

# **Green Mountain & Finger Lakes Air Quality Assessment Package**

**December 3, 2002**

**Prepared by the Region 9 Air Program  
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Dear Deputy Forest Supervisor Malone:

To help support you in your position as the Forest Supervisor of the Green Mountain & Finger Lakes National Forests, we decided to prepare a package of figures and notes summarizing the most important aspects of air pollution as it affects the nation and the Green Mountain & Finger Lakes National Forests. Since coming to the Forest Service from a productive career as an air quality regulator, I have recognized that many management decisions in the Forest Service, dealing with such things as timber harvest, aquatic resource management, and recreational values require full knowledge of the influences of air pollution. Nowhere in the nation is this knowledge more important than in Region 9. Region 9's forests receive the heaviest rates of acidic deposition of any Region, and at times, suffer concentrations of ground level ozone that are unhealthy for both Forest Service personnel and tree growth. Acid deposition has accelerated the leaching of base cations from forest soils across much of the Region, resulting in the accumulation of sulfur and nitrogen in those soils, contributing to a loss of ecosystem vitality, and in some cases, tree mortality. Some R9 lakes and streams are now overly acidified and others are very sensitive to further acidification by atmospheric deposition. Mercury deposition is recognized as a problem of national importance, affecting not only the Green Mountain & Finger Lakes, but also the aquatic resources of every National Forest.

**The Green Mountain & Finger Lakes lie within an area characterized by some of the best air quality in the nation. For this reason, it is important to preserve that level of quality. It is the intent of the Air Program to do just that.**

You may ask, what can the leadership of a single National Forest do to address industrial emissions, occurring outside the boundaries of the Forest. Listed at the end of this package are measures that will enable you and your Forest's leadership to influence the production of air pollutants and the management of the resulting impacts to the Forest.

Even though air resource management issues can be dauntingly complex, if you understand that the overwhelming majority of impacts to natural systems can be understood by knowledge of the production and dynamics of a very short list of pollutants, you will grasp what is most important to your Forest. As you review the figures provided, you will notice that I have divided them into first those having a national focus, followed by those that more closely address conditions on and near the Green Mountain & Finger Lakes. Those focused on the Green Mountain & Finger Lakes deal primarily with what I am calling the Green Mountain & Finger Lakes Assessment Area, an area encompassing those counties within 200 km of the Forest Boundary. This 200 km buffer has no regulatory significance, but it does contain most of the large emission sources that may have a direct impact on the Green Mountain & Finger Lakes, and is a convenient way to standardize assessment of pollutant impacts to any National Forest.

I hope this package will prove useful to you, and of course, please contact me through email or at 414-297-3529, if you have any questions or concerns with this or other related matters.

Sincerely,

Chuck Sams, QEP  
Air Quality Program Manager

## **Background to this Air Assessment Package**

**In the past, the Air Program’s primary focus was the protection of “Air Quality Related Values”(for a select group Forest Service lands. In the case of Region 9, that was eight of the nation’s 158 Mandatory Class I Wilderness Areas. Yet, air pollution knows no boundaries, and all National Forest lands are at risk. In preparation for the drafting of a mid-level Air Quality Assessment for the Green Mountain & Finger Lakes, this package was produced to summarize air pollutant impacts to the Green Mountain & Finger Lakes, and to gauge how those impacts compare to those affecting other forests in the Region and the nation. I have produced a similar package for all Forest Supervisors. I encourage you to discuss these data with your fellow Forest Supervisors. Ultimately, I think you will agree that Region 9 should take a leadership role to influence both how these pollutants are produced and how their resulting impacts are managed.**

**Through a series of legislative and regulatory requirements, federal land management agencies have the unique responsibility to not only protect the air, land, and water resources under their respective authorities from degradation associated with the impacts of air pollution emitted outside the borders of Agency lands (Clean Air Act, 1990), but to protect those same resources from the impacts of air pollutants produced within those borders (Clean Air Act, 1990, Organic Act, 1977, Wilderness, Act 1997). The authority and responsibility to protect resources within National Forest lands are not limited to Class I Wilderness Areas, but requires federal land managers to take the necessary steps to protect all federal lands from those impacts. The Clean Air Act of 1990 contains numerous sections dealing with these responsibilities, and Section 101(c) states the primary purpose of the Act:**

**“A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local governmental actions, consistent with the provisions of this Act, for pollution prevention.” (Clean Air Act, 1990)**

**Further, the National Forest Management Act states that Land and Resource Management Plans are, in part, specifically based on:**

**“...recognition that the National Forests are ecosystems, and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems” (National Forest Management Act, 1976).**

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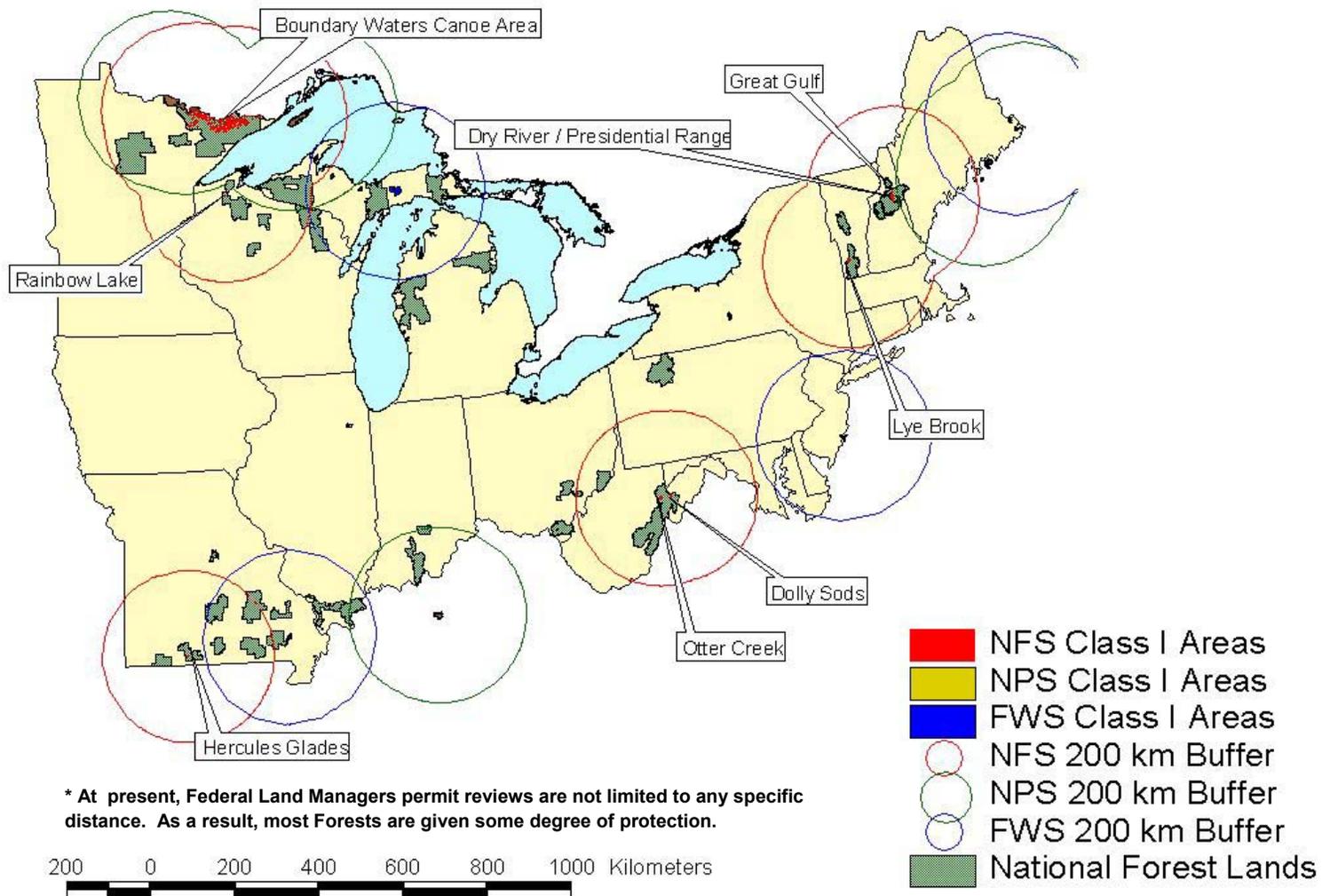
**Figure 17: Ozone Induced Tree Growth Suppression Ratings Surrounding the Shawnee National Forest**

**In Addition**

**Table 1: Actions that may be Considered by Forest Supervisors Addressing Air Pollutant Impacts to Forest Resources**



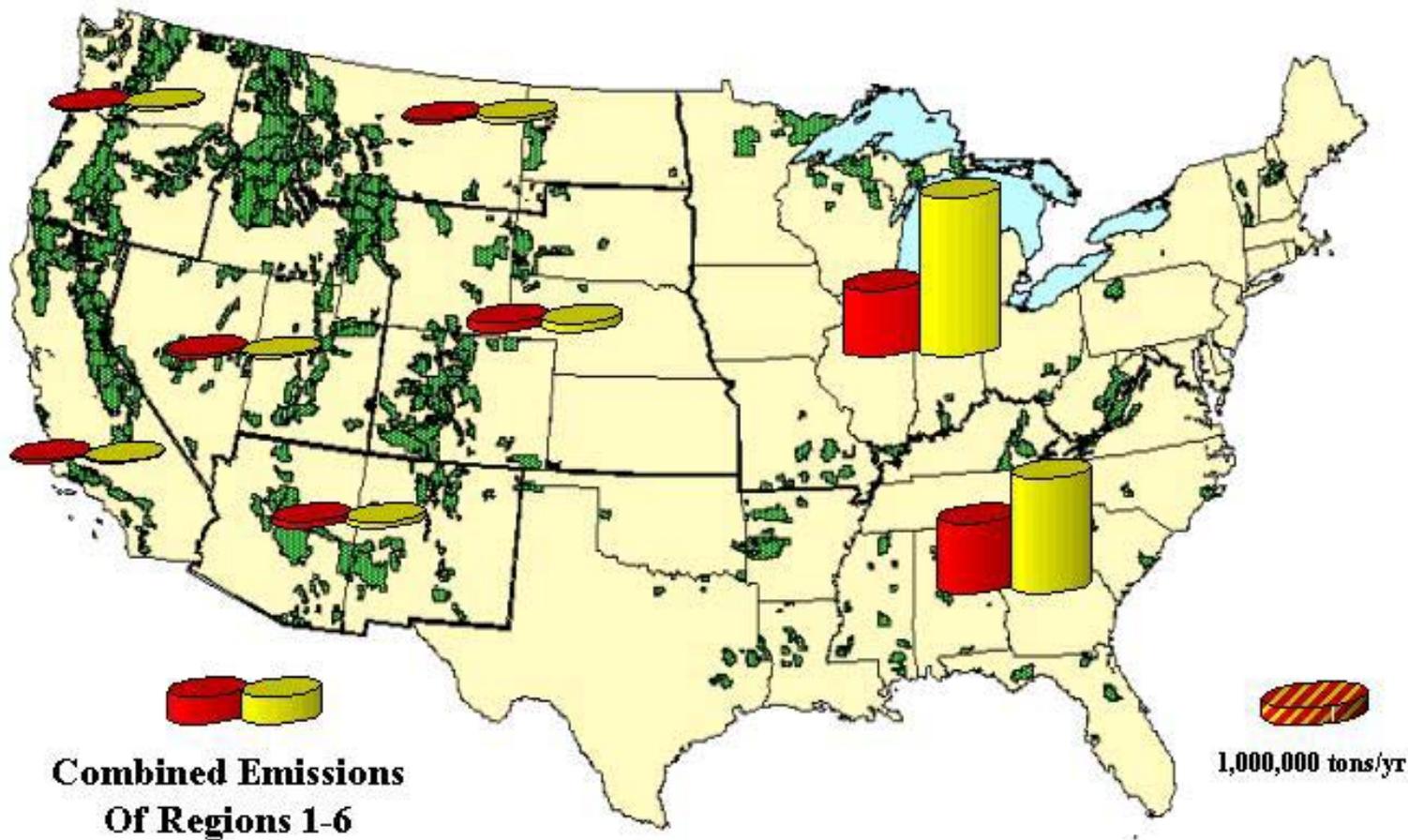
**Figure 1: Region 9 and Associated Mandatory Federal Class I Areas With their Respective 200 km Buffers\***



