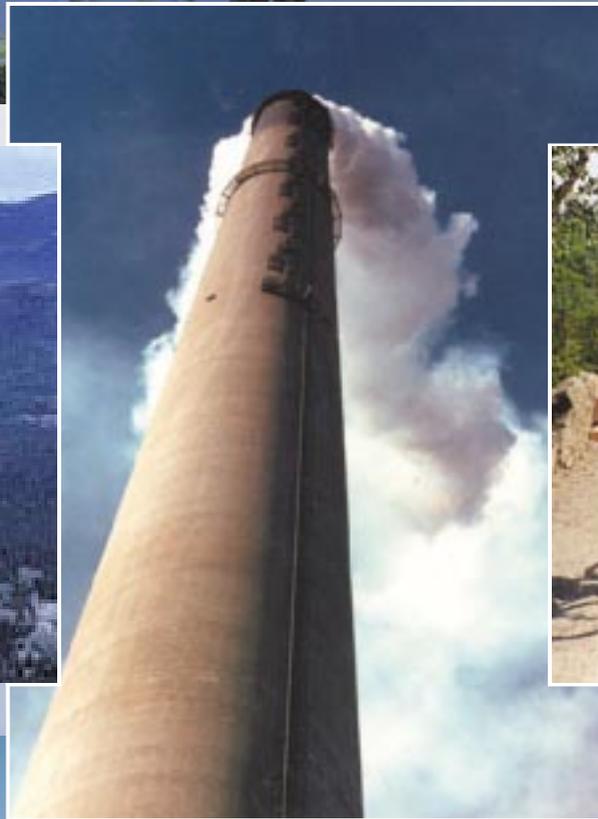
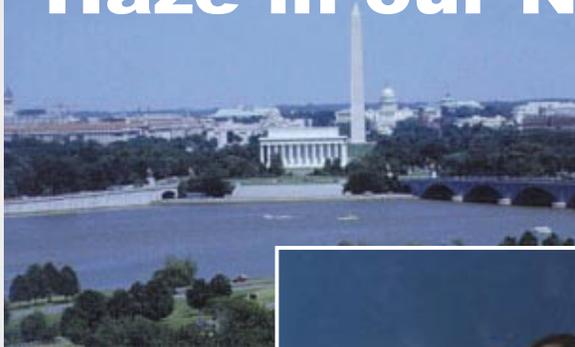




A CLEAR THE AIR REPORT

# OUT OF SIGHT:

## Haze in our National Parks



*How Power Plants Cost Billions  
in Visitor Enjoyment*

# Executive Summary

## *There's No Escaping Air Pollution in our National Parks and Wilderness Areas*

Wilderness is at the heart of our national identity. The sheer beauty and variety of America's natural environment, the vastness of her natural resources — and our responses to them throughout our history — define us as a nation. In *Walden*,<sup>1</sup> Henry David Thoreau wrote:

*"Our village life would stagnate if it were not for the unexplored forests and meadows which surround it. We need the tonic of wildness...that the land and sea be infinitely wild. We must be refreshed by the sight of inexhaustible vigor, vast and titanic features..."*

In recognition of this, Americans have created the national parks, with the goal of preserving our most treasured areas. Little did the founders of the park system dream that these places would also serve as economic engines to communities throughout the U.S.

Over the past half-century our national gems—America's national parks, wilderness areas and national wildlife refuges—have become shrouded in a milky white haze. Gone are the days when you could find respite from the smog-filled air of the cities in a family vacation to a national park or forest. What is causing this blight on our treasured vacation spots? Although many believe that summertime haze is simply a result of heat and humidity, scientists have determined that haze is actually due to the same fine particles that cause acid rain and tens of thousands of premature deaths each year — fine particles primarily caused by pollution from power plants. According to U.S. EPA, power plants are responsible for over two-thirds of the sulfate particles that are

the chief cause of haze in the U.S.

Since the mid 20th century, following World War II, our appetite for electricity has dramatically increased, and along with it came huge increases in emissions of sulfur dioxide and other visibility-harming pollutants from coal-fired electrical power plants. Sulfur dioxide, an extremely harmful gas, converts to acidic sulfate particulate matter in the atmosphere, and is the principal cause of the thick haze that obscures the natural vistas in the Great Smoky Mountains, Shenandoah, Acadia, Grand Canyon and many other national parks.

Poor air quality in some national parks and wilderness areas rivals that in major U.S. cities. Regional haze has reduced annual average visibility in our national parks and wilderness areas to about one-third (west) to one-quarter (east) of natural conditions. For example, the average natural visual range in Virginia's Shenandoah National Park and in the Great Smoky Mountains of Tennessee and North Carolina is about 80-90 miles, while average summertime visibility has been reduced to a paltry 12 miles.

Hazy parks are parks at risk. A 1998 report showed that visibility and "clean, clear air" were among the most important park attributes to visitors. At some parks, as many as 80% of respondents felt clear air and visibility were very to extremely important to their recreational experience. Take away the clear view, and you remove vacationers' primary reason for visiting the parks.

### *Haze from Electric Power Plants Costs Americans Billions*

Haze comes at no small cost to our national parks. A report by Abt Associates commissioned by the Clean Air Task Force for Clear the Air estimates that the value of eliminating power plant haze is over seven billion dollars a year.

Abt's results show that, based on the public's willingness to pay for



*"O! say can you see?"  
Because of haze  
pollution, far too  
often the answer  
is "No."*

visibly cleaner air where they live, the adverse impact of power plant emissions are worth \$3.4 billion a year. Similarly, the impact of power plant emissions on visibility in parks and wilderness areas are \$4.3 billion a year. Together, Abt found that the impact of power plant emissions as measured in people's willingness to pay for visibly cleaner air where they live and in parks and wilderness areas totaled \$7.7 billion per year. Based on this analysis, if emissions from power plants — particularly sulfur dioxide — were reduced substantially beyond levels mandated by current regulatory programs, the monetary benefits could total hundreds of millions to billions of dollars a year.

The Abt study also demonstrates that small increases in park visitation could result in significant increases in revenues and jobs. Their analysis shows that local economies benefit from increased tourism that is likely



PETER ALTMAN

*Electric utilities are the source of two-thirds of all sulfur dioxide emissions.*

### *Summary of Findings*

- Visitors to national parks and wilderness areas consistently rate visibility and clear scenic vistas as one of the most important aspects of their experience.
- 287 million people visited national parks (not including national forests) in 1998. Travel-related expenditures by visitors to all Department of Interior lands generated an average of \$35 billion (in 1996 dollars) in annual travel-related expenditures, and created approximately half a million jobs.
- Studies have shown that when visibility in parks declines, people spend less time in the parks and reduce the number of visits they make.
- Economies in and around public lands could benefit from increases in tourism that would result from improvements in visibility. If enhanced visibility were to result in an increase in park visitation by just 10 to 25%, hundreds of millions of dollars in revenues and thousands of jobs would be generated.
- Visitors and non-visitors alike are willing to pay for cleaner air in our national parks.
- The value of eliminating haze from power plants, both in parks and residential areas, is estimated at over seven billion dollars a year.

*"We must be refreshed by the sight of inexhaustible vigor, vast and titanic features..."*

Henry David Thoreau, in *Walden*



DONNA DANNEN, IZAAK WALTON LEAGUE

when visibility is improved. For example, if visibility improvements increased park visitation by 25 percent, the potential annual benefit to a local community can range, depending on the park, from \$13 million and 390 new jobs to \$320 million and 4,188 new jobs. National parks and concessionaires also stand to benefit from an increase in visitation. A 25 percent increase in visitors could yield approximately \$30 million in increased fee collection and \$160 million in additional concession sales.

- The costs of diminished visitor enjoyment in parks and wilderness areas due to power plants are enormous. For example: Great Smoky Mountains National Park the cost is estimated at \$1.8 billion, Acadia National Park \$328 million, Grand Canyon National Park \$278 million, Shenandoah National Park \$128 million, Yosemite National Park \$76 million, Mount Rainier National Park \$148 million, Glacier National Park \$64 million, Big Bend National Park \$48 million.

