money and protect park air quality at the same time.

Congress and the states should adopt policies that maximize the use of clean and renewable power for transportation and electricity generation, and that require more efficient appliances and automobiles.

9. Fully fund the National Park System

The national parks lack sufficient staff and financial resources to fulfill their obligations under the Clean Air Act to protect park air resources. Many parks lack dedicated air quality specialists and basic air pollution monitoring equipment. Much of the analysis needed to understand and respond to air pollution in the parks remains unfunded. And without full staffing, the Park Service's Air Resource Division is at risk of being overwhelmed by the wave of new energy projects near the parks.

On top of this, park sites are being hit with an unprecedented number of natural disasters. Severe storm damage, such as occurred at Gulf Islands and other coastal parks in 2004 and 2005, is a major drain on park resources.

In June 2006, the U.S. House of Representatives approved an additional $55 million allocation for the National Park Service to fund necessary expenses related to the consequences of Hurricane Katrina and other recent storms. Unfortunately, even this amount covers only a fraction of the

SHANE FARNOR

parks' needs. For instance, in 2004 Hurricane Ivan caused $30 million in damages at Gulf Islands National Park alone, and the Park Service has estimated that the 2005 hurricane season caused $100 million in damages to parks along the Gulf Coasts of Florida, Mississippi and Louisiana.

On average, national parks operate with only two-thirds of the money needed to cover annual operating expenses. When projected to the entire park system, this chronic funding shortfall is more than $800 million annually.

NPCA's National Park Legacy Campaign, and our 400-member Americans for National Parks coalition, is working to secure an increase in annual funding for the parks and significantly reduce the park system's burgeoning maintenance and resource-protection backlog in the next four years. You can learn more about this effort at **www.npca.org/across_the_nation/legacy/**.

Ultimately it is the responsibility of the Administration and Congress to ensure the park system has the funds necessary to fulfill its mission. They must take steps to eliminate the parks' budget shortfall and ensure full funding of the National Park System.

10. Act as concerned citizens to help clean the air in the parks

Finally, as individual citizens, we can all do our part to help protect the parks from air pollution. At home, we can use electricity and gas more efficiently to help reduce fossil fuel emissions. EPA's Energy Star program offers numerous examples of ways to save money on utilities and cut pollution at the same time. Visit **www.energystar.gov** to find out about high efficiency air conditioners, furnaces, and other home appliances.

If you are thinking of buying a new vehicle, EPA and the U.S. Department of Energy can help you choose one with low emissions and high gas mileage. Or, they can advise you how to operate your current vehicle more cleanly and efficiently. Check out their website at **www.fueleconomy.gov**.

Within the parks, you can help cut pollution by using free shuttles, where available, instead of driving. Each park offers information to help you plan your trip. An alphabetical listing of all national park web pages is available at **www.nps.gov/applications/parksearch/atoz.cfm**.

PHOTODISC

"Two roads diverged in a yellow wood, …

And I, I took the one less traveled by,

And that has made all the difference."

— Robert Frost, The Road Not Taken, 1915

Will we take the road to clean and healthy parks?

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Endnotes

[1] U.S. Energy Information Administration, Electric Power Monthly, May 2006, http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html

[2] U.S. General Accounting Office, "Air Pollution: Meeting Future Electricity Demand Will Increase Emissions of Some Harmful Substances," October 2002, http://www.gao.gov/new.items/d0349.pdf.

[3] U.S. Department of Energy, National Energy Technology Laboratory, "Tracking New Coal-Fired Power Plant Development; Coal's Resurgence in Electric Power Generation," June 21, 2006, http://www.netl.doe.gov/coal/refshelf/ncp.pdf.

[4] U.S. Energy Information Administration, "U.S. Primary Energy Consumption and Carbon Dioxide Emissions, 2001," http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html.

[5] National Park Service, Air Quality in the National Parks, 2nd Edition, p. 37, http://www2.nature.nps.gov/air/Pubs/aqnps.cfm.