**Notes for Figure 1:**

- The birth of the Air Program stems from the 1977 Clean Air Act, which mandated the protection of Air Quality Related Values (e.g. forest health, water quality, visibility, etc) of Mandatory Class I Wilderness Area through coordinated Federal Land Manager (FLM) review of permit applications for the siting or modification of large air pollutant point sources (i.e. industrial sources).
- **Efforts of the NFS Air Program and other FLM air programs affect much more than just Class I Wilderness Areas.** The overwhelming majority of National Forests in the nation benefit from these efforts (i.e. **Air Pollution Does Not Recognize Borders**). Two examples of such work follow, from the efforts of the Monongahela's Air Specialist, Cindy Huber, resulting in benefits for the Monongahela, the George Washington-Jefferson, the Cherokee, and the Pisgah:
  - A proposed permit for construction of the coal-fired Hadson Power Plant, near Buena Vista, VA was withdrawn after a determination of adverse impact to the water quality and an appeal to the EPA. This resulted in complete avoidance of 358 tons/yr of SO<sub>2</sub> and 797 tons/yr of NO<sub>x</sub> emissions.
  - A gas fired power plant was proposed for Henry County, in South-central VA. After Program review, NO<sub>x</sub> emissions were reduced by 550 tons/year. As a result of this effort, the Program was instrumental in establishing a lower NO<sub>x</sub> emission rate for every subsequent gas fired power facility constructed in VA. To this date, due to further efforts by the Program to lower this statewide NO<sub>x</sub> emission rate even more, over 1000 tons/yr of emissions have been avoided.
- The Bush Administration supports limiting the purview of the Air Program's permit review to 50 km from a Class I Area, severely limiting the power of FLMs to protect the resources of Federal lands.
- A Class I Areas within 200 km of the Green Mountain & Finger Lakes are the Lye Brook Wilderness on the Green Mountain National Forest and the Great Gulf / Dry River Wilderness on the White Mountain.

**Figure 2: Regional NOx and SO2 Point Source Emissions\***

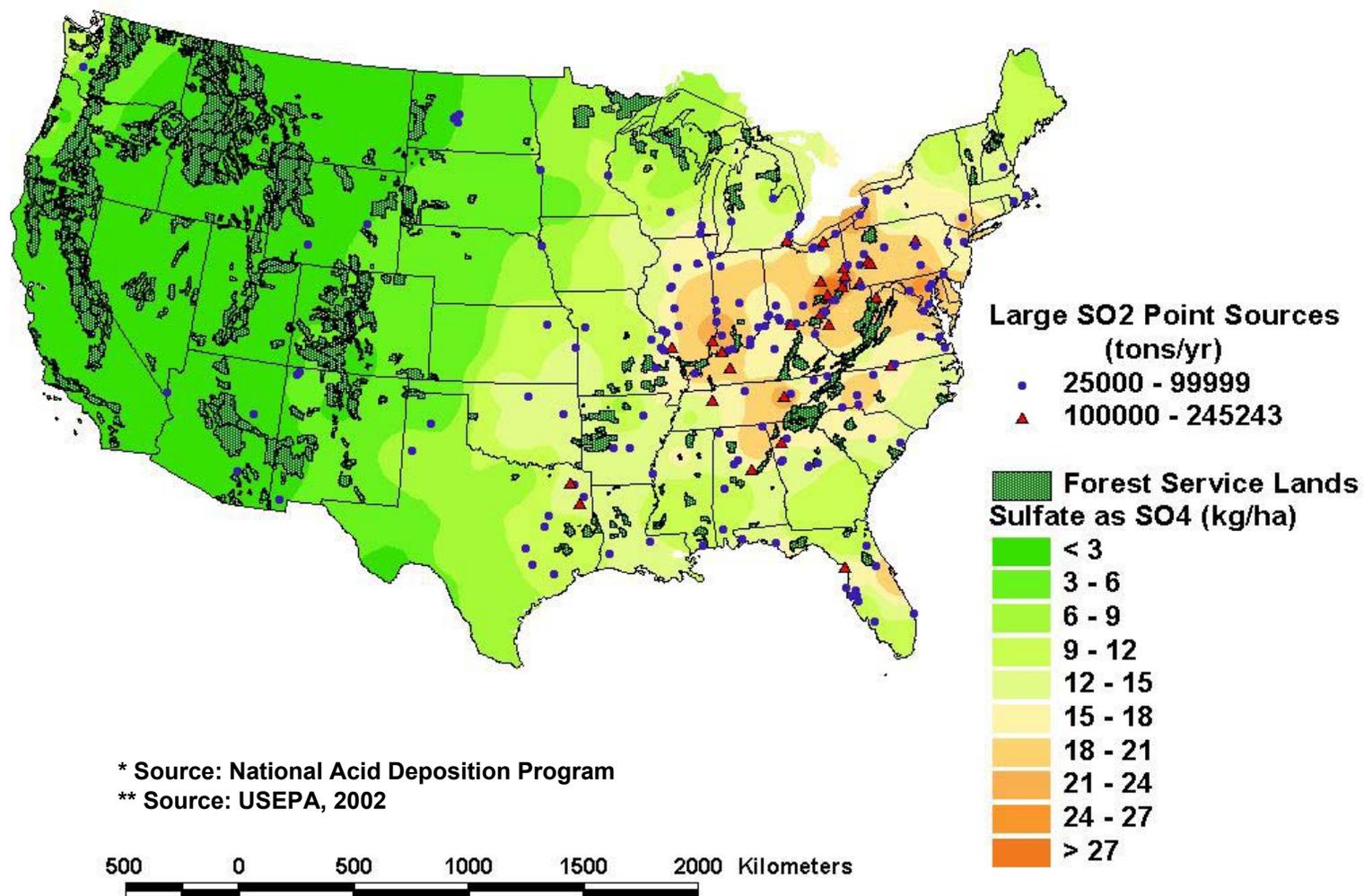


\* Source: 1999 EPA National Emissions Inventory, Total NOX = 9.0 M tpy, SO2 = 16.4 M tpy

**Notes for Figure 2:**

- Air pollutant emissions within Region 9 alone represent 45% of the nation's NO<sub>x</sub> and 57% of the nation's SO<sub>2</sub> emitted from point sources, or those sources potentially under the purview of the Air Program.
- Emissions from either Region 8 or Region 9 dwarf those from all other Regions combined. Emissions of this magnitude, combined with prevailing weather patterns and natural conversion mechanisms, result in greater impacts to Region 9 Forests than to other National Forests.

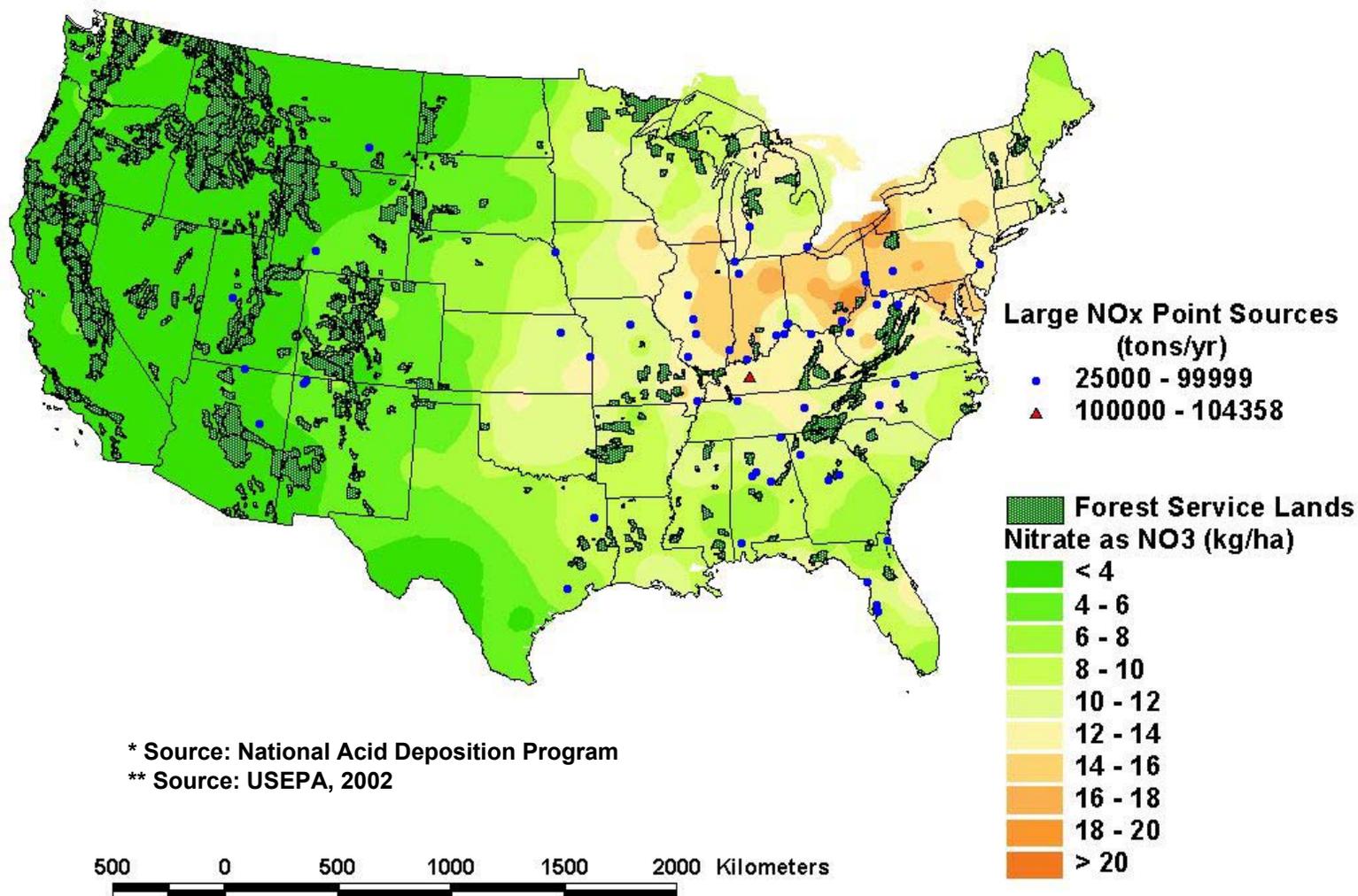
**Figure 3: Sulfate Deposition During 1999\* and Largest Sulfur Dioxide Point Sources\*\***



**Notes for Figure 3:**

- Of all Regions, sulfate deposition, a major component of acid deposition, is most severe within Region 9. The Wayne National Forest appears to be at the epicenter of sulfate deposition during 1999.
- Figure 3 represents a typical pattern of annual sulfate deposition for the nation. Because of measures implemented as a result of the Clean Air Act of 1990, sulfate deposition has shown a slight decrease in recent years. However, with the very recent renewal of interest in the use of coal fired electrical production, this trend may be reversed.
- The nation's highest concentration of its largest SO<sub>2</sub> sources are within Region 9, and that concentration is the greatest in the Ohio River Valley, surrounding the Wayne National Forest, but affecting all of Eastern North America. Not surprisingly, it appears that as the concentration of large SO<sub>2</sub> sources increases, so does the level of sulfate or acidic deposition nearby.
- The largest sources of SO<sub>2</sub> emissions are from coal-fired power plants. It is interesting to note that these same facilities are also the major emitters of the precursors of Regional Haze, acid deposition, and mercury deposition.
- SO<sub>2</sub> is a precursor of ammonium nitrate formation. Ammonium sulfate is the most important component of Regional Haze. It has been determined that a desire for unimpaired scenic vistas are among the top reasons drawing visitors to National Forests.