### *Recommendations*

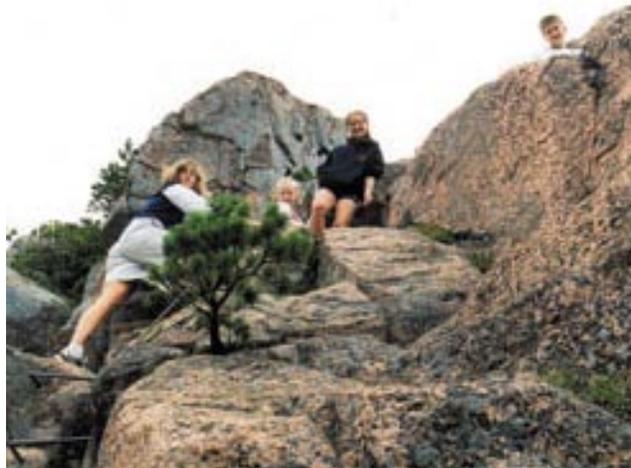
A 1993 National Academy of Science report stated, "Current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility." Large reductions in sulfur dioxide from old coal and oil burning power plants represents the single most important—and cost-effective—step in improving visibility in our parklands and wilderness areas. Reducing emissions from industrial sources as well as cars and diesel trucks and buses are important additional steps. Existing sulfur scrubber technology as well as switching to cleaner natural gas can remove over 90 percent of the visibility-harming sulfur emissions from an electric utility smokestack. Several significant policy options could encourage these developments:

- In late 2000 EPA plans to propose rules on "best available retrofit technology" (BART) for power plants and industrial facilities that contribute to haze in our parks. These rules could result in significant reductions of haze-forming sulfur dioxide and nitrogen oxide emissions. In order for this to happen, EPA must require states to undertake a rigorous review of power plants that contribute to visibility impairment in parks and wilderness areas.
- Legislation has been introduced in Congress that if passed would expeditiously and effectively reduce electric utility emissions of haze-forming sulfur dioxide and nitrogen oxide emissions by as much as 75% beyond current Clean Air Act requirements.



DONNA DANNEN, IZAAK WALTON LEAGUE

*National Park Service surveys consistently show that clean, clear air is one of the top features cited by visitors as important to their enjoyment of the park.*



## Parks Rival the Smoggiest U.S. Cities

For many Americans, our national parks and wilderness areas are family vacation destinations. According to estimates by the National Park Service (NPS), in 1998 the national parks alone saw 287 million visitors.<sup>2</sup> People seek the parks to escape the heat, noise, and pollution that characterizes many of our urban areas and to enjoy fresh clean air and solace in the expansive scenic vistas that are the hallmark of many of our national parks and wilderness areas. Yet the sparkling image of our parks has become tarnished as their scenic vistas have become severely degraded by air pollution. In short, our parks are suffering. In 1999, Great Smoky Mountains National Park in Tennessee and North Carolina, suffered an astounding 52 days in violation of the national health standard for ground-level ozone, rivaling the dirtiest cities in the United States for unhealthy air. In Maine's Acadia National Park, annual ozone violations rival nearby Boston and even New York City.<sup>3</sup>

Although ground-level ozone, a toxic gas, is a serious health problem for visitors to our parks, the hazy vistas are caused by another dangerous air pollutant: particulate matter. Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. These particles, caused largely by combustion of fuel, can travel hundreds of miles causing visibility impairment. They also pose a significant threat to public health.

In the western United States natural visual range is estimated to be about 140 miles, but because of haze average annual visibility is now 35-90 miles.<sup>4</sup> In the

eastern United States natural visibility is somewhat less than in the west due to natural haze and humidity, averaging about 90 miles. However, man-made haze has reduced visibility in the eastern parks to 18-35 miles. Average annual visibility has been reduced to as low as one-quarter of what it would be under natural conditions. During the summer season, visibility can drop even lower. In the southern Appalachians, in the Great Smoky Mountains, Shenandoah and Mammoth Cave National Parks, as well as in national wilderness areas such as Dolly Sods Wilderness and James River Face Wilderness in Virginia, the visibility is reduced to an average of less than 12

miles in the summer season. On any given day, visibility can be just a few miles or less in these areas.

*Great Smoky Mountains National Park often rivals America's dirtiest cities for unhealthy air.*

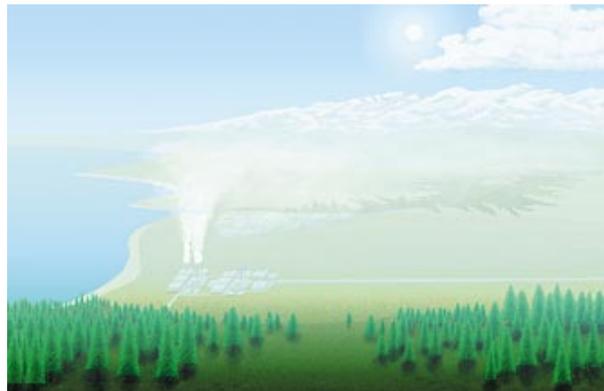


NATIONAL PARK SERVICE

## What is Regional Haze?

Our ability to see a distant scene such as a mountain, depends both on the light reflected to our eyes from the mountain and the intervening conditions in the atmosphere. As the light reflected from the mountain towards our eyes is absorbed and scattered by gaseous pollutants and particulate matter, our ability to see the mountain is reduced. The more particulate matter in the air, the greater the haze.

Where visibility is impaired by a soupy mixture of particulate matter from a wide variety of sources scattered across a large region, it is called "regional haze." Sulfate



*Illustration of regional haze caused by power plants.*

MALM, INTRODUCTION TO VISIBILITY (2000)

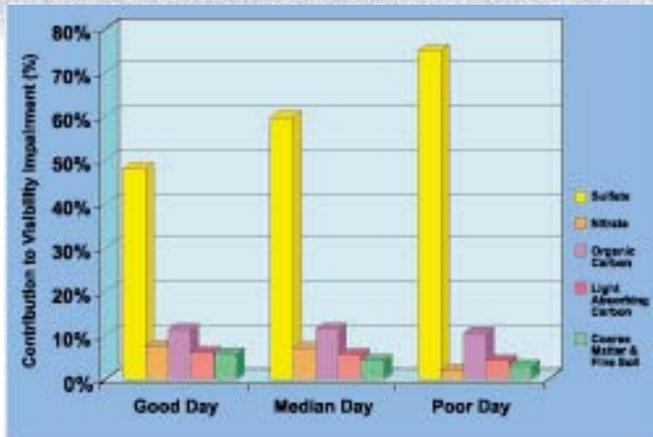
*Have you ever been adversely affected by the air quality at a destination?*

**YES**  **47%**

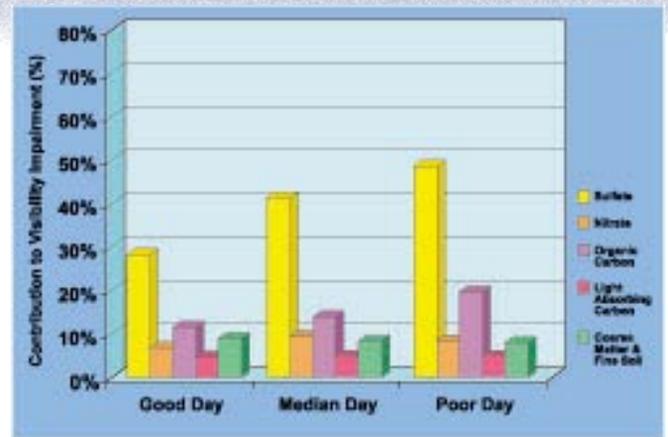
**NO**  **51%**

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## Sulfate Pollution is the Biggest Contributor to Visibility Impairment



Eastern U.S.

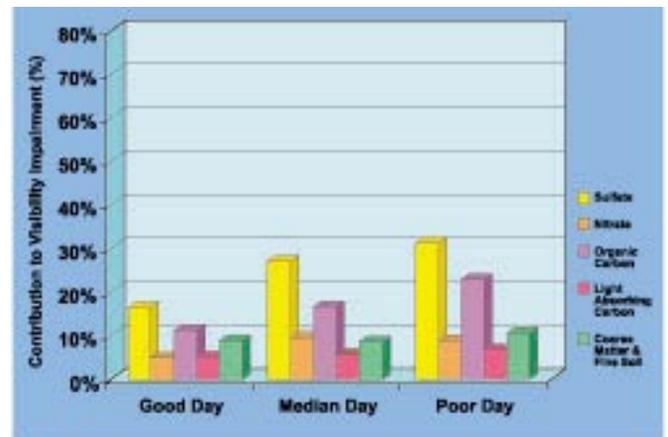


Mid-Western U.S.

particulate matter from power plants and other sources, the prime component of regional haze in most areas, gives the atmosphere a washed-out, whitish appearance.

Regional haze is not simply humidity. Regional haze is particulate matter pollution that is enhanced by humidity. Yet humidity alone does not cause visibility impairment. Haze from particles such as sulfates and nitrates is enhanced by humidity as the particles absorb water and grow. Sulfates and nitrates can more than triple in size as relative humidity increases, thus making visibility worse during periods of high humidity, such as the summer months in the east.

