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## **TACKLING REGIONAL AIR QUALITY ISSUES:**

*A Breath of Fresh Air for North Carolina Residents*

**NADO RESEARCH FOUNDATION'S  
CENTER FOR REGIONAL DEVELOPMENT AND ENVIRONMENTAL STEWARDSHIP**

# Acknowledgements

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In 2002 the western region of North Carolina around Asheville faced a “non-attainment” designation from the U.S. Environmental Protection Agency (EPA) regarding air quality. That would have been especially bad news for an area heavily dependent on tourism, and it would bring with it federal restrictions on transportation spending. Only in late November of that year were staff members at the Land-of-Sky Regional Council (LOSRC), a four-county regional development organization (RDO), informed about an alternative to federal regulatory constraints: an early commitment by local governments to voluntary pollution-abatement efforts. But time was short. Counties at risk for non-attainment status would have to sign an Early Action Compact (EAC) by December 31, 2002.

Land-of-Sky put its networking resources into overdrive. On December 3 it brought together the executives from the four counties in its own primary service area (Buncombe, Henderson, Madison and Transylvania counties), plus Haywood County. Despite major uncertainties about the political risks and benefits of signing this kind of compact, all five county governments signed before the end-of-the-month deadline. The City of Asheville and several smaller municipalities also signed on. As matters turned out, changed weather conditions soon removed the immediate threat of a non-attainment designation, and two counties later dropped out of the EAC. But most of the planned projects are underway, as are others developed during the subsequent five years.

As an instance of intergovernmental cooperation, the EAC was a remarkable 30-day success story – one at least 10 years in the making. The ability of LOSRC to act as a catalyst for a fast response to a perceived crisis was based on its long history of working closely with local elected officials and their staffs and, in 2002, approximately a decade of engagement with air quality issues.

“What our staff does,” says Joe McKinney, LOSRC’s Executive Director, “is scan the horizon and try to foresee what local governments will someday face. We have the responsibility of looking years down the road.”

Where air quality is concerned, some things have already come together, and more are bound to occur. Largely because of advocacy by political, business and environmental leadership in the western part of the state, North Carolina has taken positive steps to improve air quality. The single most important step to date was the passage in 2002 of the Clean Smokestacks Act, which set a 2009 deadline for reducing key pollutants by over 70 percent. Veterans of the political battles that produced that legislation may resent any implication that this was an “easy” problem. It was not. Nevertheless, a relative handful of stationary point sources like power-plant smokestacks offers a clearer target for action than, say, hundreds of thousands of private automobiles. Since that time LOSRC and over





30 public and private partners have been operating on the premise that air-quality issues affect almost every facet of their daily lives.

The relationship of environmental issues to transportation and economic development was not always so obvious. LOSRC was founded in 1966, but air quality was not even a concern until the early 1990s. Two controversies – one local, the other involving a multi-state region – changed that.

The local event was a “not-in-my-backyard” controversy of a kind familiar to local governments – opposition to a proposal to cope with dwindling landfill space by building a solid waste incinerator in Henderson County. The county Board of Commissioners asked LOSRC for advice on air quality impacts. Lacking prior expertise, the LOSRC staff secured a small foundation grant to study the question. Ultimately, the incinerator proposal was dropped, but the findings of the study foreshadowed those of later, more comprehensive analyses. Western North Carolina faced increasingly serious problems from ground-level ozone, haze and acid deposition (usually “acid rain” although it may come down in wet or dry forms), and that major pollution-abatement efforts would be needed to avoid adverse economic effects. [See p. 11.]


A “not-in-my-backyard” notice from a high-level federal official triggered the region-wide controversy. In February 1992, the U.S. Interior Department Assistant Secretary for Fish, Wildlife, and Parks, acting in his capacity as federal land manager, announced opposition to the construction of a new coal-fired power plant at Kingsport, Tennessee, near the edge of the Great Smoky Mountains National Park. Slightly more than half of the park lies in North Carolina. In accordance with advice from the National Park Service

(NPS), he also recommended that permitting authorities in five neighboring states not issue permits for new major pollution sources within 120 miles of the park boundaries unless abatement measures were taken. Similar warnings about problems in other national parks and wilderness areas had already affected three other states.