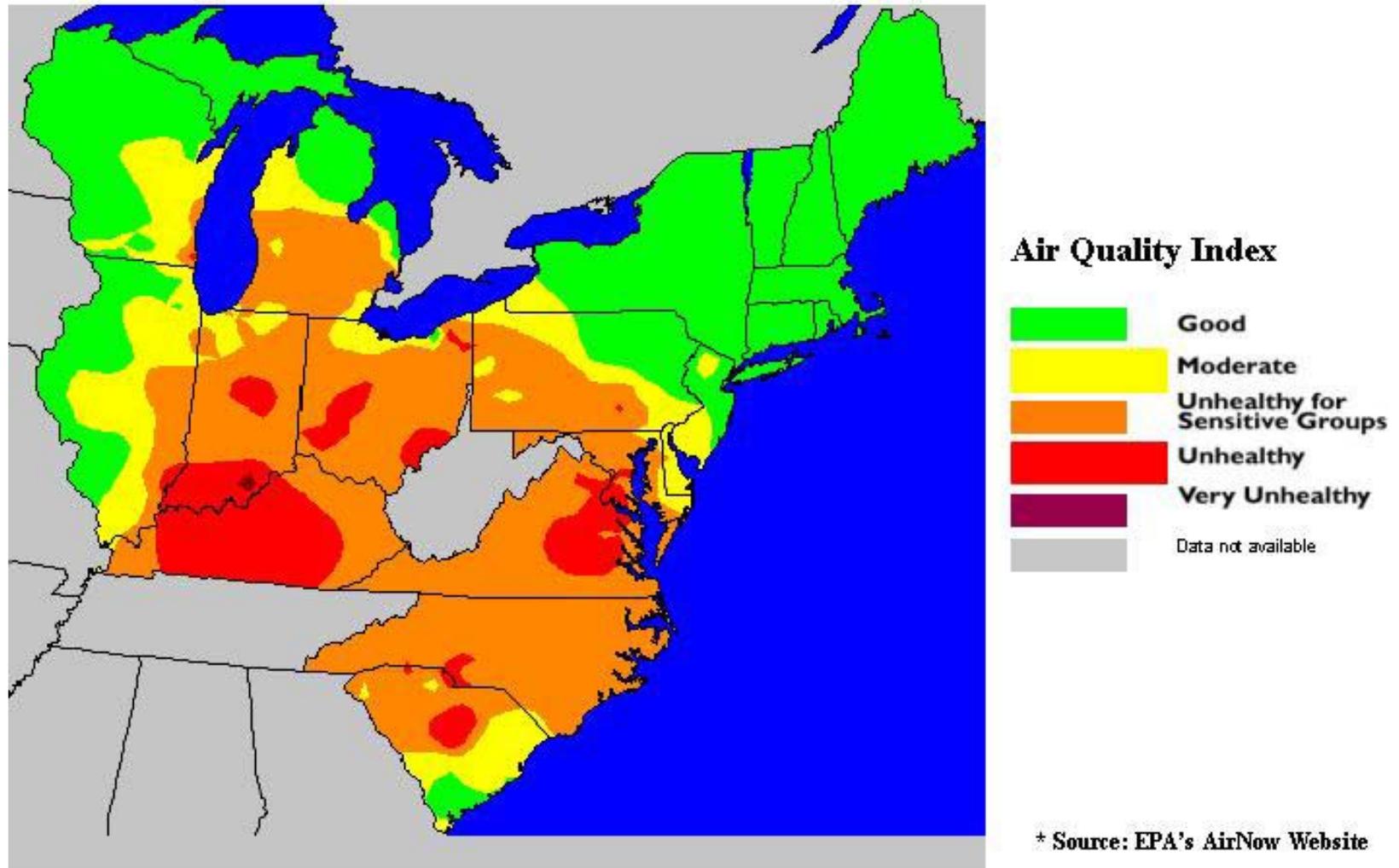
**Figure 4: Nitrate Deposition During 1999\* and Largest Nitrogen Oxides Point Sources\*\***



**Notes for Figure 4:**

- Of all Regions, nitrate deposition, a major component of acid, is most severe within Region 9. The Wayne National Forest appears to be at the epicenter of nitrate deposition during 1999.
- Figure 3 represents a typical pattern of annual nitrate deposition for the nation. Despite progressive measures implemented as a result of the Clean Air Act of 1990, nitrate deposition has not shown a decrease in recent years. With the recent renewal of interest in the use of fossil fuel electrical production and the increase in the number of automobile vehicle miles traveled, NO<sub>x</sub> emissions will likely increase, as well as the associated acid forming nitrate deposition and ground level ozone formation.
- The nation's highest concentration of its largest NO<sub>x</sub> sources are within Region 9, and that concentration is the greatest in the Ohio River Valley, affecting all of Eastern North America. Not surprisingly, it appears that as the concentration of large NO<sub>x</sub> sources increases, so does the level of nitrate or acidic deposition and ozone formation nearby.
- NO<sub>x</sub> is also a precursor to ammonium nitrate formation. Ammonium nitrate is one of the key components of Regional Haze. It has been determined that a desire for unimpaired scenic vistas are among the top reasons drawing visitors to National Forests.
- The largest NO<sub>x</sub> emitters, as shown, are generally coal fired power plants. It is interesting to note that these same facilities are also the major emitters of SO<sub>2</sub> and mercury, the other two most important air pollutants regarding impacts to forest resources.

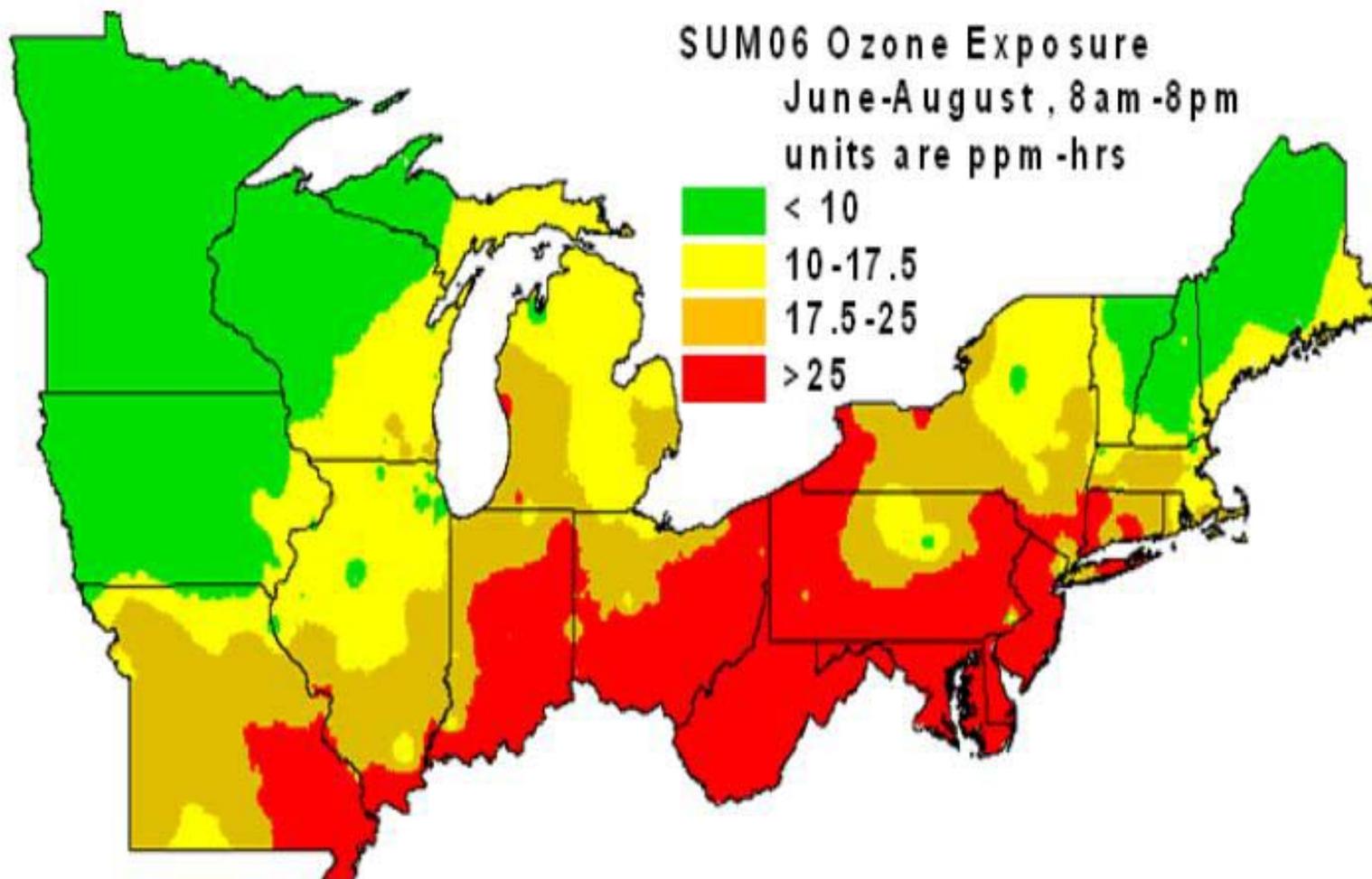
**Figure 5: Peak 8-hour Ozone Levels for Sunday, September 13, 1998\***



**Notes for Figure 5:**

- Ground level ozone within Region 9 can reach level that have been shown to be unhealthful to human health. Not only are young children, asthmatics, and older adults at risk, often ozone concentrations are reached that are harmful to the lungs of any healthy adult.
- Ground level ozone is formed from a combination of NO<sub>x</sub>, volatile organic compounds, and sunlight. Volatile organic compounds are always in abundance during the growing season due to forest species emitting them in great quantities (e.g. isoprene emitted from oak species). Stagnant weather conditions during hot sunny weather are ideal for the formation of ozone.
- Though ozone concentrations are in a state of continual flux, due to changing weather patterns, Figure 3 is a typical representation of hot stagnant summer day within Region 9. Note the “Very Unhealthy” area seemingly over the Hoosier National Forest during this day in September, 1998.
- The largest point source NO<sub>x</sub> emissions are generally from fossil fuel power plants. It is interesting to note that these same facilities are also the major emitters of the precursors to Regional Haze and acid deposition, and in the case of coal, of mercury. Even so, nationally, mobile (i.e. automotive) sources together emit more NO<sub>x</sub> than do power plants.