[6] National Park Service, Great Smoky Mountains National Park, www.nps.gov/grsm; see also UNESCO Biosphere Reserve web pages, http://www.unesco.org/mab/faq_br.shtml.

[7] National Park Service, Air Quality in the National Parks, 2nd Edition, p. 37, http://www2.nature.nps.gov/air/Pubs/aqnps.cfm.

[8] Great Smoky Mountains National Park Management Folio #2, Air Quality

[9] National Park Service, Great Smoky Mountains National Park, www.nps.gov/grsm.

[10] Great Smoky Mountains National Park Management Folio #2, Air Quality, http://www.nps.gov/grsm/gsmsite/airquality01.pdf.

[11] Appalachian Highlands Science Learning Center, http://www.handsontheland.org/monitoring/projects/ozone/ozone_bio_search.cfm.

[12] Regional Clean Air Coalition (RCAC), http://www.etnrcac.org/.

[13] National Park Service, Mammoth Cave National Park, www.nps.gov/maca.

[14] Webb, et al. 2005. *Occurrence and Distribution of Mercury in Mammoth Cave National Park*, Paper No. 167-7, Geological Society of America; US EPA Human Methylmercury Exposure Reference Dose, http://www.epa.gov/mercury/exposure.htm.

[15] Greenwire, EPA study links fallout in Ohio to nearby coal-burning plants, February 15, 2006; This study has been submitted for publication by a scientific journal; for a summary of the results by the lead author, Matthew S. Landis, contact Mark Wenzler at mwenzler@npca.org.

[16] US EPA Total Maximum Daily Loads, http://www.epa.gov/owow/tmdl/.

[17] U.S. Global Change Research Information Office, 2000. Our Changing Planet: The FY 2001 U.S. Global Change Research Program, A Report by the Subcommittee on Global Change Research, Committee on Environment and Natural Resources Research of the National Science and Technology Council, A Supplement to the President's Fiscal Year 2001 Budget, p. 27, http://www.gcrio.org/ocp2001/.

[18] Ziska, L.H., R. Blank, 2005. Rising Atmospheric Carbon Dioxide and the Success of Invasive Plant Species, U.S. Climate Change Science Program (CCSP) Workshop: Climate Science in Support of Decision Making. November 14-16, 2005, http://www.climatescience.gov/workshop2005/posters/P-EC4.6_Ziska.pdf.

[19] National Park Service, Rocky Mountain National Park, http://www.nps.gov/romo/, http://www.nps.gov/romo/resources/environment.html.

[20] National Park Service, Rocky Mountain National Park, Air & Water Quality, http://www.nps.gov/romo/resources/environment/airandwater.html.

[21] National Park Service, Rocky Mountain National Park, Environment and Landscape, http://www.nps.gov/romo/resources/environment.html.

[22] National Park Service, Rocky Mountain National Park, Nitrogen Deposition Correlated with Changes in Lake Organisms, http://www.nps.gov/romo/downloads/CDRLC/summaries/diatoms.pdf.

[23] Rocky Mountain National Park Initiative, "Nitrogen Deposition: Issues and Effects in Rocky Mountain National Park (Technical Background Document)," March 2004, http://www.cdphe.state.co.us/ap/rmnp/noxtech.pdf

[24] Ibid.

[25] National Park Service, 2005 Annual Performance & Progress Report: Air Quality in National Parks, http://www2.nature.nps.gov/air/Pubs/pdf/gpra/Gpra2005_Report_03202006_Final.pdf.

[26] Rocky Mountain National Park Initiative, http://www.cdphe.state.co.us/ap/rmnp.html.

[27] Memorandum of Understanding For Interagency Collaboration to Address Air Quality Issues Affecting Rocky Mountain National Park, entered into by the Colorado Department of Public Health and Environment, the U.S. Environmental Protection Agency, Region 8, the U.S. Department of the Interior, National Park Service, Intermountain Region, December 13, 2005, http://www.cdphe.state.co.us/ap/rmnp/rmnpmoa.pdf

[28] Letter from Vaughn Baker, Superintendent of Rocky Mountain National Park, to Dennis E. Ellis, Executive Director of Colorado Department of Public Health and Environment, May 9, 2006, http://www.cdphe.state.co.us/ap/rmnp/rmnpCLLetter.pdf.