The consternation that followed this announcement led to the creation of the Southern Appalachian Mountains Initiative (SAMI). Its voting members represented the governors of eight states, who were joined on a non-voting basis by three federal agencies (EPA, NPS and the USDA Forest Service), the power industry and a nonprofit public interest group. Everyone involved agreed on at least one point: a need for better data. However, because of the political sensitivities involved, it was also agreed that the design of the studies – the parameters to be measured, data sources, and statistical techniques to be applied – would be decided by consensus.

A technical advisory committee was also formed, which grew to include about 50 people, plus consultants. As the complexity of the task became apparent, SAMI advertised for a technical coordinator. Bill Eaker, a LOSRC environmental planner, and Tom Elmore, then a LOSRC planner and now an independent consultant, proposed that LOSRC provide administrative and logistical support for SAMI. The proposal was accepted, and LOSRC became closely involved with what ultimately became a \$10 million air quality modeling project that took eight years to complete. As the process became more complex technically and organizationally, LOSRC’s role evolved.

“Tom Elmore ran the [advisory committee] meetings, and that was one tough job,” recalls Paul K.



Since the 2002 passage of the Clean Smokestacks Act, LOSRC and over 30 public and private partners have been operating on the premise that air-quality issues affect almost every facet of their daily lives.

Muller, regional supervisor of the Division of Air Quality within the North Carolina Department of Environment and Natural Resources (NCDENR). “We had as diverse a group as you can get – EPA, the Park Service, state governments, the power industry. Tom provided a lot of leadership. You were always struggling to find common ground.”

“From a group process viewpoint,” Elmore says, “it was very challenging ... to select people who don’t get along with each other and then require decisions by consensus. On the bright side, none of the technical results have been challenged, and we ended up with maybe the best-studied air quality data anywhere, except maybe for Los Angeles.”

The SAMI final report, released in August 2002, described the existing levels of air quality and four scenarios projected out to 2040, one based on existing regulations and three based on increasingly stringent controls. The analysis modeled interactions among different pollutants. It related pollution to weather patterns. Overall, the report confirmed a lot of bad news. For example, although the “natural” range of visibility (a century or so earlier) from a mountaintop in the Great Smoky Mountains was estimated at 113 miles, the recently studied range averaged about 25 miles.

A study of the impact of air pollution emissions on a state-by-state basis yielded a finding of major political importance: “The greatest benefits from reducing sulfur dioxide and nitrogen oxides emissions generally occur within the State where the reductions are made.” During debates on the Clean Smokestacks Act, western North Carolina legislators used this finding to counter arguments that reducing emissions in North Carolina would mainly benefit residents of other states.

Parenthetically, the fact that air currents change direction remains a factor in political and legal controversies. In March 2005, the EPA addressed this problem by issuing the Clean Air Interstate Rule (CAIR), a rule that will permanently cap emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) across 28 eastern states and the District of Columbia at approximately one-third of 2003 levels (a 60 percent reduction for SO<sub>2</sub> and a 70 percent reduction for NO<sub>x</sub>). In 2006, the North Carolina Attorney General filed a lawsuit asking a federal court to require the Tennessee Valley Authority to accelerate pollution-abatement efforts at power plants in Alabama, Kentucky and Tennessee. In 2007, a U.S. District Court denied a TVA motion to dismiss, and that decision is now under appeal at the Circuit Court level. If the appeal is rejected and the lawsuit moves forward, an initial ruling on the merits will likely arrive in 2008 but will unlikely end the argument.

### Three Hot, Dry Summers

As early as 1998, well before the SAMI report was issued in final form, LOSRC established a Regional Clean Air Campaign to inform citizens and officials about the region’s air quality problems and what actions could be taken to address them. That effort helped lay the groundwork for a regional response to a potentially divisive crisis brought to a head by three hot, dry summers. An EPA non-attainment designation can be triggered by three consecutive years in which an area’s average air pollution index exceeds safe levels, and in 2000, 2001 and 2002 measured ozone levels were high enough to push Buncombe County (whose county seat is Asheville) into non-attainment territory. A formal notice of non-attainment would lead to stricter constraints on transportation investments and stricter permitting requirements for new industries.



In November 2002, this outcome seemed almost unavoidable. That was when LOSRC Interim Director James Stokoe, in the course of talking with a local air quality agency about diesel school bus retrofit, learned about the proactive option of entering into a voluntary Early Action Compact. LOSRC recognized that the county governments in its area could still act on that option.