**Figure 6: Typical Ozone Exposure Rates in Region 9\***

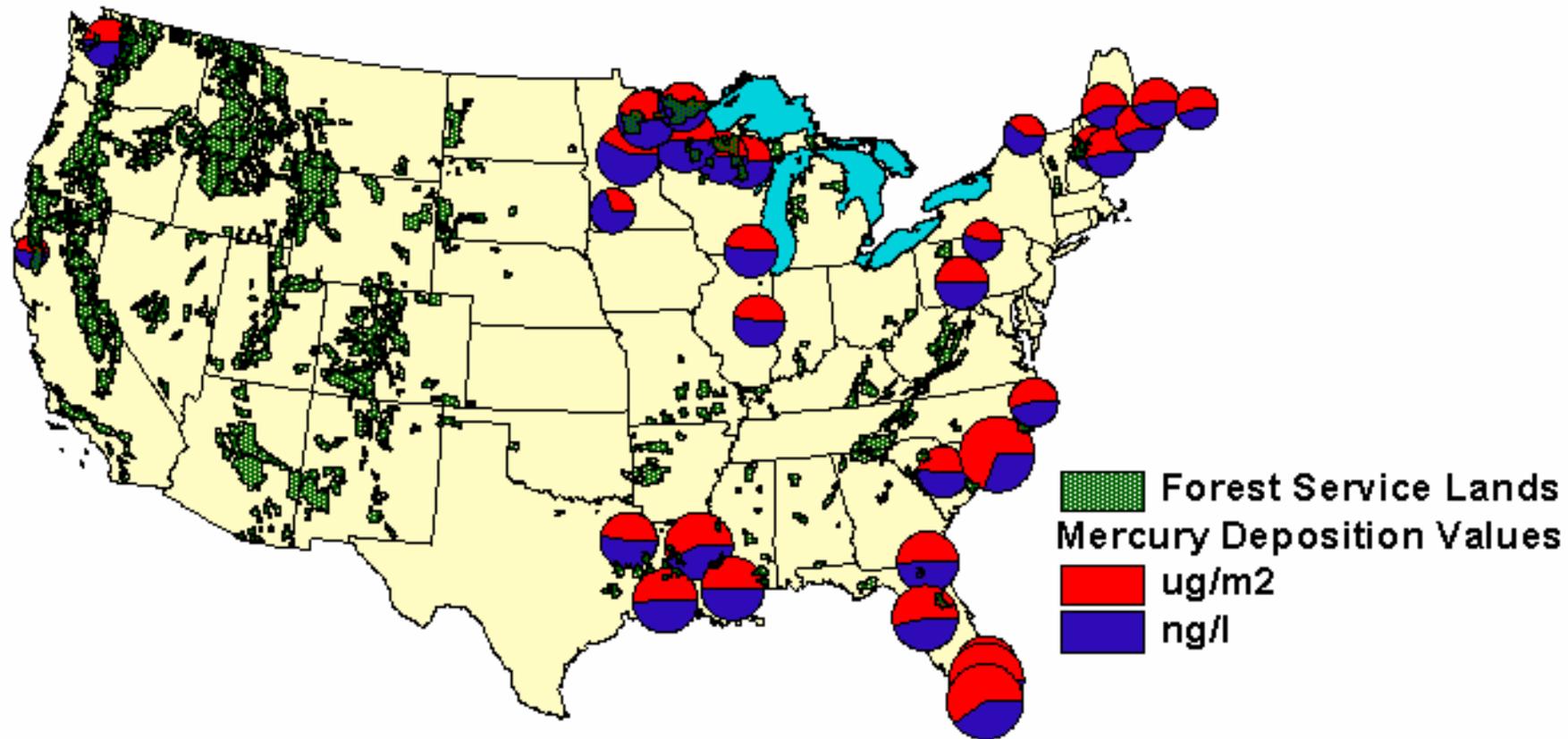


\* Source: USDA Forest Service Ozone Biomonitoring Project

**Notes for Figure 6:**

- SUM06 exposures are considered a surrogate for impacts of ground level ozone to plant species. SUM06 levels within Region 9, particularly surrounding the sites of the largest NO<sub>x</sub> emitters (see Figures 4 and 13), can reach some of the highest in the nation. Figure 6 illustrates a typical summer ozone exposure pattern, similar to that shown in Figure 5. Controlled studies have shown that ozone levels, as illustrated in orange and red, can lead to measurable growth suppression in sensitive tree species.
- Some of the most sensitive species to ozone exposure are important timber and pulp species (e.g. black cherry, tulip poplar, and aspen).
- Ozone levels can occasionally reach high levels anywhere in Region 9. Higher altitude sites, such as the peaks of the Presidential Range in the White Mountains, frequently reach higher levels than other Northern tier Forests, and often reach levels rivaling Forests to the South. Areas approaching 3,500 feet and above, anywhere in Eastern America, appear to be at higher risk than nearby areas at lower altitudes.
- Only Southern California and some areas near the Southern Appalachians experience greater and/or more frequent concentrations of rural, ground level ozone. This can be attributed to higher temperatures and longer, more severe, periods of stagnant weather conditions.

Figure 7: Mercury Deposition Rates During 1999\*

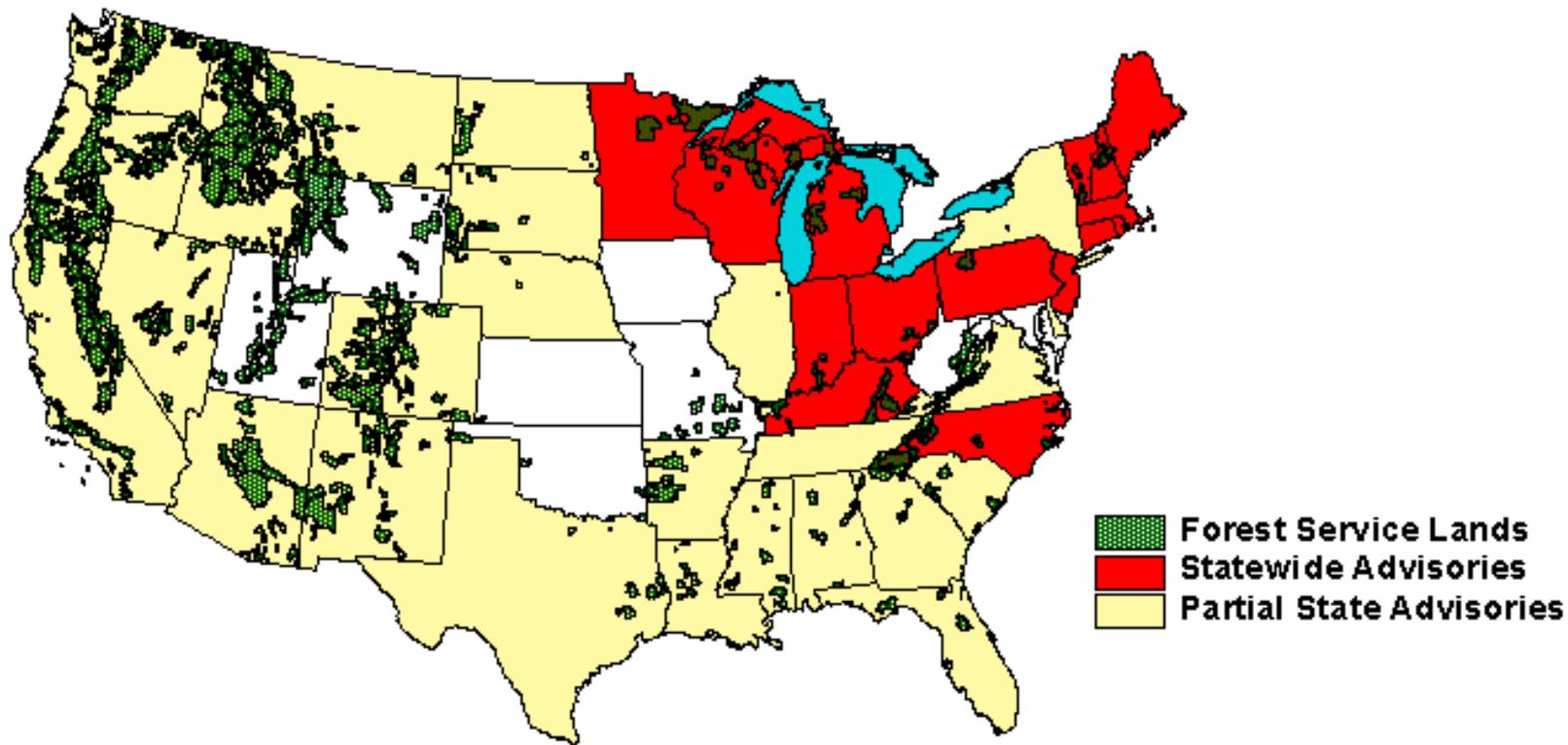


\* Source: 1999 National Mercury Deposition Network

**Notes for Figure 7:**

- Mercury deposition, resulting primarily from emissions of coal-fired power plants, leads to the formation of methyl mercury in the aquatic environment.
- Methyl mercury is a potent neurotoxin, greatly biomagnified through the aquatic food chain, and ultimately reaching us through ingestion of fish. Many states have established fish advisories (see Figure 8).
- It is important to note that due to long range atmospheric transport, mercury deposition occurs on every Nation Forest. Even though not shown because of a lack of monitoring data for the Ohio River Valley, mercury deposition is expected to be high there, due to the proximity of the largest mercury emissions sources (i.e. coal fired power plants).
- Studies show that 70% of mercury found in waters of Voyageurs National Park was transported there via atmospheric transport. This is likely the case across the nation.
- Mercury, originating from point sources and deposited in forest ecosystems, will be re-entrained in the atmosphere by wildland fire.