In general, scientists estimate that on the haziest days sulfate contributes to about 75 percent of the particulate matter that impairs visibility in the east, and about 30 percent in some western areas where nitrogen oxide emissions from cars and trucks and forest fires comprise a greater portion of the problem.<sup>5</sup> In some areas of the



Western U.S.

southern U.S., sulfate contributes up to 80% or more of the visibility impairment. Most of the sulfate is from old dirty power plants.<sup>6</sup>

## Identifying Sources of Haze in Our Public Lands

How far away from its source does particulate matter affect visibility? The smallest and lightest particulate matter can affect areas well downwind of power plants — fine particles are transported further even than ozone from its sources. According EPA's work,<sup>7</sup> the range of influence of sulfate particulate deposition is between 300 miles and 750 miles. More specifically, for the Ohio River Valley sources, two-thirds of the total sulfate deposition falls between 300 and 450 miles. In the south where stagnant air masses are more typical, transport is more limited so that two-thirds of the total sulfur deposition is in the 200 to 300 miles range.

Sorting out the individual sources that contribute to haze in a single wilderness area or national park presents a technical challenge. Regional haze, by its very nature, is a mixture of particulate matter from a variety of sources originating, in many cases, hundreds of miles away. In one case, a finding of "attributable impairment" of visibility in a park by a single source was made for the Navajo Generating Station's impact in the Grand Canyon National Park and subsequent emissions reductions were made.



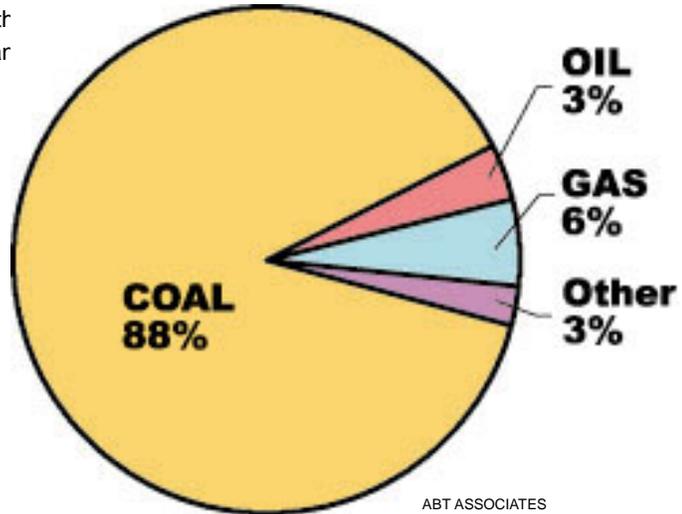
TABLES: ABT ASSOCIATES

KENNETH KIMBALL

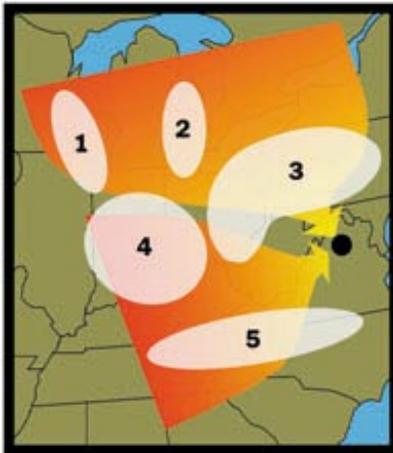
Work has been done in tracking the source and transport of sulfate to the national parks. Typically, such analyses use "source apportionment" models. These models track the path of the wind from areas where pollution sources are located to the park and estimate the contribution of the sources in these areas to the pollutant concentrations in the park. For example, for Grand Canyon National Park, southern California contributes about one-third of the ambient sulfur and one-quarter of that sulfur comes from three nearby power plants: Mojave, Navajo and Reid Gardner plants. However, additional work needs to be done to identify the power plants and other industries that contribute to haze in other parks.

Because regional haze is a diverse mixture of particulate matter that results from pollution sources over wide geographic areas, the most important thing we can do to address poor visibility in our parks and wilderness areas is to reduce the sources of regional haze-forming pollution in broad multi-state areas.

**Most of the sulfur dioxide pollution from power plants comes from burning coal.**

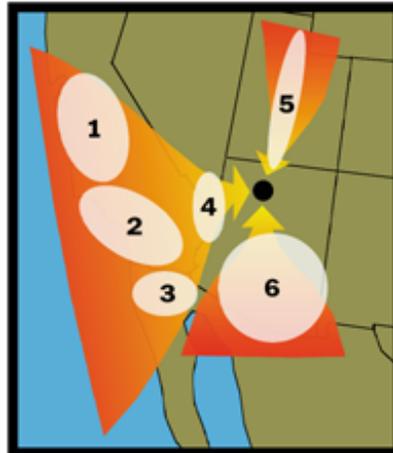


**SOURCES OF SULFATE AT SHENANDOAH NATIONAL PARK**



1. Chicago: 5%
2. Detroit & Toledo: 6%
3. Pittsburgh & Cleveland: 30%
4. Columbus, Dayton, & Cincinnati: 12%
5. Piedmont & N. Tennessee: 16%
6. Other Sources: 31%

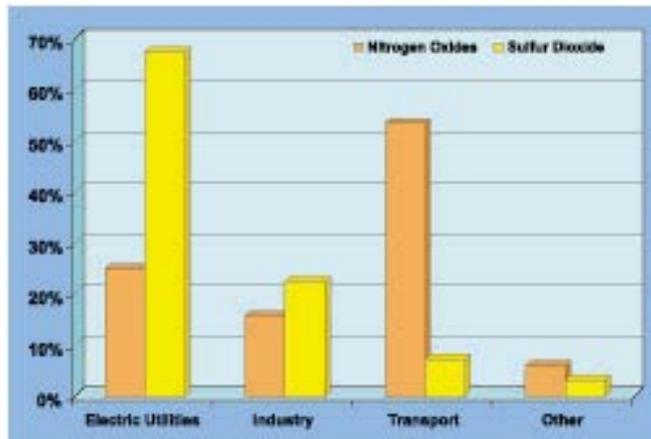
**SOURCES OF SULFATE AT GRAND CANYON NATIONAL PARK**



1. San Joaquin: 6%
2. Southern California: 20%
3. Baja California: 7%
4. Near Canyon Sources: 23%
5. Northeasterly Transport: 12%
6. Southern Arizona: 14%
7. Other Sources: 18%

ILLUSTRATIONS: MALM, INTRODUCTION TO VISIBILITY (2000).

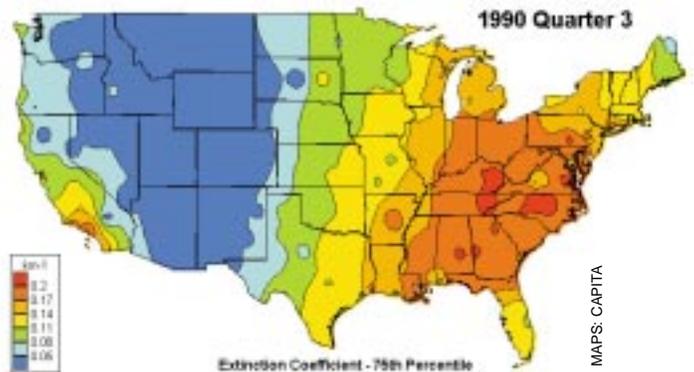
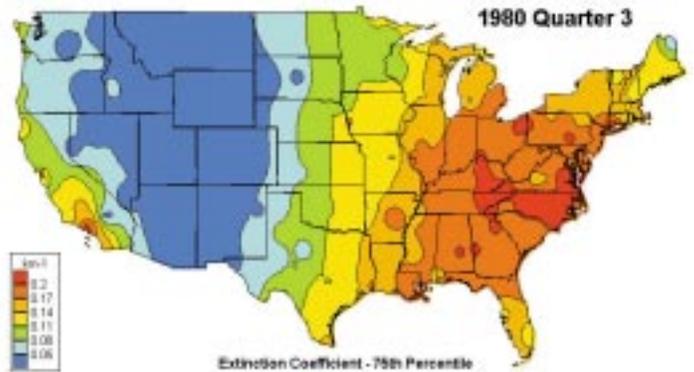
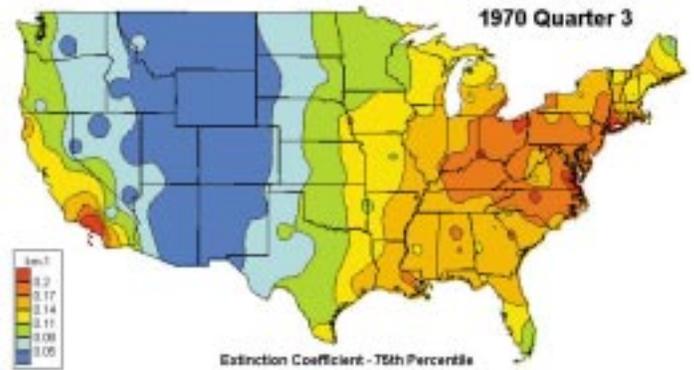
**National Emissions Sources of Sulfur Dioxide and Nitrogen Oxides**