A regional response could not be taken for granted because many questions could not be definitively answered. For example, if a non-attainment designation were to be applied only to counties wherein the measured levels of ozone had been found excessive, one could argue that only Buncombe County would cross the non-attainment threshold. That perspective might imply that other, smaller counties need not join a compact to help Asheville solve its air pollution problems.

However, the EPA typically applies its findings to metropolitan statistical areas (MSAs) as a whole, which would include adjacent Madison County. Also, the Census Bureau defines “urban areas” to include key transportation corridors, and it appeared likely that the MSA would be enlarged to include Henderson and Haywood counties. In short, an EAC might be voided if it were later determined that it had not been signed by all county governments in a non-attainment zone, but LOSRC staff acknowledged that no one (at least

no one outside Buncombe County) could know in advance whether or not they might later be deemed to be within such a zone.

Ringside seats during SAMI air quality modeling disputes (including several rounds in a referee role) had earned LOSRC credibility on these kinds of issues. All of the local government entities involved, including several municipalities with no clear legal obligation to comply, promptly put formal resolutions on their December agendas. All passed before the December 31, 2002 deadline, and county managers took responsibility for moving the compact forward. They designated the planning department of Buncombe County as the lead agency for decisions on how to implement the compact, which allowed LOSRC to continue its role in longer range planning.

As noted earlier, EPA never actually issued a finding of non-attainment. The year 2003 was cool and rainy. Ozone levels dropped down into the air quality index green zone, ending a three year pattern of air pollution levels excluding federal standards. Everyone involved in the EAC could breathe easier for a while, literally and metaphorically. After a time, Henderson and Transylvania counties decided to drop out of the EAC. But everyone involved also recognized that weather conditions – and state and federal air quality standards – could change in the future.



### Regional Vision: Natural Capitalism

No one reviewing recent LOSRC planning documents and air quality activities would suppose that LOSRC and its partners are counting on future luck, whether that is defined as long stretches of good weather or curbs on emissions originating elsewhere. As Eaker says, “We tell folks, no matter how much pollution is blowing in, we need to do our part before we go to folks in other areas and ask them to do more.”

During 2001 - 2002, while North Carolina legislators were debating the bill that became the Clean Smokestacks Act, LOSRC and a committee of over 50 local leaders were developing a new strategic plan that would also qualify as a Comprehensive Economic Development Strategy (CEDS)—a requirement at five-year intervals to maintain eligibility for assistance under the U.S. Economic Development Administration (EDA) Public Works and Economic Adjustment programs. This first CEDS of the new decade became Regional Vision 2010 (RV 2010), a bold document that declared that in western North Carolina economic development and environmental protection are inseparable goals. “Our mental planning models,” the document says, “continue to view the economy, ‘environment’ and social systems in separate compartments when in reality they are all part of one highly interrelated and interdependent web.”

## Eastern Band of Cherokees Bio-diesel Fueled Shuttle

The transition from petroleum-fueled vehicles happens one step at a time. In July 2006, a public transit service owned by the Eastern Band of Cherokee Indians began running a biodiesel-fueled shuttle bus across part of the Great Smoky Mountains National Park, from Cherokee, North Carolina, to Gatlinburg, Tennessee, about an hour away. About the same time, the Cherokee Boys Club opened Cherokee’s first private biodiesel service station for use by tribal employees, tribal transit and maintenance vehicles, and Cherokee Boys Club buses.

“It’s not just for visitors,” says Kathi Littlejohn, transit services manager. “A lot of our local families want to ride the shuttle.” Grants from the U.S. EPA, the Cherokee Preservation Foundation and the North Carolina State Energy Office helped jump-start these biodiesel projects. Littlejohn says that the Land-of-Sky Regional Council helped her and staff from the Cherokee economic development office with the grant application. “I’ve written grants before,” she says, “but I never had to come up with a vehicle emissions formula. It’s very complicated, and they did that part. And they helped with the alternative-fuel part of it.”