**Figure 8: Mercury Fish Consumption Advisories\***

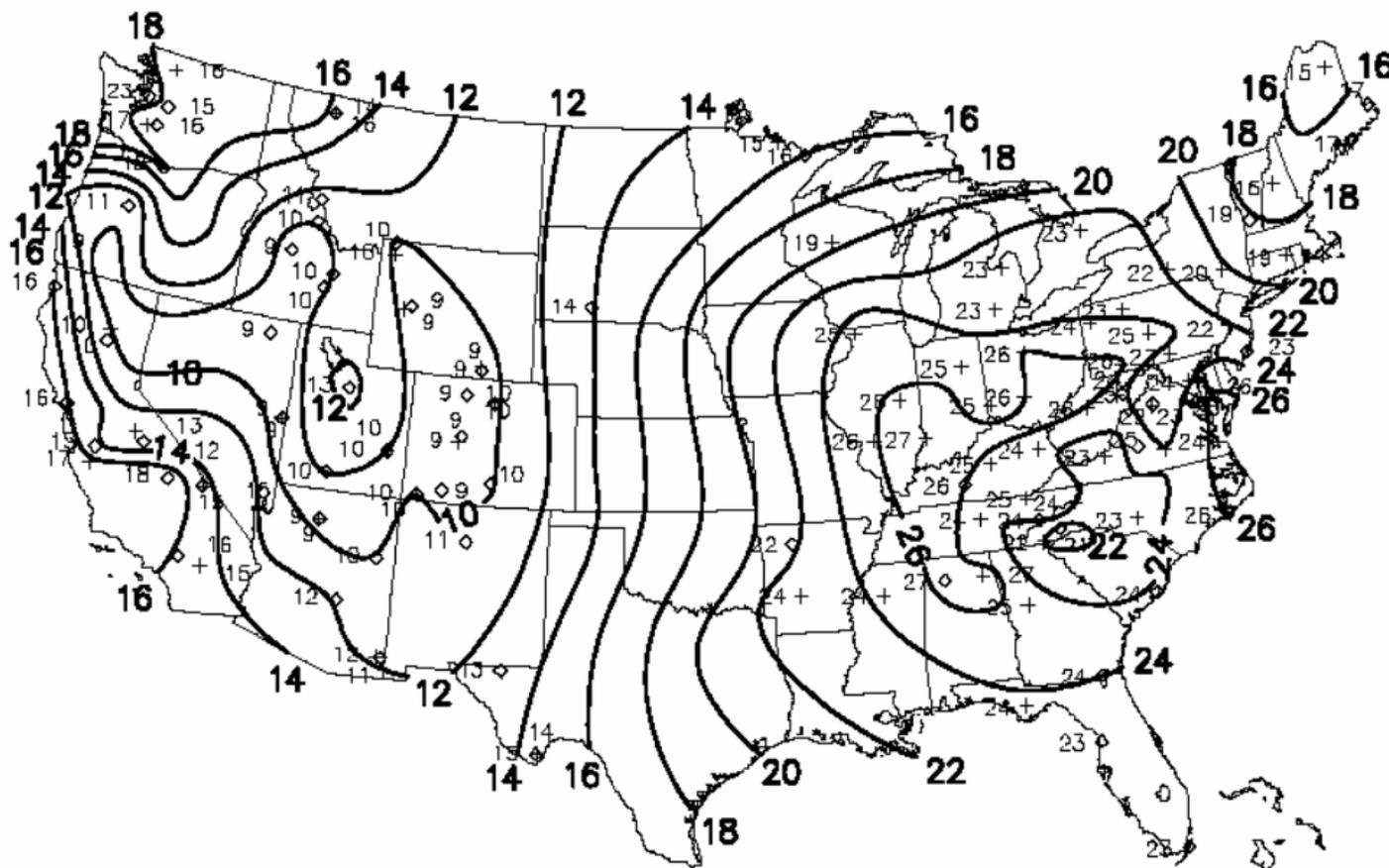


\* Source: <http://www.epa.gov/ost/fish>

**Notes for Figure 8:**

- As illustrated in Figures 7 and 8, mercury deposition is ubiquitous. Most states have established fish consumption advisories on some or all waters within their boundaries. Wisconsin appears to be a major leader in the study of mercury deposition and cycling within natural systems.

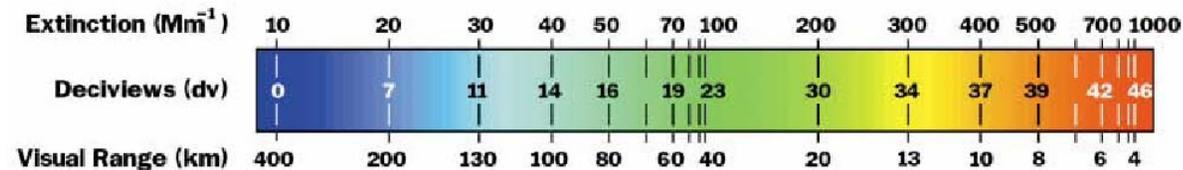
**Figure 9: Average Deciview Values\*  
IMPROVE and CASTNET Network, 1995-1998**



\* Source: Malm, 2000

### Notes for Figure 9:

- The IMPROVE and CASTNET Networks monitor atmospheric particulate loads and dry deposition respectively. The Forest Service is affiliated with the IMPROVE Network, through its operation of monitors located at selected Class I Wilderness Areas.
- The color graphic below will allow you to convert Deciviews to Visual Range in km. For example, Figure 9 suggests that average Visual Range on the Green Mountain & Finger Lakes is approximately 40 miles, not as clear as at the IMPROVE visibility monitor near the more pristine Boundary Waters Canoe Area Wilderness, but one of the clearer areas in the Eastern United States. It is the intent of the Air Program to keep it that way.

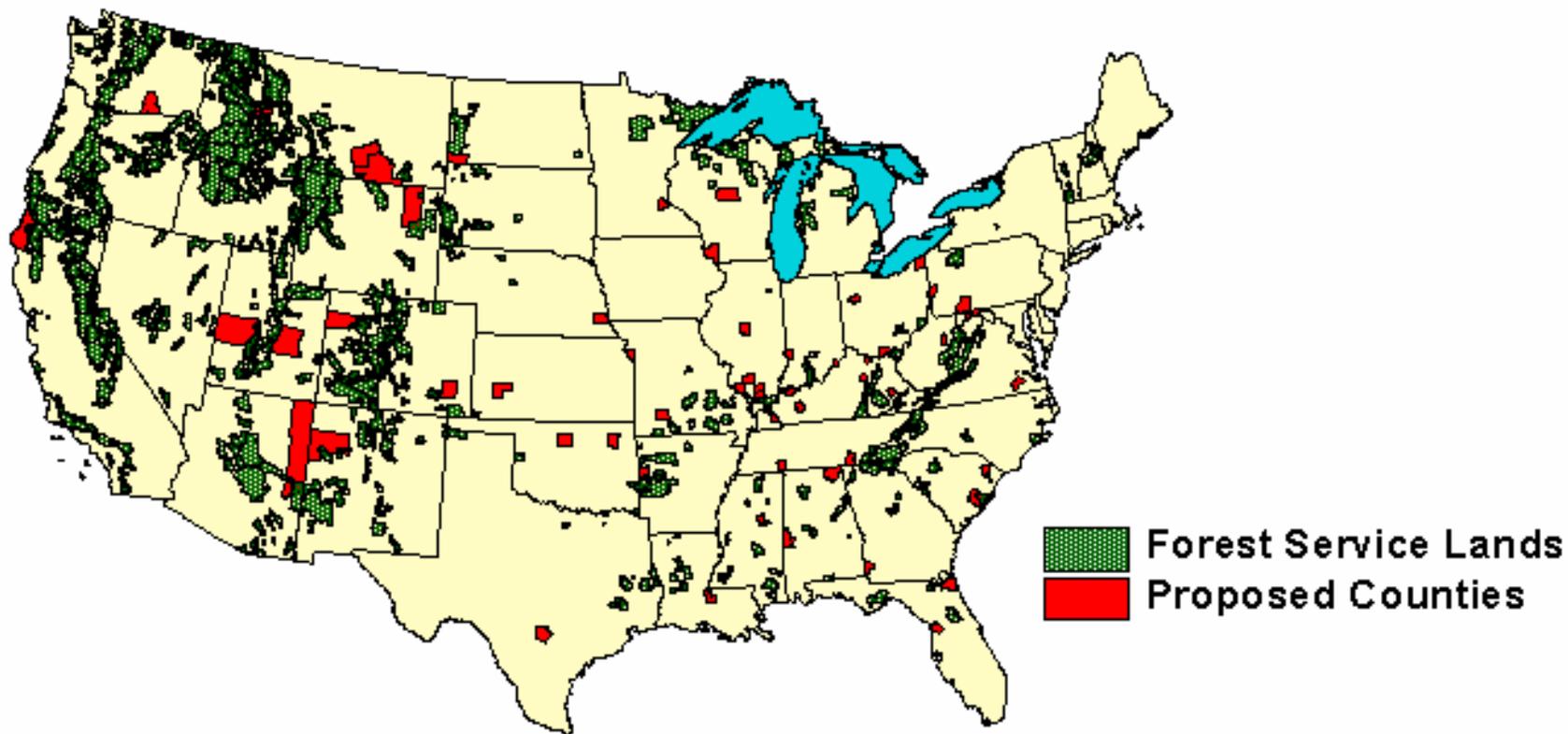


- Natural visibility (i.e. unimpaired visibility) in the East is estimated to be between 95 and 130 km (60 to 80 miles).
- Visibility impairment is caused by buildup of particulate matter levels of various materials including, sulfates, nitrates, soot, organic carbon, and soil, most severely when the particles of particulate matter are smaller than 2.5 microns in diameter. By comparison, a human hair is approximately 70 microns in diameter.

- Ammonium sulfates, stemming from the emission of SO<sub>2</sub>, are responsible for 60 to 90 % of the visibility impairment across the Eastern United States and Canada.
- Visibility in the Eastern United States has shown a marked decline over the last five decades, particularly in the Southern tier of Region 9, and the Southeastern United States.
- Measurable impairment has been monitored at all IMPROVE monitors, even at the more pristine sites, such as the Superior National Forest's Boundary Waters Canoe Area.