## Hazy Days Getting Worse?

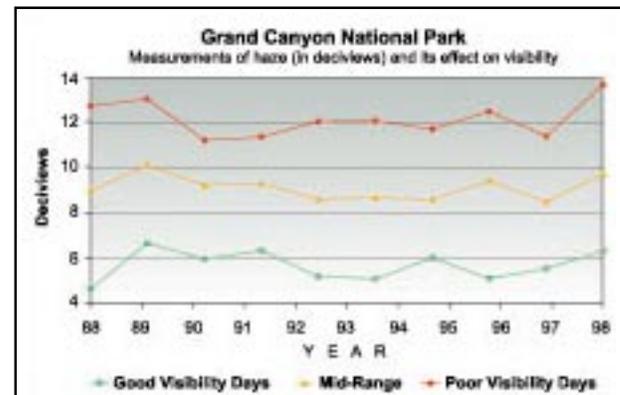
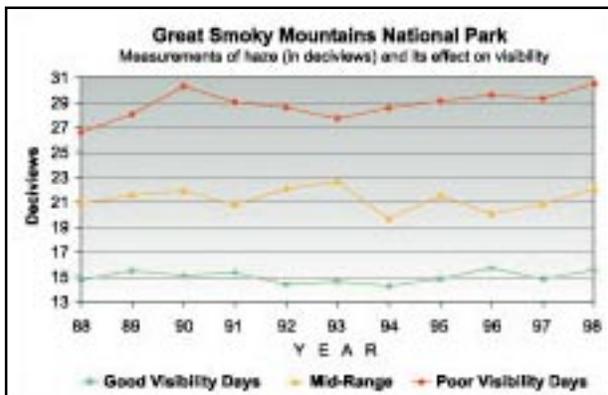
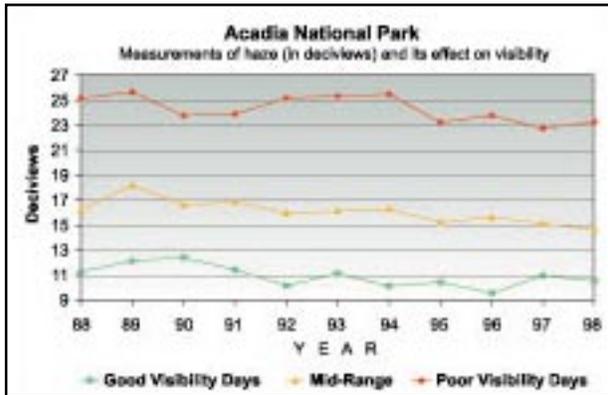
Has visibility improved since enactment of the Clean Air Act of 1970? From the mid 19th century on, visibility conditions throughout the United States generally worsened. Only with implementation of the acid rain provisions of the 1990 Clean Air Act Amendments, requiring the first major cuts in utility sulfur dioxide emissions, did visibility begin to improve. Since then, atmospheric sulfur, as indicated by sulfate deposition, has begun to decline in some areas, largely because of the sulfur dioxide emissions reductions in the mid 1990s.<sup>8</sup> However, recently published research suggests that over the 1988-1998 interval, visibility on the haziest days worsened in some parks due to regional increases in sulfur emissions.<sup>9</sup> For example, visibility is declining on the haziest days at Big Bend National Park (TX), Great Smoky Mountains National Park (TN, NC), Badlands National Park (SD), Bryce Canyon (UT), Yosemite National Park (CA), and Mesa Verde National Park (CO). Other areas showed no change over the same period, for example Rocky Mountains National Park (CO), Shenandoah National Park (VA), Acadia National Park (ME), Glacier National Park (MT), Mount Rainier National Park (WA), and San Geronio Wilderness (CA).

## Maps Show Little Progress Over the Last Three Decades



MAPS: CAPITA

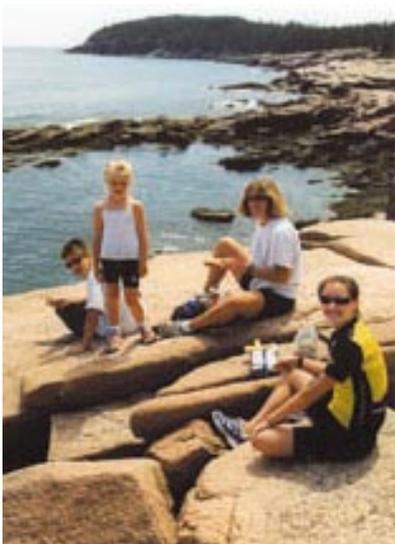
## Visibility Trends in Three Parks



TABLES: MALM, INTRODUCTION TO VISIBILITY (2000)

## Visitors Enjoy Parks Less When it is Hazy

A 1983 study confirmed that park visitors notice when scenic vistas are impaired by haze.<sup>11</sup> Visitors were asked if they had noticed haze at the parks, and if so, whether they thought it was: slightly, moderately, very, or extremely hazy. After comparing their responses to actual visibility measures taken on the same day, researchers found that when visibility was poor, visitors were more aware of haze and were more likely to say it was very to extremely hazy. This same



study also found that visitors to the Grand Canyon and Mesa Verde National Parks who said the view was hazy enjoyed the park less than those visitors who said they were not aware of haze or were aware of only slight to moderate haze. Not only did park visitors notice haze, but when they considered the view to be relatively hazy it detracted from their enjoyment of the park. Moreover, studies have shown that if visibility in parks declined further, people would reduce the number of trips they take. Conversely, visitors would spend more time at parks if there were a perceptible improvement in visibility.<sup>12, 13</sup>

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*Studies have shown that if visibility in parks declined, people would reduce the number of trips they take.*

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## Park Visitors: Vistas Most Important

American vacationers believe that the most desirable qualities for vacation spots are beautiful scenery and clean, clear air. National Park Service surveys consistently show that visibility is one of the top four features identified by visitors as important to their enjoyment of the park.<sup>14</sup> For example, at the Grand Canyon, over 80 percent of the respondents rated clean, clear air as very important or extremely important to their recreational experience. "Clean, clear air" was ranked third out of all twenty-four features at the Grand Canyon, after cleanliness of the park and deep gorges. Several scenery-related features, such as colorful rock formations and viewing canyon rims, were the next most important features. Although the importance of visibility in our cities may be less obvious, some monuments and cityscapes are integral to the image of the city, for example the Washington Monument or the Statue of Liberty.



Acadia National Park, Maine



NATIONAL PARK SERVICE

## What is at Stake?

The number of tourist visits to national parks has grown tremendously, increasing from approximately 30 million visits in 1951 to 287 million in 1998. The park system has also expanded, with 376 parks comprising a total of 83 million acres and employing approximately 21,000 permanent and seasonal employees. There are also over 600 concessionaires in operation throughout the national park system providing visitors with lodging, transportation, food, shops and recreational services. In 1997 the National Park Service collected \$122.2 million in recreation fee revenue (entrance fees, season passes, parking fees) and sales from concessions were estimated to be \$650 million.<sup>15</sup> A Department of the Interior study found that travel-related expenditures by visitors to national parks totaled an average of \$14.55 billion (in 1996 dollars) and generated approximately 210,000 jobs.<sup>16</sup> Moreover, if all visitation to all Department of the Interior lands are included, travel related expenditures were estimated at \$35 billion a year and generated approximately half a million jobs. This estimate does not include similar estimates for national forest lands administered by the U.S. Forest Service. However, these numbers illustrate the enormous scale of economic activity associated with visitation to public lands.

Significantly, the majority of revenues associated with visitation to national parks are generated outside of the



BOB LIEWELLYN, IZAAK WALTON LEAGUE

park boundaries. In 1997 alone, approximately nine billion dollars was spent on goods and services in communities neighboring national parks.

If park visitation declined due to impaired visibility, revenue generation within the local economy would decrease and the national park and the concessionaires within the park would lose as well. Conversely, if visibility improved at national parks, the number of visitors to national parks, and thus, revenues, would increase.