[29] US EPA, "Ozone and Your Health," (EPA-452/F-99-003), http://www.epa.gov/airnow//ozone-bw.pdf.

[30] Air Resource Specialists, Inc. Annual Data Summary 2004: Gaseous Pollutant Monitoring Program, Ozone, Sulfur Dioxide, Meteorological Observations. National Park Service, Department of the Interior, Air Resources Division, p. 3-17, http://www2.nature.nps.gov/air/monitoring/ads/ADSReport.cfm

[31] National Park Service, http://www1.nature.nps.gov/sustainabilitynews/Summer_03/Summer_03_Innovations/SustainabilityNewsSummer2003Innovations.htm

[32] An overview of all efforts related to emission reduction at Joshua Tree National Park is at: http://www.nature.nps.gov/sustainabilityNews/search_docs/CEI_Park_Updates/JoshTree_Update_Page.htm

[33] National Park Service, http://www.nps.gov/guis/extended/home.htm

[34] National Park Service, http://www.nps.gov/guis/extended/FLA/History/Forts.htm

[35] National Park Service, http://www.nps.gov/guis/extended/MIS/MHistory/Forts.htm

[36] U.S. EPA, "Global Warming Impacts, Coastal Zones," http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ImpactsCoastalZones.html.

[37] U.S. Global Change Research Program, "U.S. National Assessment of the Potential Consequences of Climate Variability and Change. *Gulf Coast Region: Findings of the Gulf Coast Regional Assessment*," Chapter 5, "Gulf Coast Regional Climate," p. 80, http://www.usgcrp.gov/usgcrp/Library/nationalassessment/gulf-coast/gulfcoast-chapter5.pdf.

[38] Science News Online, "The Wind and the Fury: Has climate change made hurricanes fiercer, or are such claims hot air?," September 15, 2005. http://www.sciencenews.org/articles/20050917/bob8.asp.

[39] NOAA, National Climactic Data Center, "Climate of 2005 Atlantic Hurricane Season," http://www.ncdc.noaa.gov/oa/climate/research/2005/hurricanes05.html.

[40] NOAA News Release, "NOAA PREDICTS VERY ACTIVE 2006 NORTH ATLANTIC HURRICANE SEASON," http://www.noaanews.noaa.gov/stories2006/s2634.htm.

[41] Reuters, "Global Warming Behind Record 2005 Storms — Experts," April 26, 2006.

[42] Testimony of Nathaniel Pryor Reed, former assistant secretary of the U.S. Department of the Interior for Fish, Wildlife and Parks in the Nixon and Ford administrations, re: "National Parks of Florida" before the Subcommittee on Criminal Justice, Drug Policy and Human Resources f the House Government Reform Committee U.S. House of Representatives, January 11, 2006, http://www.npca.org/media_center/testimonies/testimony011106.html .

[43] NPS, "Natural Resource Year in Review — 2005: Impacts to national parks from 2005 hurricane season coming to light: A preliminary overview," http://www2.nature.nps.gov/YearinReview/00_B.html.

[44] Times Picayune, "Crews working to pull national seashore from Katrina's mire," September 24, 2005; Heritage Emergency National Task Force, "NPS Status Report, December 30, 2005," http://www.heritagepreservation.org/PROGRAMS/KatrinaNPS.HTM.

[45] Ibid.

[46] Times Picayune, "Crews working to pull national seashore from Katrina's mire," September 24, 2005.

[47] Washington Post, "Park Service Team Set to Rescue Years of Artifacts," September 1, 2005

[48] National Park Service, "Briefing for Heritage Emergency National Task Force: Hurricane Response," February 7, 2006.