**Figure 10: Counties Proposed for Development of Large Coal Fired Facilities, as of 11-01-02\***

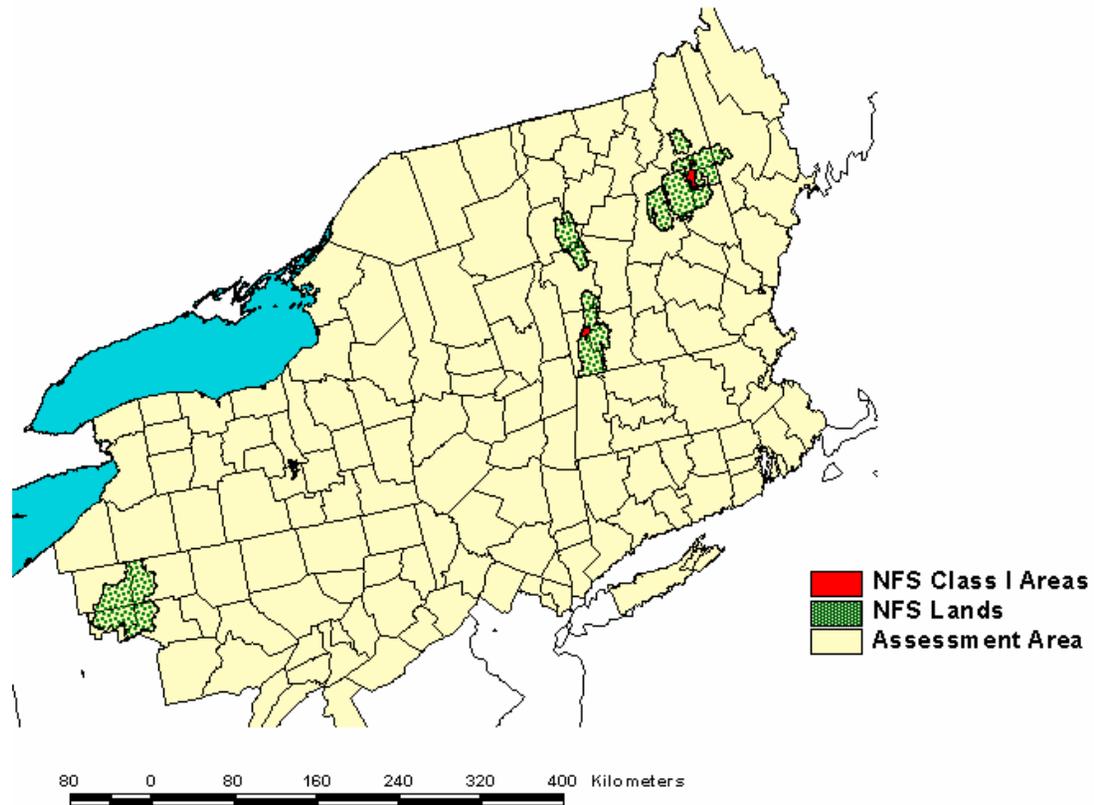


\* Source: USDOE's Nation Energy Technology Laboratory

**Notes for Figure 10:**

- As indicated throughout this package, coal fired power plants are considered one of the largest contributors of air pollution impacting the Forests of the Eastern United States. Figure 10 illustrates that the use of coal has recently become more attractive to utilities in their plans for expansion of generating capacity. As indicated above, more projects are proposed for Region 9 than any other Region, perhaps indicative of the availability of nearby coal deposits. Coincidentally, the largest of these facilities are proposed for the Ohio River Valley, particularly in Southern Illinois. The data in Figure 10 should be tempered with the knowledge that these facilities are only proposed, and many may not be permitted. Most that do undergo the permitting process will come under the watchful eye of the Agency's Air Program.
- A recent GAO study forecasts that electrical generation from all fuel sources will increase 42% by 2020. Most of that generation will take place in the East, and most will be fueled by fossil fuels. It is likely that the bulk of this generation will be in or near Region 9. Because of prevailing weather patterns, Region 9 will continue to be the most heavily impacted of any Region.

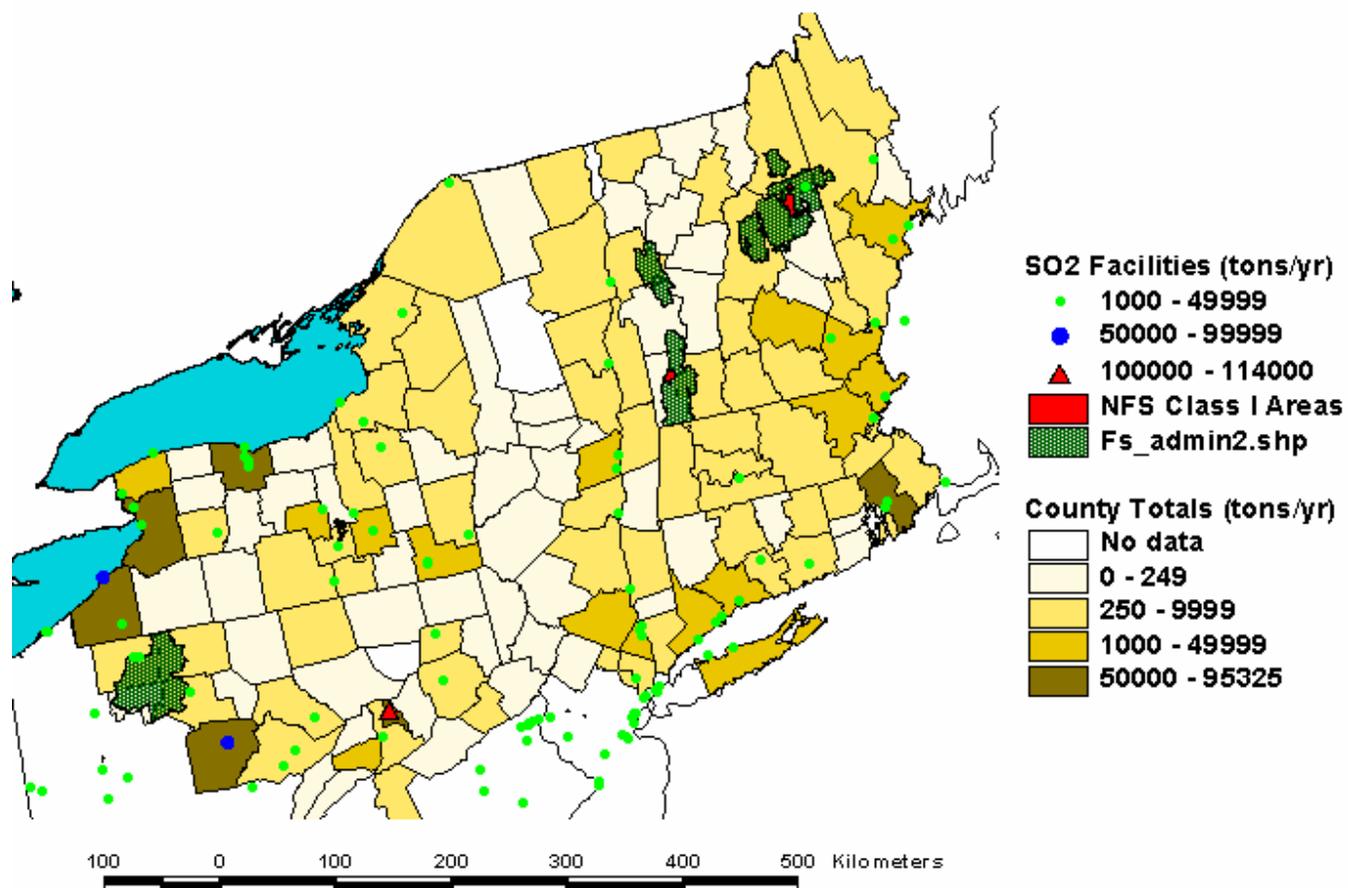
**Figure 11: Air Quality Assessment Area, the Green Mountain & Finger Lakes National Forests**



**Notes for Figure 11:**

- Even though air pollution knows no boundaries, for the purposes of understanding air pollution impacts to individual Forests, it is useful to limit our analysis to those areas nearest the Forest. In this package, that areas is referred to as an Air Quality Assessment Area.
- The Green Mountain & Finger Lakes's Air Quality Assessment Area is contained within nine states, and represents those counties within 200 km of a Forest's boundaries. Counties are chosen as a standard because EPA compiles emission data on a county basis. 200 km was chosen for convenience and because most, but not all, large pollutant sources affecting the Forest are within 200 km of a Forest's boundary, and those areas that may be affected by emissions from our prescribed fires are well within this 200 km buffer.

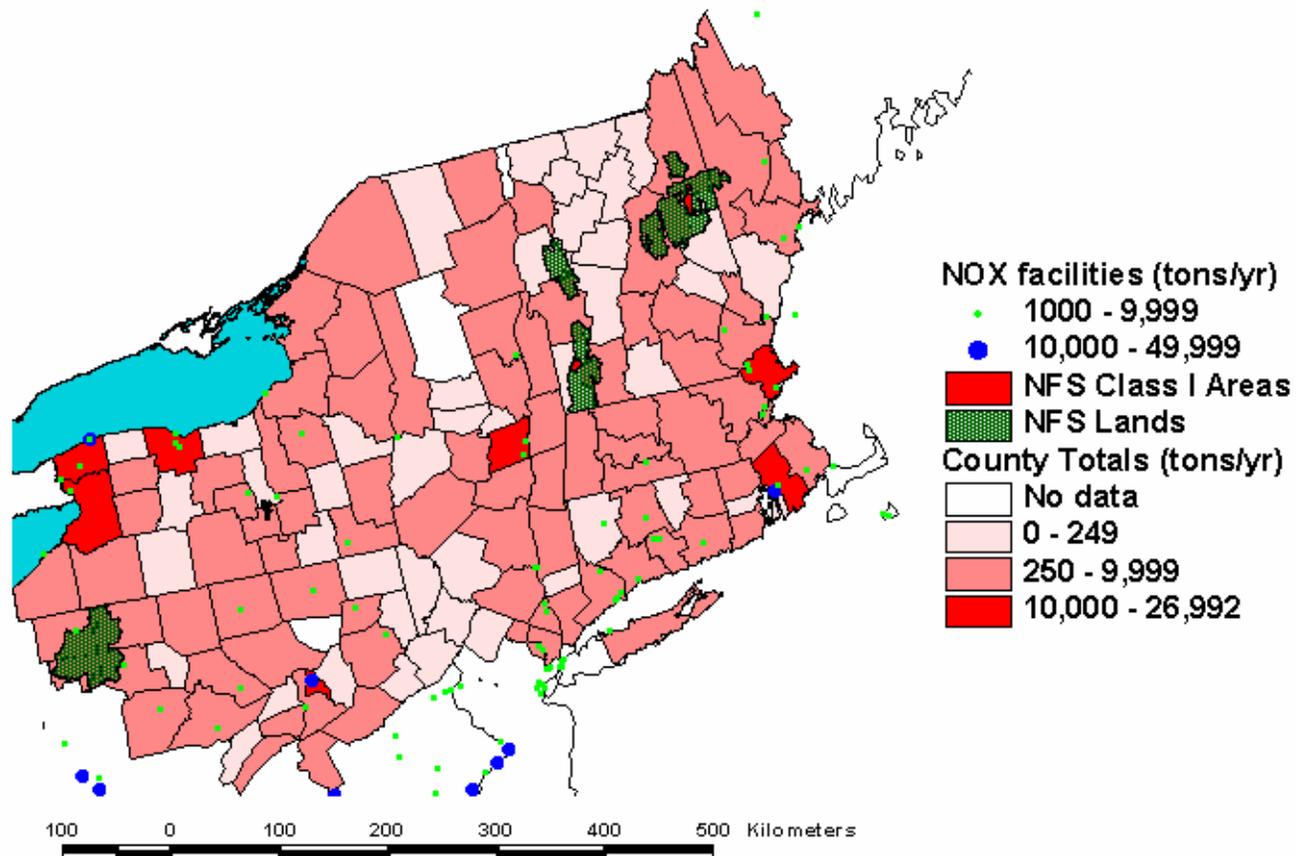
**Figure 12: Sulfur Dioxide Emissions within the Green Mountain & Finger Lakes Assessment Area\* County Totals and Large Point Sources**



**Notes for Figure 12:**

- The lies far from the largest sulfur dioxide (SO<sub>2</sub>) emitters in the nation nearer the Ohio River Valley, but is nonetheless impacted by them. While the resulting acidic sulfate deposition is not the heaviest in the nation, the Forest nevertheless experiences some level of acid deposition stemming from these and other nearby sources (see Figure 3).
- The bulk of acid deposition on the Green Mountain & Finger Lakes, illustrated in Figure 3 and 4 is the result of SO<sub>2</sub> and NO<sub>x</sub> emissions within or near the Green Mountain & Finger Lakes Assessment Area, and to a large extent, transported from the Ohio River Valley.
- SO<sub>2</sub> is also a precursor to ammonium sulfate formation. Ammonium sulfate is one of the key components of Regional Haze. It is very important to the Air Program and the nation as a whole, as stated in the 1999 Regional Haze Rule, to preserve and even improve the quality of visibility found on the Green Mountain & Finger Lakes.
- It has been determined that a desire for unimpaired scenic vistas are among the top reasons drawing visitors to the National Forests.