*Are you concerned about environmental conditions at your destination when making travel plans?*

YES  91%

NO  9%

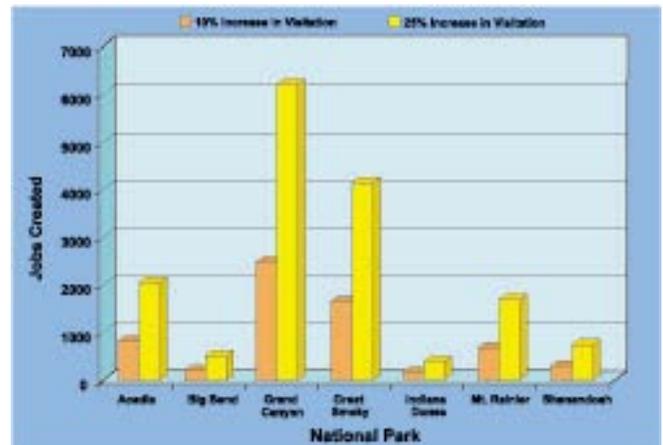
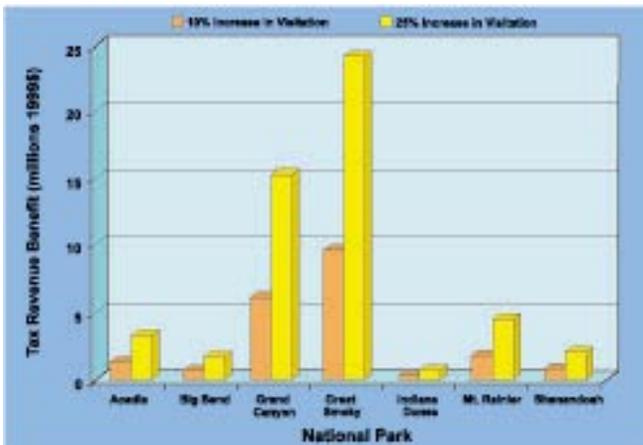
SURVEY CONDUCTED FOR CONDE NAST TRAVELER BY MARK CLEMENTS RESEARCH, INC.

## Less Haze = More Jobs and \$ for Local Economies

A study by Abt Associates commissioned by the Clean Air Task Force demonstrates that small increases in park visitation could result in significant increases in revenues and jobs.<sup>17</sup> To measure the impact tourism has on communities adjacent to or near national parks, the

National Park Service developed the Money Generation Model (MGM).<sup>18</sup> The model estimates three types of economic benefits generated by park visitors: 1) income to local businesses; 2) increases in local area tax revenues; and 3) new jobs. Abt used the MGM to demon-

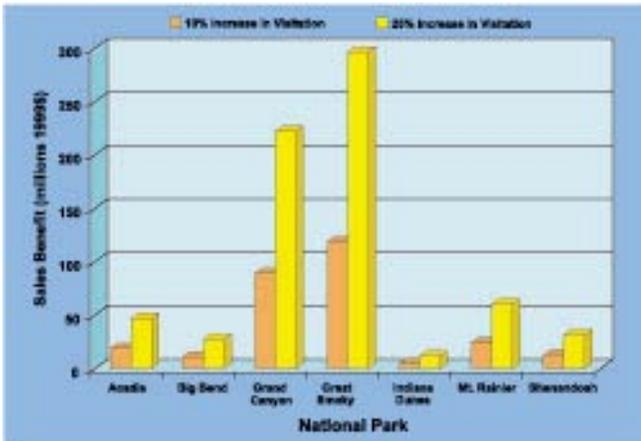
### Increased Visitorship Means More Sales, Revenues, and Jobs



CHARTS: ABT ASSOCIATES

strate the potential impact on the local communities of six parks: Acadia National Park, Grand Canyon National Park, Great Smoky Mountains National Park, Indian Dunes National Lakeshore, Mt. Rainier National Park, and Shenandoah National Park.

The resulting analysis showed that local economies



benefit from increased tourism that is likely when visibility is improved. For example, if visibility improvements increased park visitation by 25 percent, the potential annual benefit to a local community can range, depending on the park, from \$13 million and 390 new jobs to \$320 million and 4,188 new jobs. National parks and concessionaires also stand to benefit from an increase in visitation. A 25 percent increase in visitors could yield approximately \$30 million in increased fee collection and \$160 million in additional concession sales.

*Have you ever had to change travel plans because of an environmental problem at your chosen destination?*

YES  25%  
 NO  75%

SURVEY CONDUCTED FOR CONDE NAST TRAVELER BY MARK CLEMENTS RESEARCH, INC.

## *Haze from Electric Power Plants Costs Americans Billions*

To determine the total economic impact or damages resulting from electric power generation, Abt Associates estimated the value of visibility-related changes associated with eliminating power plant emissions entirely.<sup>19</sup> In the study, the monetary values were estimated for two broad categories of visibility benefits: (1) changes in “residential” visibility – i.e., the visibility in and around the locations where people live; and (2) changes in “recreational” visibility at Class I areas – i.e., visibility at specially designated national parks and wilderness areas. To take into account projected emissions reductions based on existing policies, 2007 was adopted as the base year for emissions in the study. The 2007 base-case assumes that current EPA emissions reduction programs

for power plants and cars will be implemented, i.e. full implementation of the NO<sub>x</sub> SIP call rule, full implementation of Title IV of the 1990 Clean Air Act Amendments (acid rain), partial implementation of the Tier II rule (automobile emissions standards), and no explicit adoption of emissions reductions from a climate change treaty.

Abt’s results show that, based on the public’s willingness to pay for visibly cleaner air where they live, the adverse impact of power plant emissions is \$3.4 billion a year. Similarly, the impact of power plant emissions on visibility in parks and wilderness areas is \$4.3 billion a year. Together, Abt found that the impact of power plant emissions as measured in people’s willingness to pay for visibly cleaner air where they live and in parks and wilderness areas totaled \$7.7 billion per year. These totals reflect the potential for substantial visibility-related benefits attributed to power plant emission reductions alone summed for all counties in the U.S. (residential estimates) and for all Class I areas (recreational estimates) that are shown in the data table in this report. These estimates are comparable to the benefit totals estimated in other similar policy analyses such as the 812 Prospective<sup>20</sup> and Retrospective analyses<sup>21</sup> (Benefits of the Clean Air Act) and the Ozone/PM National Ambient Air Quality Standards analysis.<sup>22</sup> Of course, this analysis was not undertaken to support a policy option of eliminating all



DONNA DANNEN, IZAAK WALTON LEAGUE

emissions from power plants, but to illustrate costs associated with diminished visitor enjoyment from power plant emissions. Based on this analysis, if emissions from power plants — particularly sulfur dioxide— were reduced substantially beyond levels mandated by current regula-



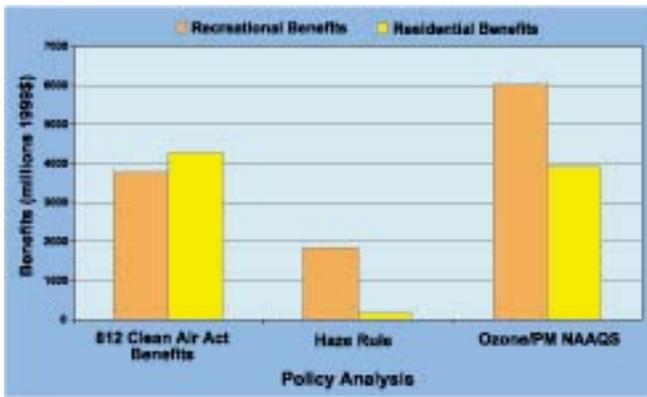
ABT ASSOCIATES

tory programs, the monetary benefits could total hundreds of millions to billions of dollars a year.

Both visitors and non-visitors to national parks and wilderness areas are willing to pay for cleaner air. In the most

important study to gauge the public's willingness to pay for cleaner air in the parks<sup>23, 24</sup> it was found that the average household in the southeast would be willing to pay \$68 (in 1999 dollars) a year for a 100 percent increase in visibility in national parks in that part of the country, and \$84 (in 1999 dollars) a year for a 200 percent increase in visibility. In a recent study in New Hampshire's White Mountains, 80 percent of respondents said they would not accept a hazier wilderness vista in exchange for a lower electric utility bill.<sup>25</sup>