[49] Hall, M. H. P. 1994. Predicting the impact of climate change on glacier and vegetation distribution in Glacier National Park to the Year 2100. M.S. Thesis. State University of New York, Syracuse, NY. 192 pp.

[50] United States Department of the Interior and Parks Canada, Period Report on the Application of the World Heritage Convention, Report on the State of Conservation of Waterton-Glacier International Peace Park, Considered by the World Heritage Committee July 2005.

[51] International Environmental Law Project (IELP) Petition to the World Heritage Committee to list Waterton-Glacier World Heritage Site in Danger Due to Climate Change. Filed February 16, 2006.

[52] Alftine, K. J., G. P. Malanson, and D. B. Fagre. 2003. Feedback-driven response to multidecadal climatic variability at an alpine forest-tundra ecotone. Physical Geography 24(6): 520 — 535; Klasner FL, Fagre DB. 2002. A Half Century of Change in Alpine Treeline Patterns at Glacier National Park, Montana, U.S.A. J Arctic, Antarctic and Alpine Res (34):53-61; Key, C. H., D. B. Fagre, and R. K. Menicke. 2002. Glacier retreat in Glacier National Park, Montana. Pages J365-J381 In R. S. Jr. Williams and J. G. Ferrigno, editors. Satellite Image Atlas of Glaciers of the World, Glaciers of North America - Glaciers of the Western United States. United States Government Printing Office, Washington D. C., USA.

[53] Hall, M. P. and D. B. Fagre. 2003. Modeled climate-induced glacier change in Glacier National Park, 1850-2100. Bioscience. 53(2):131-140.

[54] Alaska National Interest Lands Conservation Act (ANILCA), Section 101(c)

[55] Contaminants in Alaska: Is America's Arctic At Risk? An Interagency Collaborative Paper (U.S. Department of Interior and others). 2000. http://www.conservationinstitute.org/contaminantsinalaska.htm

[56] National Park Service, Factsheet on Western Airborne Contaminants Assessment Project, January 2005.

[57] Rozell, N. "New Pesticide Traces Found at Arctic Lake". Anchorage Daily News, May 22, 2006; Contaminants in Alaska: Is America's Arctic At Risk? An Interagency Collaborative Paper (U.S. Department of Interior and others). 2000. http://www.conservationinstitute.org/contaminantsinalaska.htm

[58] Wilson, R., S. Allen-Gil, Griffin, D. Landers. Organochlorine contaminants in fish from an Arctic lake in Alaska, USA. The Science of the Total environment, 160/161: 511-519, 1995.

[59] Berner, J. Chapter 5: Contaminants and human health. In: Alaska Pollution Issues, M. Bradley (ed). Alaska Native Epidemiology Center, Anchorage. 1999.

[60] ACIA Full Science Report, Chapter 14.9.3 pg. 839. Cambridge University Press, 2004; Sigler, J.M., X. Lee and W. Munger. October 1, 2003. Emission and long-range transport of gaseous mercury from a large-scale Canadian boreal forest fire. Environmental Science and Technoloty 37 (19): 4343-4347.

[61] National Park Service, Western Airborne Contaminants Assessment Project, Research Plan, May 2003, http://www2.nature.nps.gov/air/Pubs/pdf/toxics/200305WacapResearchPlan.pdf.

[62] National Park Service, National Mall and Memorial Parks, http://www.nps.gov/nacc/index.htm.

[63] U.S. Geological Service, "Acid Rain and Our Nation's Capital," by Elaine McGee, http://pubs.usgs.gov/gip/acidrain/index.html.

[64] Ibid.

[65] For more information about NCPTT, its programs, and its research efforts, contact Mary F. Striegel, Chief, Materials Research, NCPTT at Mary_Striegel@nps.gov, 318/356-7444.

[66] National Park Service, Shenandoah National Park, Nature and Science, Scenic Vistas, http://www.nps.gov/shen/pphtml/subenvironmentalfactors25.html.

[67] National Park Service, Blue Ridge Parkway, http://www.nps.gov/blri/.

