2005 Annual Performance & Progress Report: Air Quality in National Parks

Introduction

The National Park Service strives to perpetuate the best possible air quality in units of the National Park System because air pollution affects ecological health, scenic views, human health, and visitor enjoyment even at relatively low levels. Progress toward this goal is measured by examining trends for key air quality indicators, including:

- Ozone – which affects human health and native vegetation
- Visibility – which affects how well and how far visitors can see; and
- Atmospheric deposition – which affects ecological health

The NPS monitors one or more of these indicators in 68 park units, and there are sufficient data to assess trends in 50 parks. In general, we consider stable or improving air quality trends a sign of success. Other objectives include that parks (1) comply with the national ambient air quality standards established by the Environmental Protection Agency (EPA) to protect human health and (2) show reasonable progress toward remedying existing visibility impairment as required by EPA's visibility protection regulations.

In accordance with the Government Performance and Results Act, the NPS has established performance goals reflecting these objectives and reports annually on progress toward air quality goals. Performance is measured by calculating the percentage of parks that meet the air quality goals. For the 2005 Annual Performance Report, data collected between 1995-2004 were examined.[1] As explained in more detail below, the NPS is exceeding air quality performance goals for 2005, with 68% of the reporting parks showing stable or improving air quality trends generally, 78% meeting national ambient air quality standards, and 100% meeting visibility goals. The target goals for 2005 were 64%, 75%, and 85%, respectively.

We expect these positive trends to continue and improve as regulations aimed at reducing tailpipe emissions from motor vehicles and pollution from electric-generating facilities take full effect over the next few years. In addition, States and Tribes, with assistance from regional planning organizations, are in the process of developing programs to improve visibility in national parks and wilderness areas in response to new EPA regulations. Information available through the NPS air quality monitoring program has provided a foundation and impetus for pollution control programs that will benefit parks. NPS's ability to offer expert and constructive assistance and advice to regulatory and permitting agencies has stimulated collaborative efforts to find creative and cost-effective air quality management approaches.

Air Quality Goals and Trends

The NPS Strategic Plan (2003) air quality goal calls for 70% of reporting parks to have stable or improved air quality by 2008, with progress toward that goal measured annually through target goals. Data from visibility monitoring, gaseous air pollutant monitoring (primarily ozone), and precipitation monitoring are used to assess air quality trends; six measures are used in the calculation. Not all parks monitor all the indicators. A park is considered to have improving or stable air quality if none of the measures show a statistically significant degrading trend (denoted in red on attached figures and table). The target goal for 2005 was 64%, and we

[1] The lag time in data reporting results from quality assurance and data analysis procedures.

exceeded that goal with 68% of the reporting parks having stable or improving air quality in 2005 (34 out of 50 areas). Figure 1 and Figure 2 present maps showing the overall goal status for each park and the trend for each indicator monitored, respectively. More detail on how trends are calculated appears in the Technical Appendix to this report. All referenced figures and tables follow this appendix.

Visibility Measures

For visibility, the NPS looks at the 20% clearest days and the 20% haziest days to measure visibility conditions. EPA uses these measures to assess progress toward the national goal of remedying any existing and preventing any future manmade visibility impairment in "Class I" areas. Class I areas include the largest national parks and wilderness areas.[2] They receive the highest degree of air quality protection under the Clean Air Act. All 30 parks that have monitored visibility for at least 6 years have stable or improving visibility on both the clear and hazy days. In other words, **100% are meeting the visibility goal.** On the clearest days, almost half the parks are showing improvement, including, Shenandoah and Acadia National Parks in the eastern U.S., and several sites in the northwest U.S., California, Colorado Plateau, and Rocky Mountain areas, and Alaska. See Figure 5. On hazy days, most areas are showing stable – not improving – trends, with some notable exceptions. Great Smoky Mountains National Park and Mammoth Cave National Park – two parks that have had the worst visibility over the past several years – are experiencing statistically-significant improvements in visibility (10-20% improvement in visibility). See Figure 6.

Atmospheric Deposition Measures

Sulfate, nitrate, and ammonium ions in precipitation (rain and snow) are used as indicators of atmospheric deposition, because they can be directly linked to ecological effects (e.g., acidification of surface waters, nutrient enrichment that disrupts natural systems). Of the 29 areas monitoring wet deposition, 27 – or **93% -- show stable or improving trends with respect to sulfate concentrations**. See Figure 7. **Nitrate ion concentrations are stable or improving in 24 parks (83%).** See Figure 8. Ammonium, like nitrate, is a form of nitrogen. **Ammonium is stable in 22 areas (76%),** with no areas showing a statistically significant decrease in concentrations, and seven areas showing increased concentrations. See Figure 9. In total, nine parks are seeing increased nitrogen loadings: Bandelier, Canyonlands, Craters of the Moon, Gila Cliff Dwellings, Glacier, Grand Canyon, Little Bighorn Battlefield National Monuments, Rocky Mountain and Yellowstone National Parks. The NPS has shared information and concerns about these trends with EPA, States, Tribes and stakeholders. As explained further below, collaborative efforts are underway to better understand the causes and effects of nitrogen loadings and to explore options for protecting ecosystem health, if necessary.