### Benefits of Clean Air



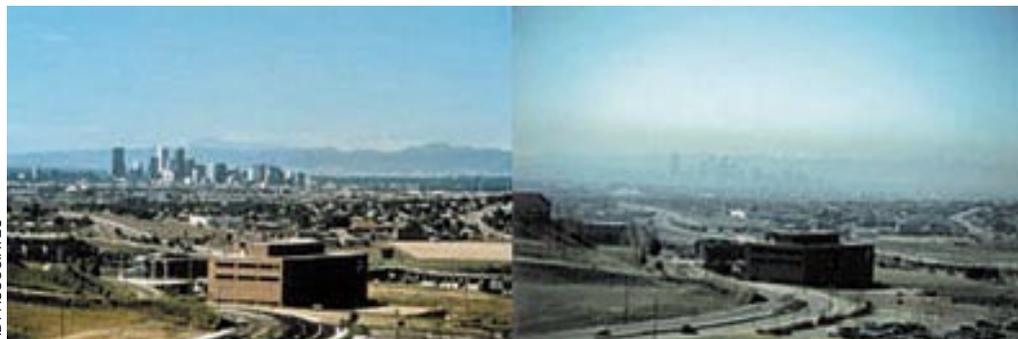
ABT ASSOCIATES

## Recreational Visibility Benefits

Park Name	State	Part Type	Benefits (millions 1999 \$)
Acadia	ME	NP	\$327.8
Arches	UT	NP	\$16.8
Badlands	SD	W	\$67.0
Bandelier	NM	W	\$5.8
Big Bend	TX	NP	\$42.0
Boundary Waters Canoe	MN	W	\$81.8
Bryce Canyon	UT	NP	\$36.7
Canyonlands	UT	NP	\$18.2
Carlsbad Caverns	NM	NP	\$8.5
Crater Lake	OR	NP	\$4.3
Death Valley	CA	NP	\$9.9
Everglades	FL	NP	\$58.6
Glacier	MT	NP	\$64.5
Grand Canyon	AZ	NP	\$278.9
Grand Teton	WY	NP	\$60.9
Great Gulf	NH	W	\$4.1
Great Smoky Mountains	TN	NP	\$1,830.1
Isle Royale	MI	NP	\$20.6
Kings Canyon	CA	NP	\$23.7
Mammoth Cave	KY	NP	\$147.8
Mesa Verde	CO	NP	\$23.3
Mount Rainier	WA	NP	\$148.4
Olympic	WA	NP	\$99.5
Point Reyes	CA	W	\$17.1
Rocky Mountain	CO	NP	\$94.3
Sequoia	CA	NP	\$59.4
Shenandoah	VA	NP	\$127.7
Theodore Roosevelt	ND	NP	\$16.8
Voyageurs	MN	NP	\$15.4
Wind Cave	SD	NP	\$28.0
Yellowstone	WY	NP	\$208.2
Yosemite	CA	NP	\$76.6
Zion	UT	NP	\$66.0

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For a state-by-state table of benefits, see page 18.



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People value good visibility where they live. Analyses show that improved visibility is worth billions to Americans.

## Residential Visibility Benefits

State	Monetary Benefits (millions 1999 \$)	State	Monetary Benefits (millions 1999 \$)	State	Monetary Benefits (millions 1999 \$)
Alabama	\$74	Maine	\$93	Oklahoma	\$33
Arizona	\$35	Maryland	\$124	Oregon	\$8
Arkansas	\$8	Massachusetts	\$17	Pennsylvania	\$230
California	\$61	Michigan	\$167	Rhode Island	\$16
Colorado	\$14	Minnesota	\$47	South Carolina	\$66
Connecticut	\$56	Mississippi	\$93	South Dakota	\$8
Delaware	\$9	Missouri	\$38	Tennessee	\$95
District of Columbia	\$17	Montana	\$3	Texas	\$170
Florida	\$208	Nebraska	\$149	Utah	\$6
Georgia	\$123	Nevada	\$5	Vermont	\$132
Idaho	\$46	New Hampshire	\$19	Virginia	\$10
Illinois	\$3	New Jersey	\$25	Washington	\$27
Indiana	\$190	New Mexico	\$139	West Virginia	\$81
Iowa	\$114	New York	\$4	Wisconsin	\$29
Kansas	\$28	North Carolina	\$4	Wyoming	\$2
Kentucky	\$71	North Dakota	\$270	<b>TOTAL</b>	<b>\$3,385</b>
Louisiana	\$37	Ohio	\$183		

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## *Reducing Haze in our Parks: A National Goal*

The first major step forward in addressing the problem of haze in our national parks and wilderness areas came with the 1977 amendments to the Clean Air Act.<sup>26</sup> In the Act, federal lawmakers recognized the blight of air pollution on our national parks and took action by setting a national objective to eliminate haze:

*“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.”*

The mandatory Class I Federal areas referred to by Congress included 156 national parks, wilderness areas and national wildlife refuges that existed in 1977. Unfortunately, no other such federal parks or wilderness areas have been deemed Class I since that time. And despite the lofty goal declared by Congress, to date little has been done to clean up the hazy vistas in these special areas.

What *has* been done since Congress established the national visibility goal? In 1980 EPA established a program to remedy visibility impairment where an impact

was attributable to a single emissions source. This program required that states adopt a review process to identify and require controls on single sources, especially power plants, demonstrated to affect a Class I area.

Unfortunately, the existing program has resulted in cleaning up very few sources due to the difficulty in singling out an individual source’s contribution to visibility impairment. Only the well-known Navajo power plant—a large source that could scientifically be demonstrated to affect the Grand Canyon and surrounding parks — has been required to reduce its emissions. At the same time



DONNA DANNEN, IZAAK WALTON LEAGUE

EPA deferred development of a control program on the many more widely scattered—and less easy to fingerprint—sources of regional haze. Yet these sources include the lion's share of older coal and oil burning power plants that cause most of the problem. Now, in 2000, two decades later, EPA promises a new program to require states to review groups of sources that cause or contribute to visibility impairment in a Class I area. Although much belated, this rulemaking could be an important step forward.

To protect Class I parks and wilderness areas from the cumulative visibility degradation due to the pollution from new or modified sources, Congress also established the "Prevention of Significant Deterioration Program." Unfortunately, this program has proven ineffective in stopping construction of new power plants even in areas where the National Park Service has found impairment, for example, in the vicinity of Shenandoah National Park. Because in most cases the recommendation of the

federal land manager to the state is non-binding, a state can disregard the opinion of the National Park Service, U.S. Forest Service or U.S. Fish and Wildlife Service and permit the source regardless of the impact.

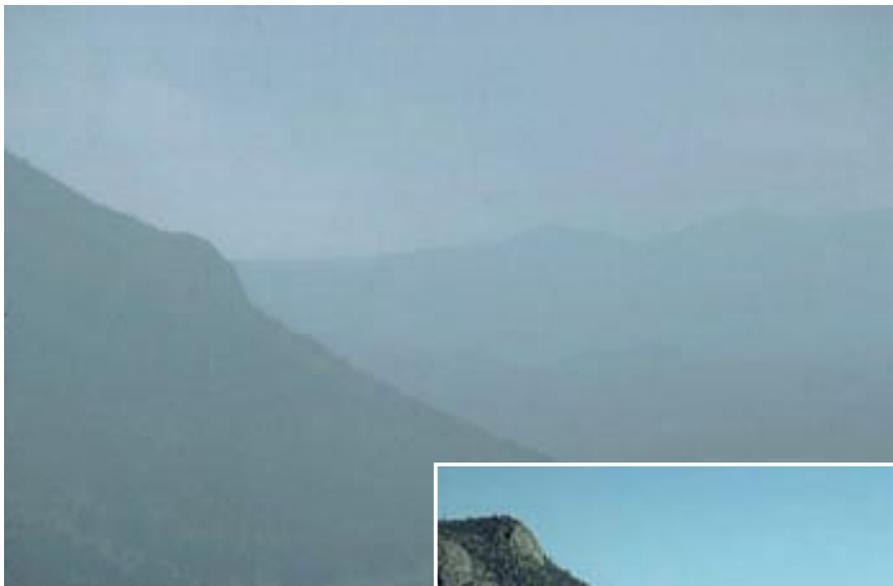
In the 1990 amendments to the Clean Air Act, Congress directed that more information be gathered about the problem of regional haze in parks. The Grand Canyon Visibility Transport Commission was established to study and remedy the hazy vistas over the Colorado Plateau area. Also, the National Academy of Sciences published its report "Protecting Visibility in National Parks and Wilderness Areas" which built a strong scientific and policy case for addressing the problem of regional haze.<sup>27</sup> The report concluded that:

*"Progress toward the national goal of remedying and preventing man-made visibility impairment in Class I areas will require regional emissions programs that operate over large geographic areas and limit emissions of pollutants that cause haze"*

and,

*"Current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility."*

Rocky Mountain National Park, Colorado



*"Current scientific knowledge is adequate, and control technologies are available for taking regulatory action to improve and protect visibility."*

1993 National Academy of Sciences Report



NATIONAL PARK SERVICE



Glacier National Park, Montana

The most effective program to date in beginning the process of reversing visibility deterioration in some Class I areas is the Acid Rain Program of the 1990 Clean Air Act Amendments which required nearly 10 million tons of sulfur dioxide reduction. Nevertheless, in a report to Congress, EPA estimates that the acid rain reductions will result in only small improvements,<sup>28</sup> achieving less than a quarter of the progress needed to meet EPA's goal of reducing regional haze in eastern areas.



NATIONAL PARK SERVICE

Most recently, in the 1997 review of the National Ambient Air Quality Standards for Particulate Matter, EPA deferred setting a secondary standard for PM<sub>2.5</sub> to remedy visibility impairment in the parks and, instead, made a commitment to propose a national regional haze rule. In 1999 the final Regional Haze Rule was signed by Vice President Al Gore.<sup>29</sup> The Haze Rule sets the Class I airsheds

on a path toward a 60-year goal of returning our national parks and wilderness areas to near-natural conditions. In a first step toward the 60-year target, EPA made a commitment, as part of the Regional Haze Rule in 1999, to establish a "Best Available Retrofit Technology" (BART) program by 2001.