The town of Cherokee is located on tribal lands about 40 miles west of Asheville, near the eastern edge of the park. It is an entry point to the park and the site of Harrah’s Cherokee Casino, which opened in 1997. In winter, Cherokee is a small town with about 7,000 residents, but in summer that total swells to about 40,000. The added people are not tourists; they are seasonal residents employed in keeping the tourists fed, sheltered and entertained. In 2000, tribal leaders authorized a public transit shuttle between downtown Cherokee and the reservation’s small communities from which many area employees were driving to work.

As early as 1992, studies by the University of North Carolina Institute for Transportation Research and Education, in Raleigh, estimated traffic in the area to hit seasonal peaks of almost 48,000 cars on weekend days. The researchers expected this total to increase by perhaps 70 percent over the next few decades. Market research commissioned by the Cherokee tribal council produced an unsurprising finding: people love the area but hate its traffic congestion.

The biodiesel-fueled bus makes the Cherokee-Gatlinburg run twice daily in winter and four times daily during peak seasons, leading the Transit Service to add another stop on its route: Pigeon Forge, Tennessee, also a high-traffic entry point into the national park.



RV 2010 embraced a concept called “natural capitalism,” meaning that market-driven economic incentives should be aligned with long-term goals for keeping the area livable. That idea implied, for example, more attention to resource productivity – getting more marketable product out of inputs in the form of energy and raw materials. RV 2010 urged “biomimicry,” defined as “redesigning industrial processes to copy nature’s designs, in which there are no ‘waste’ products to dispose of, and in which no toxics are produced that cannot be recycled by natural ecosystems.”

Stokoe acknowledges that RV 2010 was both ambitious in concept and difficult to translate into concrete action. “Regional Vision 2010 had so much in it that we weren’t able to implement it in five years,” he says, “other than getting a start on a regional ‘green infrastructure’ plan.” He adds that the most recent five-year strategic plan is “a little more practical, a little less far-reaching, action-oriented, and hopefully more implementable ... and maybe a little less idealistic.”

That most recent plan is the 2007 – 2012 CEDS, approved by the LOSRC board in September 2007. It identifies four major priorities. The “Transportation and Air Quality” priority contains the plan’s most specific objectives, eight in number. One goal embodies a standing challenge: to keep levels of any federally regulated air pollutants to 80 percent or less of federal standards. Another is open-ended with respect to time: to provide “21st century transportation to the region” featuring light rail links between areas of high-density development.

The other six goals are defined in quantitative terms linked to target dates. By 2008, LOSRC commits to a goal of 75 alternative fuel or advanced technology vehicles added to local public fleets under the U.S. Department of Energy’s (DOE) Clean Cities program. There are three 2012 targets: at least 20 percent of public fleets will consist of alternative fuel or advanced technology vehicles, local governments’ petroleum use will be reduced by 20 percent, and 90 percent of the region’s communities will be connected to each other by footpaths and bikeways. Two 2017 targets are a 100 percent improvement in the fuel efficiency of the region’s transportation fleet (doubling miles per gallon) and improving trip efficiency (reducing by 20 percent the number of vehicle miles traveled).

In addition, the other three major priorities of the 2007 – 2012 CEDS also involve air quality issues. For example, a “Regional Brownfields Initiative” focuses on reducing water pollution. But it also notes that, because brownfield sites tend to be near older residential areas, site development and re-use will generally result in reducing vehicle miles traveled and reducing release of volatile chemical compounds into the air. [See p. 9.] The two other CEDS plan components, “Housing” and “Growth Management,” bear an obvious relation to transportation patterns and hence to air quality. That part of the plan also emphasizes support for energy-efficient housing designs.

To implement a CEDS strategy of this scope requires a great many relatively small, highly-localized efforts. LOSRC is helping Asheville and surrounding



## Recycling and Air Quality

Taking 39,000 cars off the road every year would help anyone concerned with air quality breathe more easier. That is the estimated air-pollution reduction effect of solid waste recycling projects in the four western North Carolina counties served by the Land-of-Sky Regional Council (LOSRC).

“One of the strongest impacts of recycling is on air quality,” says Ron Townley, LOSRC’s interim director for local government services. “The main reason is that it takes less energy than making products from virgin materials. Drop a tree to make paper, and that tree goes from being a carbon sink that takes carbon from the atmosphere to being an atmospheric carbon source.”