[68] National Park Service, Great Smoky Mountains National Park Management Folio #2, Air Quality

[69] National Park Service, "Assessment of Air Quality and Related Values in Shenandoah National Park," Technical Report NPS/NERCHAL/NRTR-03/090, May 2003, http://www.nps.gov/shen/air_quality.htm.

[70] National Park Service, Shenandoah National Park, Nature & Science, Air Quality, http://www.nps.gov/shen/pphtml/subenvironmentalfactors23.html.

[71] National Park Service, Blue Ridge Parkway, Nature & Science, Air Quality, http://www.nps.gov/blri/pphtml/subenvironmentalfactors23.html.

[72] NPS Visibility Monitoring, http://www2.nature.nps.gov/air/monitoring/vismon.cfm.

[73] National Park Service Web Cameras, http://www2.nature.nps.gov/air/webcams/index.cfm.

[74] VIEWS Visibility Photographs, http://vista.cira.colostate.edu/views/Web/IMPROVE/Data_IMPRPhot.htm.

[75] National Park Service, Yellowstone National Park Air Quality Information, http://www2.nature.nps.gov/air/Permits/ARIS/yell/; National Park Service, "Assessment of Air Quality and Air Pollutant Impacts in National Parks of the Rocky Mountains and Northern Great Plains," August 1998, Chapter 5, Yellowstone National Park, http://www2.nature.nps.gov/air/Pubs/pdf/reviews/rm/RM5yell.pdf.

[76] Environmental Defense, "Clearing the Haze from Western Skies," http://www.environmentaldefense.org/documents/4481_ClearingHaze.pdf, citing data from the Wyoming Oil and Gas Conservation Commission, http://wogcc.state.wy.us.

[77] Greater Yellowstone Clean Air Partnership, "Greater Yellowstone Area Air Quality Assessment Update," November 2005, http://www.nps.gov/yell/publications/pdfs/airquality/GYA_AirQuality_Nov_2005.pdf.

[78] Greater Yellowstone Area Clean Air Partnership meeting notes, 2005 Annual Meeting, Heritage and Research Center Gardiner, MT, October 5 & 6, 2005, http://www.fs.fed.us/r1/gallatin/resources/air/events/index.shtml.

[79] Western Regional Air Partnership, Draft Report: Identification of BART-Eligible Sources in the WRAP Region, (04/04/05), Revised Appendix K: Eligibility of Steam Electric Plants at the Unit Level (10/18/05), http://www.wrapair.org/forums/ssjf/documents/bart/Appendix_K_EGUs_v13.xls.

[80] Montana Environmental Information Center, "Emissions Inventory for the Proposed 780 MW Roundup Power Plant," http://www.meic.org/2003_Legislature/FACT_SHEETS/roundup.pdf.

[81] Greater Yellowstone Clean Air Partnership, "Greater Yellowstone Area Air Quality Assessment Update," November 2005, http://www.nps.gov/yell/publications/pdfs/airquality/GYA_AirQuality_Nov_2005.pdf.

[82] U.S. EPA Air Markets Division, http://www.epa.gov/airmarkets/mp/pssupport/CAIR_CAMR_CAVR_Parsed_2020.xls

[83] Other cosponsors of the Clean Air Planning Act include Senators Lincoln Chafee (R-RI), Dianne Feinstein (D-CA), Judd Gregg (R-NH), Christopher Dodd (D-CT), and Lindsey Graham (R-SC).

[84] U.S. Department of Energy, National Energy Technology Laboratory, "Tracking New Coal-Fired Power Plant Development; Coal's Resurgence in Electric Power Generation," June 21, 2006, http://www.netl.doe.gov/coal/refshelf/ncp.pdf.

[85] Ibid.

[86] U.S. EPA, letter to Paul Smith, E3 Consulting LLC, from Steven D. Page, Director of EPA Office of Air Quality Planning and Standards, re Best Available Control Technology Requirements for Proposed Coal-Fired Power Plant Projects, December 13, 2005.