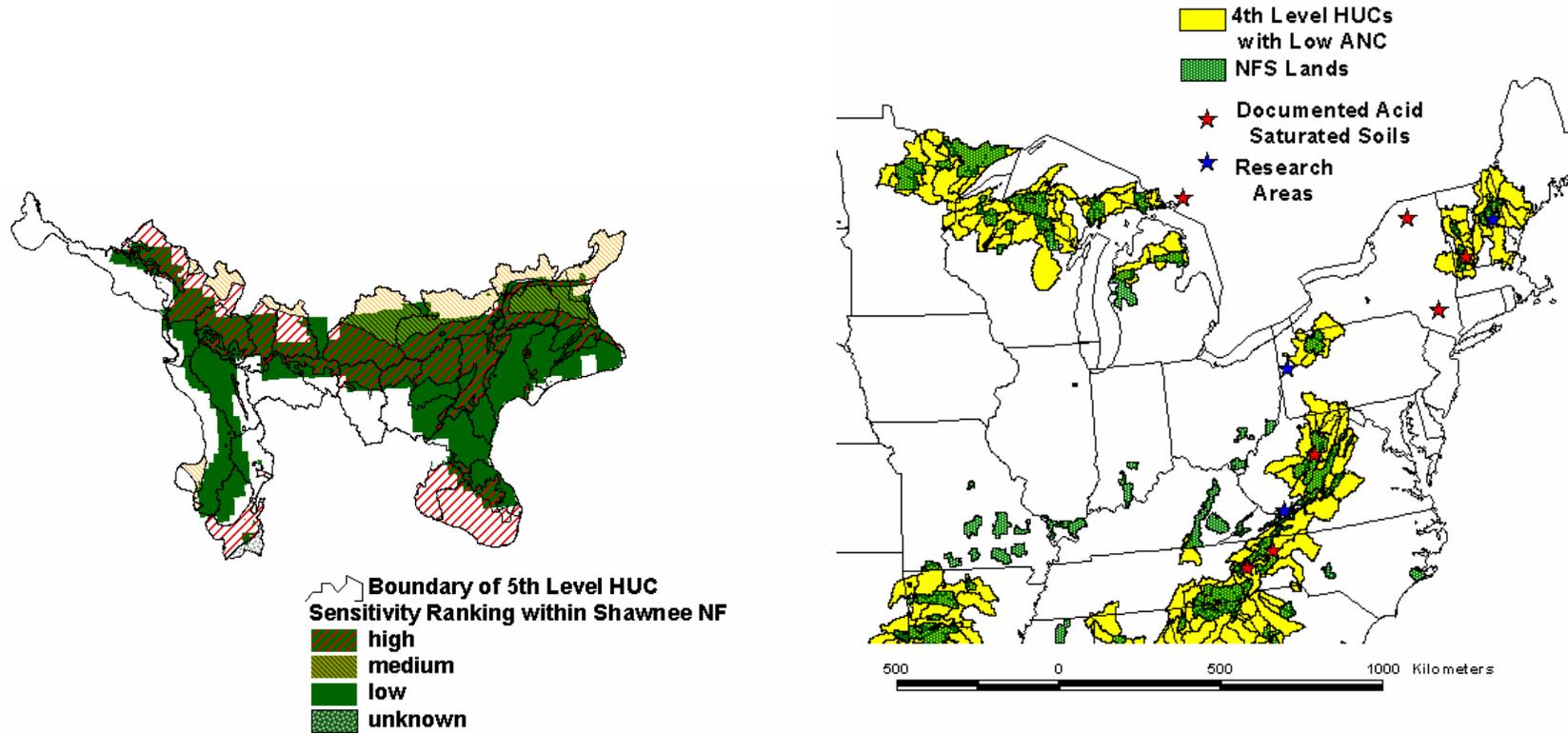
**Figure 13: Nitrogen Oxides Emissions within the Green Mountain & Finger Lakes Assessment Area County Totals and Large Point Sources**



**Notes for Figure 13:**

- The highest concentration of nitrogen oxide (NO<sub>x</sub>) sources are well South of the Assessment Area. Still, the Green Mountain & Finger Lakes is surrounded by numerous NO<sub>x</sub> sources, including some proposed coal and gas fired power plants.
- Acid deposition on the Green Mountain & Finger Lakes, illustrated in Figure 4 is the result of NO<sub>x</sub> and SO<sub>2</sub> emissions within or near the Green Mountain & Finger Lakes Assessment Area, and emissions to the greatest extent are transported hundreds of miles from the Ohio River Valley. While not as severe as other areas in the Region, acid deposition on the Forests is of concern due to the Forests' thin acidic soils.
- NO<sub>x</sub> emissions combined with the abundance of industrial and automotive volatile organic compound (VOC) emissions, and naturally occurring VOC concentrations, are readily converted to ground level ozone in the presence of sunlight. Ozone concentrations can climb to unhealthful levels within the Assessment Area during hot stagnant conditions common in the summer.
- NO<sub>x</sub> is also a precursor to ammonium nitrate formation. Ammonium nitrate is one of the key components of Regional Haze. All Forests experience visibility impairment, and the relatively good visibility on the Green Mountain & Finger Lakes is not immune to further impacts, if pollutant emissions are not kept below critical levels. It has been determined that a desire for unimpaired scenic vistas are among the top reasons drawing visitors to the National Forests.

**Figure 14: Acid Deposition Sensitivity Ranking of 5<sup>th</sup> Level HUCs Associated with the Shawnee National Forest\* and 4<sup>th</sup> Level HUCs Containing Waters with Low Acid Neutralizing Capacity\*\***



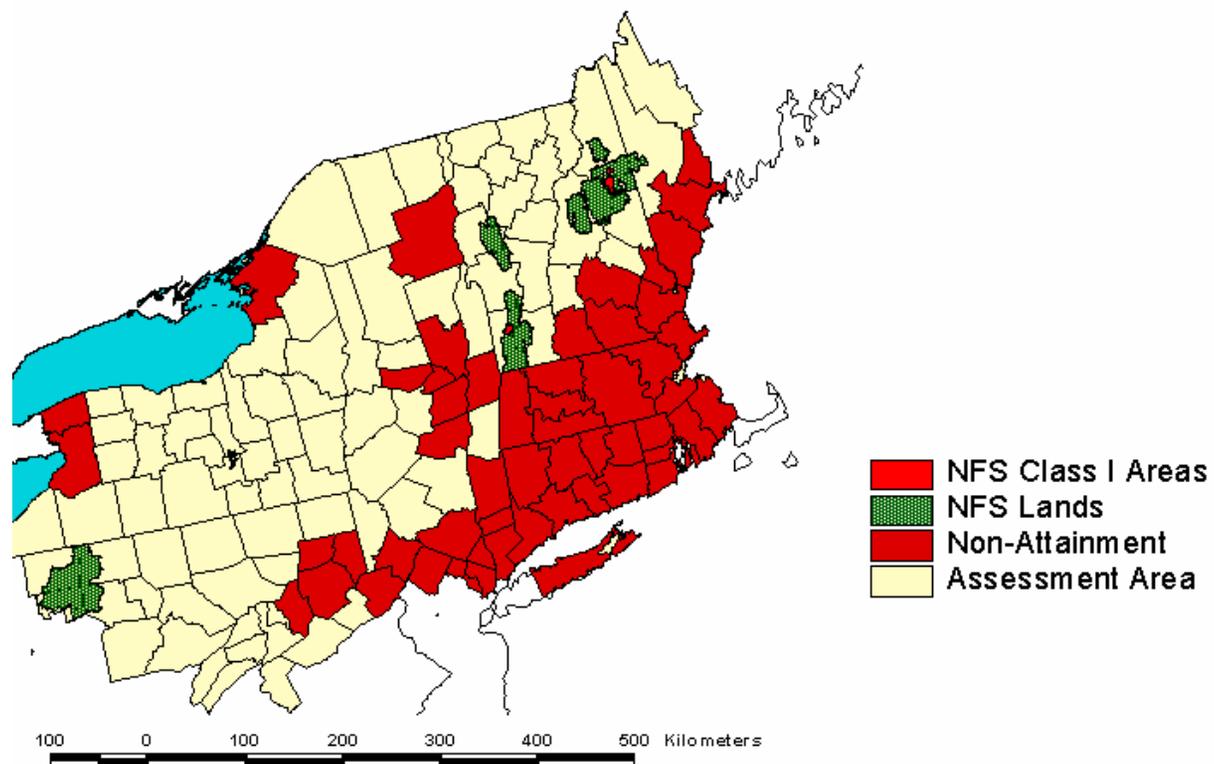
\*\* Source: National Acid Precipitation Assessment Program

- Source: Bill Jackson, R8 Air Specialist, based on lithology supplied by USNRCS and acid deposition levels as supplied by PA State University

**Notes for Figure 14:**

- Recognizing a lack of information to identify those areas most at risk from acid deposition, the R9 Air Program has undertaken an acid deposition risk assessment for the Allegheny, Daniel Boone, George Washington, Jefferson, Hoosier, Monongahela, Shawnee, and Wayne National Forests, using acid deposition rate and lithology as indicators. Figure 14 represents some preliminary results of that effort. Though it is an important step in our understanding of risk, a further factor to consider is the influence of the widely distributed loess soils characterizing the Shawnee. The areas shown at risk in Figure 14 should be reduced further by determining which areas are covered by soils so thin that lithology becomes the dominant influence. When this is done, Forest personnel will have a tool to determine the extent, if any, of acidified forests soils on the Shawnee.
- In the near future, risk assessments for other Forests may be forthcoming. Such an assessment is important for the Chippewa because of the large areas of poorly buffered soils there. Lithology is expected to be a dominant factor on most Forests.
- Many Forests in Region 9 likely contain waters with reduced in Acid Neutralizing Capacity from the impacts of acid deposition, and could benefit from such a risk assessment exercise.