The agency’s 39,000-car estimate derives from a variant of the Waste Reduction Model (WARM) developed by the U.S. Environmental Protection Agency. Most of the projected impact is due to reductions in “greenhouse gas” emissions – carbon dioxide and, to some extent, methane – but it also includes about 1,250 metric tons of other pollutants. Townley says that the estimate is conservative because most private-sector recycling efforts in the region are not counted. The estimate applies only to public-sector programs and to results from a public-private partnership, Waste Reduction Partners (WRP), which provides retired engineers as volunteer consultants to industrial clients.

Over a decade ago, local officials told LOSRC staff that their constituents were demanding more recycling programs. Existing landfills were near capacity, and acceptable locations for new landfills (or for solid-waste incinerators) were almost impossible to find. Moreover, smaller counties and municipalities generate an insufficient volume of paper, glass, metals or plastics to cover the costs of collection, sorting and transportation to potential markets.

Regional cooperation helped to change that. For example, a LOSRC analysis indicated that a new recycling plant to process and market all materials in the area could pay for itself within 10 years. Local governments’ focus on this approach led to a private company’s opening such a plant. The company secured recycling contracts with several public and private customers, creating approximately 30 new jobs.

Townley acknowledges that people who recycle for air-quality reasons are probably already recycling. “I rarely talk about the environmental benefits now,” he says. “Typically, my message is ‘jobs.’ In North Carolina the recycling industry has grown 60 percent in the last decade. For every landfill job we eliminate, we create six new recycling jobs.” Even so, he’s quick to bolster his charts by slipping environmental sound-bites into conversations. He notes, for example, that a ton of unwanted electronics contains more copper than a ton of raw copper ore, is easier to recover, and involves less shipping and energy to process. All of this leads to positive air quality impacts.

The EPA Waste Reduction Model (WARM) may be found online at [http://www.epa.gov/climatechange/wycd/waste/calculators/Warm\\_home.html](http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html).



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communities meet the criteria for the DOE Clean Cities program, which provides support for local efforts to reduce the use of petroleum in the transportation sector. A Clean Vehicles Coalition brings together public and private-sector fleet managers and others with an interest in alternative fuels or cleaner vehicle options. The Coalition sponsors training sessions and forums, assists individual stakeholders with alternative fuel projects and helps eligible organizations tap into state and federal grants for cleaner vehicles or fueling infrastructure. [See sidebar on p. 7 for more on one LOSRC-assisted biofuels project.]

In the past five years, over 30 fleets in the region have begun to switch over to biodiesel, ethanol, compressed natural gas, propane, or electricity or to acquire fuel-conserving, low emission gas-electric hybrid vehicles. The region is fast approaching 400 alternative-fueled vehicles – the number required for a DOE Clean Cities designation (nationally, the DOE estimates that Clean Cities coalitions in almost 90 U.S. cities have saved 1.6 billion gallons of gasoline since the program's start in 1993).

### **Air Quality Essential for Tourism Growth**

“I think this community tends to be very environmentally aware,” says Ted Katsigianis, a vice president for the Biltmore Company, owner of the Biltmore Estate, a major tourist attraction near Asheville. “In our business we’re promoting a place to get away. When you’re the Biltmore Company and part of the tourist industry, you’re promoting, ‘Come to Asheville to escape the pollution of places like Atlanta or New York City.’ So we have been very, very proactive on this issue.”

The current LOSRC strategic plan builds on the central premise of Regional Vision 2010 that environmental and economic objectives are inextricably linked. Air quality issues affect not only the tourist industry but also raise quality-of-life issues to vital, highly mobile entrepreneurs in high-tech fields.

Rodney Locks, mayor pro tem of Brevard, Transylvania County seat, and former chair of the LOSRC board, moved to western North Carolina in 1989. Like many others, he worries that the popularity of the Asheville area makes it harder to maintain the qualities that drew him there. The area’s future, he says, depends on “having people in place who appreciate and value what’s here ... and who make the effort to institutionalize and preserve the unique qualities of North Carolina.”

Locks emphasizes that quality-of-life issues have become critical to local governments. “As an elected official,” he says, “my charter is water and sewer, streets and public safety. It’s not air quality, mental health and so on. But those are the things that keep us growing. Land-of-Sky’s role is to keep those issues in the forefront.”