[87] U.S. EPA Fact Sheet, Technical Report On The Environmental Footprint and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies, July 7, 2006, http://www.epa.gov/airmarkets/articles/IGCCfactsheet.html.

[88] In a September 2005 rulemaking on nitrogen oxide standards, EPA noted that "critical loads represent a promising mechanism for addressing environmental impacts associated with atmospheric nitrogen deposition," and could be used "to determine the goals of emissions control and management practices related to ecosystem protection." EPA concluded that critical load programs could be developed by working collaboratively with States, tribes, and federal land managers to implement "pilot projects" in selected areas where there may be sufficient information on pollution impacts to establish critical loads. U.S. EPA, Final Rule, Prevention of Significant Deterioration for Nitrogen Oxides, http://www.epa.gov/nsr/documents/final-rule20050929.pdf.

[89] Clean Air Act, Prevention of Significant Deterioration, 42 U.S.C. §7475(d); 40 C.F.R. §51.166.

[90] To track increments, "[t]he State shall review the adequacy of a plan on a periodic basis . . . ." *40 CFR §51.166(a)(4)*. The review is to "assess periodically whether emissions from exempted or unreviewed sources are endangering an applicable increment." *43 Fed. Reg. 26381 (June 19, 1978)*.

[91] Greenwire, *EPA study links fallout in Ohio to nearby coal-burning plants*, February 15, 2006; This study has been submitted for publication by a scientific journal; for a summary of the results by the lead author, Matthew S. Landis, contact Mark Wenzler at mwenzler@npca.org.

[92] Clean Air Act § 112, 42 U.S.C. 7412.

[93] STATES challenging EPA's mercury rule in court: California, Connecticut, Delaware, Illinois, Maine, Massachusetts, Michigan, Minnesota, New Jersey, New Hampshire, New Mexico, New York, Pennsylvania,

Vermont and Wisconsin; HEALTH ADVOCATES: Physicians for Social Responsibility, the American Public Health Association, American Nurses Association, and American Academy of Pediatrics.

[94] *Reuters*, "US Senate defeats bid to repeal EPA mercury rule," September 13, 2005.

[95] States with mercury rules stronger than EPA's: Connecticut, Georgia, Illinois, Massachusetts, Maryland, Minnesota, North Carolina, New Hampshire, New Jersey, Pennsylvania, Wisconsin.

[96] *Boston Globe*, "Mercury down 32% in fish near Mass. Incinerators; Progress tied to emissions laws, "By Beth Daley, April 3, 2006.

[97] Florida Department of Environmental Protection, *Integrating Atmospheric Mercury Deposition With Aquatic Cycling in South Florida*, revised November 2003, available at [ftp://ftp.dep.state.fl.us/pub/labs/assessment/mercury/tmdlreport03.pdf], visited April 5, 2005. See especially, pp. 56-59.

[98] Michael Durham, et al., "Full-Scale Results of Mercury Control by Injecting Activated Carbon Upstream of ESPs and Fabric Filters," paper presented at PowerGen 2003, Las Vegas, NV, December 9-11, 2003, p. 19; U.S. EPA, Office of Research and Development, "Control of Mercury Emissions from Coal-Fired Electric Utility Boilers," undated, posted March 2, 2004, available at www.epa.gov/ttn/atw/utility/hgwhitepaperfinal.pdf; CRS Report for Congress (RL32868), "Mercury Emissions from Electric Power Plants: An Analysis of EPA's Cap-and-Trade Regulations, "April 15, 2005. http://ncseonline.org/NLE/CRSreports/05apr/RL32868.pdf.

[99] State and Territorial Air Pollution Control Administrators, and Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), "Reducing Greenhouse Gases and Air Pollution: A Menu of Harmonized Options," http://www.4cleanair.org/comments/execsum.PDF.