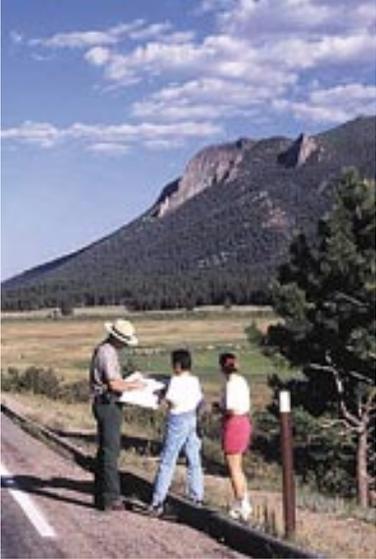
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*"Congress hereby declares as a national goal, the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from man-made air pollution."*

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The Clean Air Act Amendments of 1977

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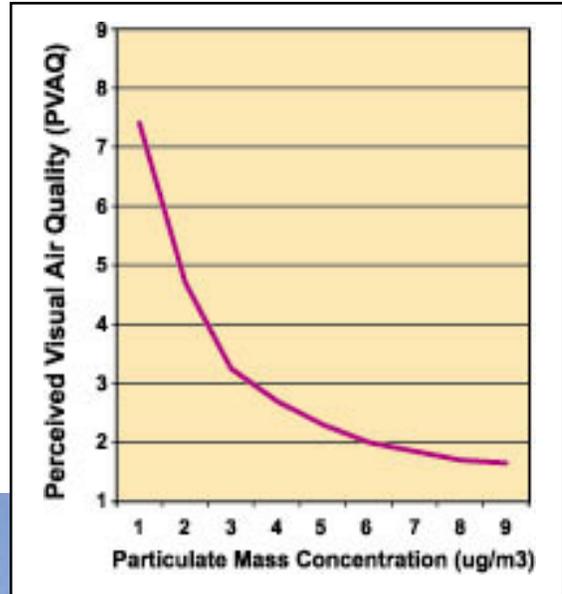
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## What Should EPA and Congress Do?

The study by Abt Associates demonstrates that visibility impairment due to power plant pollution not only hurts visitors' enjoyment of parks, but hurts park-dependent economies as well. Furthermore, improvements in park visibility can mean huge economic gains for local economies. Reducing the pollution that causes regional haze will also lead to healthier air and reduce public health and environmental damage.

Little has been done to date, aside from promises, to meet the national goal of clean, clear air in national parks established by Congress nearly a quarter century ago. Moreover, it is clear that the sulfur dioxide reductions under the Clean Air Act acid rain program will not be enough to significantly reduce regional haze. The science of visibility is now well-understood and it is clear that steep reductions — beyond the 1990 Clean Air Act Amendments — in sulfur and nitrogen oxide are needed

### Visibility Improves More Rapidly With Deeper Particulate Matter Reductions



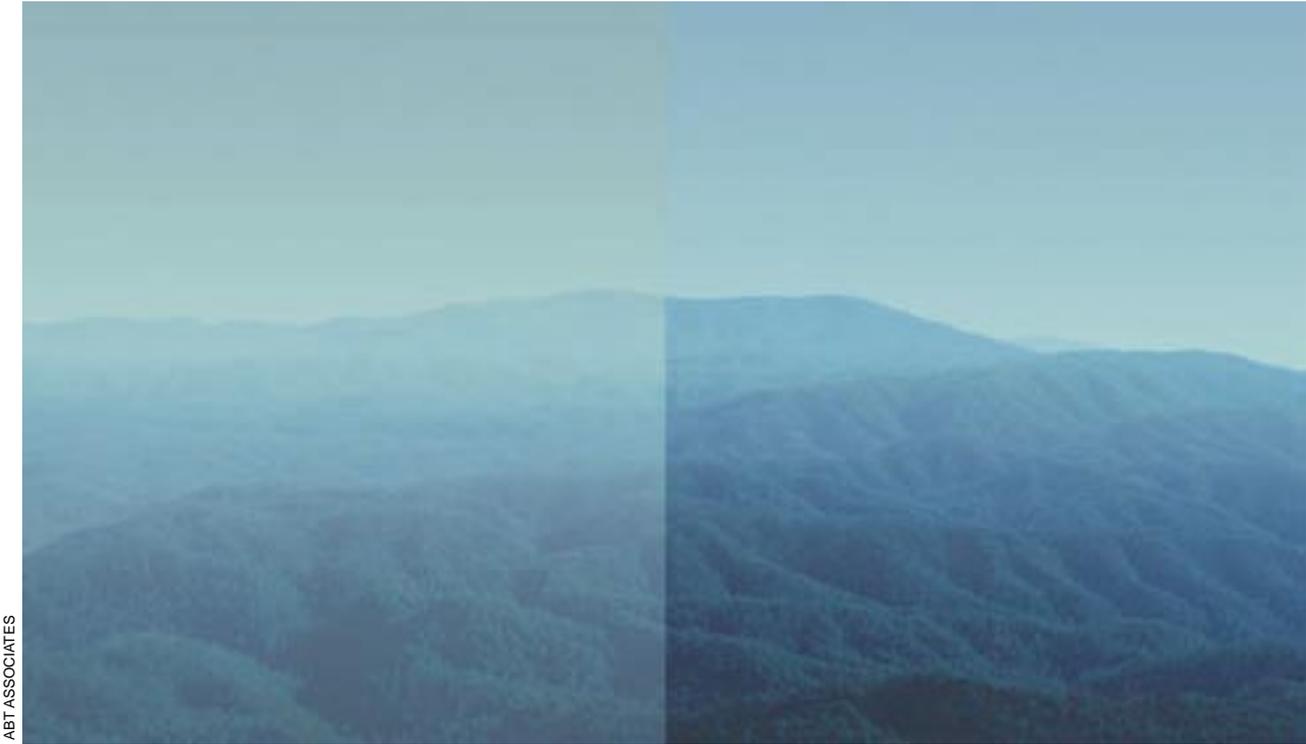
to achieve this goal. Recent research suggests that reductions in sulfur dioxide emissions under the acid rain program have resulted in a proportionate 1:1 reduction in sulfur deposition.<sup>30</sup> This suggests that sulfur dioxide reductions have been and will be very effective in reducing sulfate particulate matter. With deeper reductions come accelerating visual benefits.

NATIONAL PARK SERVICE



*Our national monuments are also blighted by haze.*

## Cleaning Up Power Plants Would Significantly Improve Vistas in our Parks

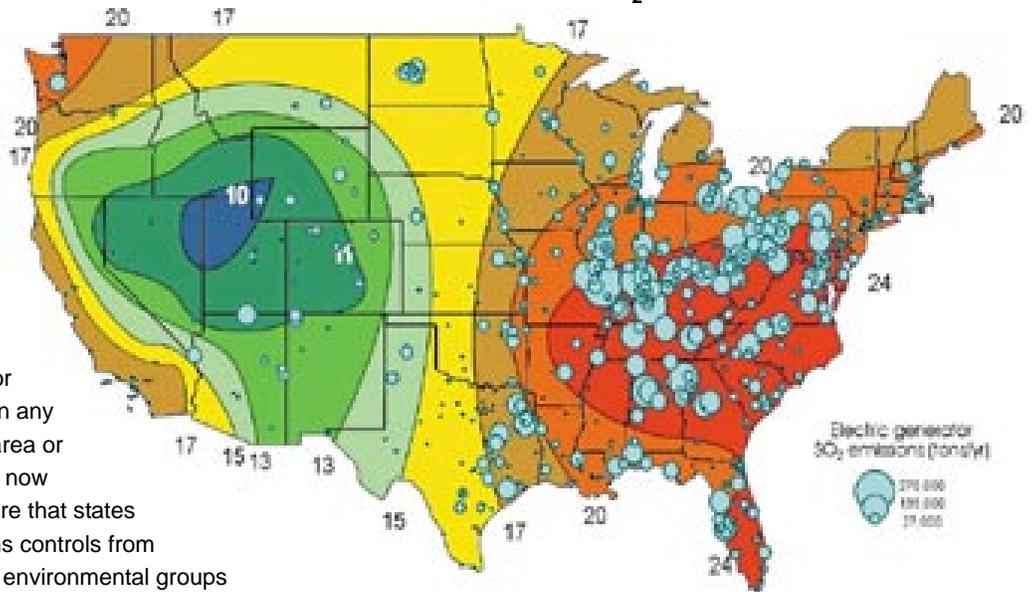


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*Estimated improvement of a 75 percent reduction in power plant sulfate at Great Smoky Mountains National Park (generated using WinHaze visual air quality modeler).*

There are few technological hurdles to cleaning up the air in our national parks. In most areas of the United States we can reduce sulfur dioxide and nitrogen oxide emissions by 90 percent with today's technology. Much better emissions reductions would result from switching to natural gas and non-polluting renewable resources and through greater reliance on energy conservation. EPA has already required states to review electric utility sources that cause or contribute to visibility impairment in any Class I national park, wilderness area or national wildlife refuge. EPA must now provide rigorous guidance to ensure that states require the best possible emissions controls from power plants. It will be crucial that environmental groups monitor this process in their states and regions. Ultimately, federal legislation will provide the most effective and expeditious way of ensuring that the oldest and dirtiest coal and oil fired power plants are cleaned up or replaced with cleaner sources of energy.