## An Air Pollution Primer: SO<sub>x</sub>, NO<sub>x</sub> and Other Nuisances

The U.S. Environmental Protection Agency (EPA) monitors six common air pollutants – sulfur oxides, nitrogen oxides, carbon monoxide, ground-level ozone, particulate matter and lead. The air quality index used by EPA to evaluate local conditions is a composite index, and different levels are represented by colors: orange means “unhealthy for sensitive groups” and red means “unhealthy for everyone,” and so on. High levels of pollutants, singly or in combination, may lead to a non-attainment designation.

The air quality models used by the Southern Appalachian Mountains Initiative (SAMI) analyzed data to reflect the most pressing issues facing an eight-state region. The following list begins with some of air pollution’s principal raw materials and ends with terms that describe some of these substances’ undesirable and sometimes dangerous effects.

**SULFUR OXIDES** (SO<sub>x</sub>) comprise a family of gases formed when fuels containing sulfur, such as coal and oil, are burned. Of most concern is sulfur dioxide (SO<sub>2</sub>), about two-thirds of which is released into the air from electric utilities, especially those that burn coal. Other major sources are industrial facilities that burn coal or oil to produce process heat – for example, oil refineries and steel mills.

**NITROGEN OXIDES** (NO<sub>x</sub>) are highly reactive gases that contain nitrogen and oxygen in varying amounts. Nitrogen oxides form when fuel is burned at high temperatures. As with SO<sub>x</sub>, most NO<sub>x</sub> compounds enter the air from the ends of pipes (smokestacks or automobile tailpipes). The primary human sources are motor vehicles, electric utilities and other industrial, commercial and residential sources that burn fuels. NO<sub>x</sub> can also be formed naturally.

**VOLATILE ORGANIC COMPOUNDS** (VOC) is a catch-all term for gases released from all kinds of organic substances: paint and paint strippers, cleaning supplies and the ink in photocopiers, to name only a few. VOC may also be released from natural sources, including trees. The main importance of these gases is their tendency to combine with other substances in potentially harmful ways, particularly in forming ground-level ozone.

**GROUND-LEVEL OZONE** is one example of a potentially harmful combination. It is a gas created by a chemical reaction between NO<sub>x</sub> and VOC in the presence of sunlight and is the harm-causing half of a chemical Jekyll-Hyde story. High above the earth, the ozone layer helps to block dangerous levels of ultraviolet radiation. By contrast, ground-level ozone may trigger a variety of health problems that include chest pain, coughing, throat irritation and congestion. It can worsen conditions like bronchitis, emphysema and asthma. Repeated exposure may permanently scar lung tissue. Ground-level ozone is known as a summertime air pollutant because sunlight and hot weather cause it to form in harmful concentrations.

**PARTICULATE MATTER**, also known as particle pollution, is a complex mixture of extremely small particles and liquid droplets. Its components can be almost anything: sulfates and nitrates, organic chemicals, metals and soil or dust particles. EPA distinguishes between “inhalable coarse particles,” whose diameters are smaller than 10 micrometers but larger than 2.5 micrometers, and “fine particles,” 2.5 micrometers and smaller. The larger particles tend to be found near roadways and dusty industries; the smaller ones, in smoke or exhaust fumes. The smaller particles can more easily penetrate heart or lung tissue and hence pose greater dangers to human health.

**ACID DEPOSITION**, more commonly called “acid rain,” refers to any material deposited from the atmosphere that contains above-normal amounts of nitric and sulfuric acids. It tends to be a by-product of sulfur dioxide or nitrogen oxides produced by fossil fuel combustion. Prevailing winds blow these compounds across state and national borders, sometimes over hundreds of miles. Acid deposition is damaging to lakes, streams and forests and the plants and animals that live in these ecosystems.

**HAZE** (reduced visibility) occurs when sunlight encounters tiny pollution particles in the air. Some light is absorbed and even more is scattered, reducing the clarity and color of what we see. The components of haze may be any of the pollutants already mentioned, but certain particles, such as sulfates, are highly effective at scattering light, particularly during humid conditions. Particulate matter pollution also contributes to haze in many national parks.

Note that **CARBON DIOXIDE** (CO<sub>2</sub>), the most common greenhouse gas, was not considered a pollutant at the time of the SAMI studies. It is naturally present in the atmosphere, accounting for just less than .004 percent of the air we breathe. Concerns about climate change have caused carbon dioxide to receive a great deal of attention recently, and this attention seems certain to increase.



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