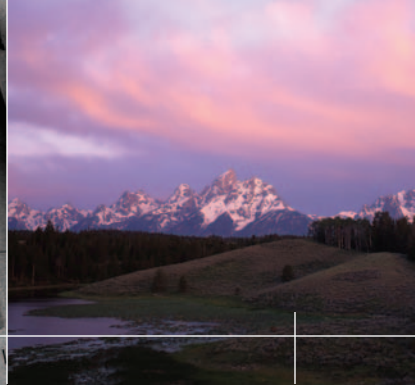
[100] Regional Greenhouse Gas Initiative (RGGI), http://www.rggi.org/.

[101] National Park Service, "2005 Annual Performance & Progress Report: Air Quality in National Parks," http://www2.nature.nps.gov/air/Pubs/pdf/gpra/Gpra2005_Report_03202006_Final.pdf

[102] National Park Service, Sustainability News, http://www.nature.nps.gov/sustainabilityNews/index.htm.

[103] National Park Service, Climate Change in Parks & the Climate Friendly Parks Initiative, http://www2.nature.nps.gov/air/features/climatechangeparks.cfm.



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National Park Sites Located in Poor Air Quality Areas as Designated by the EPA

(continued from inside front cover)

MICHIGAN
Sleeping Bear Dunes NL

MISSOURI
Jefferson National Expansion MEM
Ulysses S. Grant NHS

MONTANA
Glacier NP

NEW JERSEY
Appalachian NST
Delaware Water Gap NRA
Delaware NSR
Edison NHS
Gateway NRA
Great Egg Harbor Scenic & Recreational River
Morristown NHP
Statue of Liberty NM

NEW MEXICO
White Sands NM

NEW YORK
African Burial Ground NM
Appalachian NST
Castle Clinton NM
Federal Hall NMEM
Gateway NRA
General Grant NMEM
Governors Island NM
Hamilton Grange NMEM
Sagamore Hill NHS
Saratoga NHP
St. Paul's Church NHS
Statue of Liberty NM
Theodore Roosevelt Birthplace NHS
Theodore Roosevelt Inaugural NHS
Upper Delaware Scenic & Recreational River

NORTH CAROLINA
Appalachian NST
Blue Ridge PKWY
Great Smoky Mountains NP

OHIO
Cuyahoga Valley NP
Dayton Aviation Heritage NHP
First Ladies NHS
James A. Garfield NHS
William H. Taft NHS

OREGON
Crater Lake NP

PENNSYLVANIA
Allegheny Portage Railroad NHS
Appalachian NST
Delaware Water Gap NRA
Delaware NSR
Edgar Allan Poe NHS
Eisenhower NHS
Friendship Hill NHS
Fort Necessity NB
Gettysburg NMP
Hopewell Furnace NHS
Independence NHP
Johnstown Flood NMEM
Steamtown NHS
Thaddeus Kosciuszko NMEM
Valley Forge NHP

SOUTH CAROLINA
Congaree Swamp NP
Kings Mountain NMP

TENNESSEE
Appalachian NST
Chickamauga & Chattanooga NMP
Great Smoky Mountains NP
Natchez Trace NST
Natchez Trace PKWY
Stones River NB

TEXAS
Big Thicket NPRES
Chamizal NMEM
San Antonio Missions NHP

UTAH
Timpanogos Cave NM

VIRGINIA
Appalachian NST
Arlington House, The Robert E. Lee MEM
Blue Ridge PKWY
Cedar Creek & Belle Grove NHP
Colonial NHP
George Washington Memorial PKWY
Harpers Ferry NHP
Maggie L. Walker NHS
Manassas NBP
Petersburg NB
Prince William Forest Park
Richmond NBP
Wolf Trap Farm Park

WEST VIRGINIA
Appalachian NST
Harpers Ferry NHP

Abbreviations

NB	National Battlefield	NM	National Monument	NRA	National Recreation Area
NBP	National Battlefield Park	NMEM	National Memorial	NS	National Seashore
NHP	National Historic Park	NMP	National Memorial Park	NSR	National Scenic River
NHS	National Historic Site	NP	National Park	NST	National Scenic Trail
NL	National Lakeshore	NPRES	National Preserve	PKWY	Parkway

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