### Visibility Impairment and Electric Generator SO<sub>2</sub> Sources



IMPROVE data (1992-95)  
(Values represent visibility impairment in annual deciviews. The higher the value, the greater the visibility impairment.)

SOURCE: E<sup>3</sup> VENTURES

## Endnotes

- <sup>1</sup> Henry David Thoreau, *Walden*; Princeton University Press, 1973.
- <sup>2</sup> Wade, Tom, *Park Science*, 2000, volume 20, No. 1, p. 30-31.
- <sup>3</sup> "No Escape: Can You Really 'Get Away' from Smog?" Clean Air Task Force and Clean Air Network (1999). Available online at [www.cleanair.net/Resources/noescape.htm](http://www.cleanair.net/Resources/noescape.htm).
- <sup>4</sup> EPA, National Air Quality Emissions Trends Report, 1998, EPA 454/R-00-003, March 2000.
- <sup>5</sup> Malm, William C., Introduction to Visibility, Cooperative Institute for Research in the Atmosphere (CIRA), Colorado State University, Fort Collins, CO, April 2000.
- <sup>6</sup> Malm, William C. Spatial and Seasonal Patterns and Temporal Variability of Haze and Its Constituents in the United States, IMPROVE Report III, Cooperative Institute for Research in the Atmosphere (CIRA), Colorado State University, Fort Collins, CO, May, 2000.
- <sup>7</sup> EPA, Acid Deposition Standard Feasibility Study to Congress, EPA 430-R-95-001a, October 1995.
- <sup>8</sup> Lynch, James A., Bowersox, Van C. and Grimm, Jeffrey W.; Changes in sulfate deposition in eastern USA following implementation of Phase I of Title IV of the Clean Air Act Amendments of 1990; *Atmospheric Environment*, 34, p. 1665-1680, 2000.
- <sup>9</sup> Sisler, J. F. and Malm, William C., Trends of PM<sub>2.5</sub> and reconstructed visibility from the IMPROVE network for the years 1988-1998, Air and Waste Management Association's 93<sup>rd</sup> Annual Conference and Exhibition, VIP 97, Salt Lake City Utah, 2000.
- <sup>10</sup> The deciview (dv) is the EPA adopted standard measure of visibility. It is a logarithmic scale, like the pH scale, based on measurements of light extinction in the field. Each one deciview change is approximately "just perceptible". To illustrate, a perfect blue sky condition is 0 on the scale, average annual natural conditions range from 5 dv in the West to 10 dv in the East, and the annual average haziest fifth of days range from 16 dv in the West and 32 dv in the East.
- <sup>11</sup> Schulze, William D., Brookshire, David S., Walther, Eric, MacFarland, Karen K., Thayer, Mark A., Whitworth, Ben-David, Shaul, Malm, William C. and Molenaar, John; The economic benefits preserving visibility in the national parklands of the Southwest; *Natural Resources Journal*, Vol. 23, p. 149-173, 1983.
- <sup>12</sup> *Ibid.*
- <sup>13</sup> MacFarland, K.K., W. Malm and J. Molenaar. 1983. An Examination of Methodologies and Social Indicators for Assessing the Value of Visibility. In: *Managing Air Quality and Scenic Resources at National Parks and Wilderness Areas*. Chestnut, R.D.R.a.L.G., Ed. Westview Press: Boulder, Colorado.
- <sup>14</sup> National Park Service. 1998a. Air Quality in the National Parks. National Park Service, Air Quality Division. Denver, Colorado. Natural Resources Programs, Natural Resources Report 98-1.
- <sup>15</sup> U.S. Department of the Interior. 1998. Recreational Fee Demonstration Program, Volume I – Overview and Summary. Progress Report to Congress. January 31.
- <sup>16</sup> Peacock, B., C. Killingsworth, and B. Simon. 1998. State and National Economic Impacts Associated with Travel Related Expenditures by Recreational Visitors to Lands Managed by the U.S. Department of the Interior. U.S. Department of the Interior. January.
- <sup>17</sup> Abt Associates, Out of Sight: The Science and Economics of Visibility Impairment, June 2000, Prepared for Clean Air Task Force, Boston, MA; Project Manager: Bruce Hill; Abt Associates Inc. 4800 Montgomery Lane Bethesda, MD 20814-5341.
- <sup>18</sup> National Park Service. 1998b. The Money Generation Model. National Park Service, Public Use Statistics Office; <http://www.nps.gov/planning/mgm>.
- <sup>19</sup> Abt Associates, Out of Sight: The Science and Economics of Visibility Impairment.
- <sup>20</sup> U.S. EPA. 1997. The Benefits and Costs of the Clean Air Act: 1970 to 1990. U.S. EPA, Office of Air and Radiation, Office of Policy, Planning and Evaluation. Washington, DC. EPA 410-R-97-002. October.
- <sup>21</sup> U.S. EPA. 1999. The Benefits and Costs of the Clean Air Act: 1990 to 2010: EPA Report to Congress. U.S. EPA. Office of Air and Radiation, Office of Policy. Washington, DC. EPA 410-R-99-001.
- <sup>22</sup> U.S. EPA. 1997. Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. July.
- <sup>23</sup> Chestnut, L.G. and R.D. Rowe. 1990. New national park visibility value estimates. Mathai, C.V., Ed. *Visibility and Fine Particles: An Air and Waste Management Association / EPA Specialty Conference at Estes Park, CO*, October 1989. Pittsburgh, PA.
- <sup>24</sup> Chestnut, L.G. and R.D. Rowe. 1990. Preservation values for visibility protection at the National Parks: Draft Final Report. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Economic Analysis Branch. Research Triangle, NC. February 16.
- <sup>25</sup> Hill, B.L., W. Harper, J.M. Halstead, T.H. Stevens, I.T. Porras and K.D. Kimball. 2000. Visitor perceptions and valuation of visibility in the Great Gulf Wilderness, New Hampshire. In: *Proceedings: Wilderness Science in a Time of Change*. D.N. Cole and S.F. McCool, Ed. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: Ogden, UT. Vol.: RMRS-P-000.

## Recreational Visibility Benefits For Parks & Wilderness Areas by State

State	Benefits (millions 1999 \$)	State	Benefits (millions 1999 \$)	State	Benefits (millions 1999 \$)
Alabama .....	\$2.1	Minnesota .....	\$97.2	Tennessee .....	\$1,839.2
Arkansas .....	\$1.6	Missouri .....	\$2.3	Texas .....	\$44.4
Arizona .....	\$293.3	Montana .....	\$69.4	Utah .....	\$142.3
California .....	\$218.7	North Carolina .....	\$6.8	Virginia .....	\$128.3
Colorado .....	\$152.6	North Dakota .....	\$16.8	Vermont .....	\$0.6
Florida .....	\$58.6	New Hampshire .....	\$6.0	Washington .....	\$263.8
Idaho .....	\$5.8	New Mexico .....	\$20.6	West Virginia .....	\$4.4
Kentucky .....	\$147.8	Nevada .....	\$0.1	Wyoming .....	\$277.7
Maine .....	\$327.8	Oregon .....	\$10.0		
Michigan .....	\$20.6	South Dakota .....	\$95.0		

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- <sup>26</sup> Clean Air Act, subpart 2, Section 169A (a)(1).
- <sup>27</sup> National Academy of Sciences, Protecting Visibility in National Parks and Wilderness Areas, National Academy Press, Washington, D.C., 1993.
- <sup>28</sup> U.S. EPA, Effects of the 1990 Clean Air Act Amendments on Visibility in Class I Areas: An EPA Report to Congress; EPA-452/R-93-014, October 1993.
- <sup>29</sup> U.S. EPA, Regional Haze Regulations, 40 CFR Part 51.
- <sup>30</sup> Butler, Thomas J., Likens, Gene E. and Stunder, Barbara J.B.; Regional scale impacts of Phase I of the Clean Air Act Amendments: the relation between emissions and concentrations, both wet and dry; in press Atmospheric Environment, 2000.

**This report is available at the  
Clear the Air website  
[www.cleartheair.org](http://www.cleartheair.org)**

### *Methodology*

The analysis of increased sales, tax revenues, and jobs due to improved visibility and the analysis of the public's willingness to pay for visibly cleaner air was performed by Abt Associates. Abt Associates' Environmental Research Area provides scientific research and policy analysis to U.S. EPA, U.S. Agency for International Development, and the World Bank and to foreign, state, and local governments. A full copy of Abt Associates analysis including the details of the methodology used is available online at [www.cleartheair.org](http://www.cleartheair.org)

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