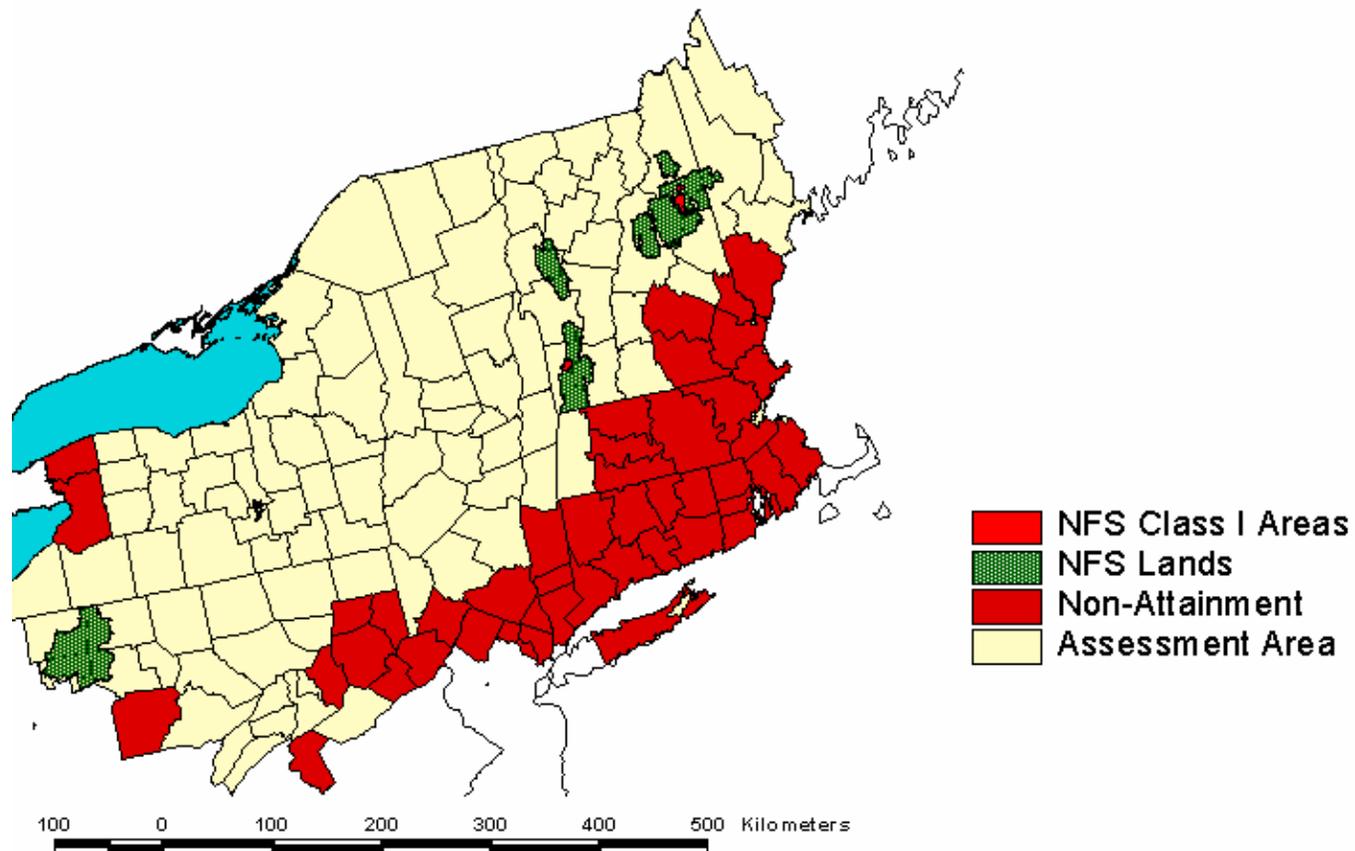
**Figure 15: Class I and 1-hour Ozone Non-Attainment Area\*  
Within the Green Mountain & Finger Lakes Assessment Area**



**Notes for Figure 15:**

NO<sub>x</sub> emissions combined with the abundance of industrial and automotive volatile organic compound (VOC) emissions, and naturally occurring VOC concentrations, are readily converted to ground level ozone in the presence of sunlight. Ozone concentrations can climb to unhealthful levels within the Assessment Area during hot stagnant conditions common in the summer. Until recently, the 1-hour ozone standard of 0.120 ppm (averaged over 1 hour) has dominated regulatory initiatives to abate ozone formation and to protect human health. In the future, the 8-hour standard of 0.085 ppm (averaged over 8 hours) will dominate (see Figure 16). Proximity of Non-Attainment Areas can be a factor in Forest management decisions.

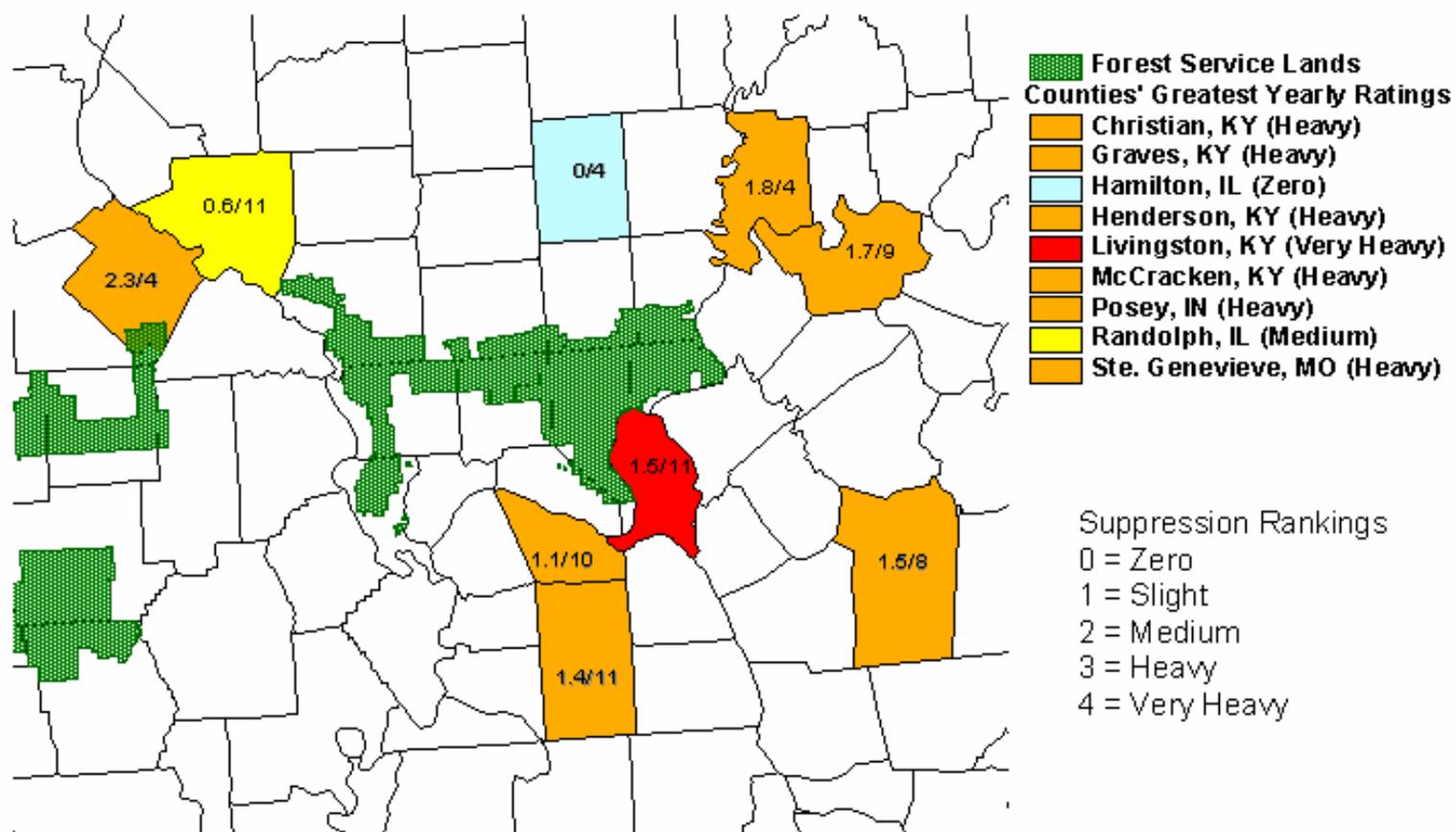
**Figure 16: Class I and 8-hour Ozone Non-Attainment Areas\* within the Green Mountain & Finger Lakes Assessment Area\***



**Notes for Figure 16:**

- As explained under Figure 15, NO<sub>x</sub> emissions lead to the formation of ground level ozone. The older 1-hour ozone standard (0.085 ppm average over one hour) will eventually be replaced with the more stringent 8-hour standard (0.120 ppm running average over 8 hours). As a result, a greater number of counties will be declared non-attainment. Several of those counties will lay adjacent, and in some cases, overlap National Forest Lands. It will be important to carry out activities in a manner to minimize impacts to those Non-Attainment Areas from Forest activities. This situation may actually support an expanded prescribed fire program. NO<sub>x</sub> emissions from prescribed fires, acre for acre, are significantly less than will be emitted from those wildfires resulting from a lack of adequate fuel reduction.

**Figure 17: Ozone Induced Tree Growth Suppression Ratings Surrounding the Shawnee National Forest\***



\* Color code reflects highest growth suppression rating during 1990-2000 ozone seasons based on data from Federal Reference Monitors. 1.5/11 = Average Ranking / Number of Years Monitored.

**Notes for Figure 17:**

- As stated under Figure 6, controlled studies have shown that ozone levels as indicated above in orange and red, can lead to growth suppression of sensitive species. Some of the most sensitive species to ozone exposure are important timber and pulp species (e.g. black cherry, tulip poplar).
- Figure 17 shows a compilation modeled tree growth suppression data regarding two of the more sensitive species that grow on the Shawnee National Forest. It is based on numerous dose response studies and over ten years of data from Federal Reference Method (i.e. EPA sanctioned) ozone monitors near the Shawnee. Many factors relate to ozone induced response in the field, and due to varying climatic conditions, these values should be used only as an indication of potential growth suppression. However, it can be surmised that ozone levels, as they exist near the Shawnee, have resulted in some level of tree growth suppression, and will likely continue until ozone levels are ultimately reduced.
- Even though ozone levels on the Green Mountain & Finger Lakes are not as severe as those on Forests on the Southern tier, the Green Mountain & Finger Lakes is not immune to unhealthful concentrations of ozone.

### **Table 1: Actions that may be Considered by Forest Supervisors Addressing Air Pollutant Impacts to Forest Resources**

#### **In General:**

- **Integrate Air Resource Management into the management of the Forest.**
- **Involve Forest Leadership in your state's permit process for siting or major modification of any large air pollutant source within your Forest's Assessment Area (e.g. establish a relationship with the leaders of state or local Air Agencies).**
- **Establish a relationship with other FLMs with Class I Areas within your Forest's Assessment Area collaborating to protect your Forest's resources.**
- **Support the Air Program's efforts to retain unlimited purview for review permits of large pollutant sources (i.e. Administrative efforts are underway that could limit Program purview to 50 km).**

#### **Specifically Regarding Acid Deposition:**

- **Identify areas that may be at risk from acid deposition, and combine the parameters needed to assess air pollutant impacts with the I&M efforts of other NR disciplines (e.g. encourage aluminum monitoring with all water monitoring studies within the high risk areas, increase the number of Forest Health Monitoring plots in those areas.)**
- **In those areas that show signs of acidified soils and/or acidified lakes and stream, take avoid removing cations from those areas' soils through otherwise sound logging practices.**

#### **Specifically Regarding Ozone:**

- **If your Forest is in an area that often experiences unhealthful levels of ground level ozone:**
- **Work with the air pollution control agency of your state, and those of surrounding states, to establish an ozone forecasting network, as have NC, SC, and GA. Enabling your visitors and employees advance warning of probably unhealthful conditions.**
- **Work to expand the number of ozone biomonitoring sites on the Forest as part of the Forest Health Monitoring network.**



**Specifically Regarding Mercury Deposition:**

- **Support your state's efforts to monitor mercury and abate emissions.**
- **Increase the level of mercury monitoring of fish species on the Forest, and if necessary identify those areas where fish carry the highest mercury burden.**

**Specifically Regarding Visibility:**

- **Participate in the drafting of your state's Smoke Management Plan to make sure your Forest's and the Agency's interests are represented. A state's Smoke Management Plan will ultimately dictate how the Forest will conduct its burns.**