Ozone Measures

The NPS calculates ozone trends using EPA's metric for the national ambient air quality standard (i.e., the 3-year average of the annual fourth highest daily maximum 8-hour ozone concentration). **Of the 32 park units that monitor ozone, 20 units have stable or improving trends (63%).** See Figure 10. In the East, where ozone concentrations in parks like Great Smoky Mountains, Mammoth Cave, and Shenandoah sometimes reach high enough levels to harm human health, the ozone trends are primarily stable over the past ten years. However, in the past few years, most eastern states implemented new pollution control programs designed to reduce nitrogen oxides – a precursor to ozone formation. If we examine the most recent years of data, an improving trend (decreasing ozone) is discernible and one that we expect to

[2] National parks greater than 6,000 acres and national wilderness areas greater than 5,000 acres that were in existence or authorized as of August 7, 1977.

continue. An improving ozone trend can also be seen at some western parks -- Big Bend, Channel Islands, Pinnacles, and Saguaro National Parks. On the other hand, ten parks in the West have increasing ozone levels, including Canyonlands, Craters of the Moon, Death Valley, Glacier, Grand Canyon, Mesa Verde, North Cascades, Rocky Mountain, Sequoia, and Yellowstone. As with concerns about increasing nitrogen loadings in western parks, the NPS has shared information about ozone trends with regulatory agencies, and several initiatives are underway to understand causes and effects and explore management options.

The U.S. Department of the Interior Strategic Plan (2004) includes two air quality goals focused on Class I areas. One goal is measured by compliance with national ambient air quality standards, the other measures whether visibility objectives are met.

National Ambient Air Quality Standards

In 2005, 35 out of 45 NPS Class I areas with monitoring met the NAAQS for ozone, particulate matter (PM 2.5) or sulfur dioxide. Ten of the 45 parks violate one of those pollutant standards, or they are part of EPA-designated non-attainment areas for one of those pollutants. See Figure 11. Parks with ozone levels above the NAAQS (violating the standard) are: Acadia, Great Smoky Mountains, Joshua Tree, Sequoia, Kings Canyon, Shenandoah, and Yosemite National Parks. Rocky Mountain NP has monitored ozone levels below the level of the NAAQS but is part of an EPA ozone non-attainment area. Point Reyes does not have onsite ozone monitoring but is part of an EPA-designated ozone non-attainment area. For PM2.5 particulate matter, no NPS Class I area with monitoring exceeds the level of the standard but the following five NPS areas are all or part in EPA's PM2.5 non-attainment areas: Great Smoky Mountains, Joshua Tree, Sequoia, Kings Canyon, and Yosemite National Parks. Sulfur dioxide levels at Hawaii Volcanoes NP occasionally exceed the level of the NAAQS. Such exceedances of the standard are caused by natural volcanic, and not anthropogenic, emissions.

Visibility Objectives

The visibility objectives are met when "reasonable progress" is made toward achieving restoring natural background visibility conditions over a 60-year period, as outlined in EPA's visibility protection regulations. The definition of reasonable progress will differ for each class I area because both existing baseline visibility conditions and target natural background visibility conditions differ from area to area. Moreover, States are not required to submit plans consistent with EPA's regulations until the end of 2007. In the meantime, NPS is using a surrogate goal of "stable or improving visibility" to assess trends. As mentioned above, all parks where visibility is monitored are meeting this goal. See Figure 4.

Information and Collaboration Produce Results

Making progress toward meeting park air quality goals is challenging because the NPS has no direct authority to control sources of pollution located outside park boundaries. In order to achieve park air quality goals, the NPS supports or helps shape federal and state air pollution control programs by sharing information about air quality conditions and trends in parks with regulatory agencies and the public. Information sharing has led to collaborative efforts with States, Tribes, EPA, the private sector, and the public aimed at protecting air quality in parks. For example:

- Evidence of deteriorating air quality trends in western parks has been shared with western State air directors and resulted in a collaborative effort to evaluate the Clean Air Act's programs to protect clean air. NPS and western states reached consensus on numerous steps that could be taken to improve effectiveness and accountability. This

collaborative effort has now grown into a dialogue about creating a new framework for managing clean air and air quality related values.

- The National Park Service has entered into a Memorandum of Understanding (MOU) with the State of Colorado and EPA to address air pollution issues at Rocky Mountain National Park. The NPS will establish resource condition goals and Colorado will develop measures to restore ecological health.

- NPS presented information to EPA regarding degradation of park natural resources because of nitrogen-related air pollution, and persuaded EPA to allow states the flexibility to develop alternative approaches for managing clean air resources so as to avoid harm to resources. The ARD also provided assistance to EPA as it was developing new regulations to protect visibility in national parks ("best available retrofit technology" requirements for large, existing stationary sources of pollution) and provided support for the Clean Air Interstate Rule.

- NPS participated in task forces focusing on adaptively managing environmental impacts of energy development, including the Powder River Basin Air Quality Work Group (3 states, EPA, and federal land managers), the Four Corners Air Quality Task Force (4 states, several tribal nations, EPA, federal land managers), and the Federal Leadership Forum (state and regional directors from BLM, FWS, USFS, NPS, DOE and EPA in the Rocky Mountain and intermountain region).

- NPS has continued its participation in five Regional Planning Organizations (RPOs) funded by EPA to assist states and tribes in developing visibility protection plans for national parks and wilderness areas. These RPOs are comprised of states, tribes, NPS, EPA, USFS and FWS. The NPS has been able to share air quality information and air quality modeling expertise among the RPOs, and has also provided training for state and tribal staffs.

The information, expertise and management concerns that the NPS brings to many external decision making arenas have made a difference in the past and will continue to in the future.

TECHNICAL APPENDIX
FY 2005 Annual Performance Report: Government Performance and Results Act (GPRA)
Air Quality Goals Ia3, Ia3B (DOI# PEM.1.010), and Ia3C (DOI# PEM.1.011)
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The National Park Service (NPS) recently completed the FY 2005 performance assessment for the Servicewide air quality program as required by the Government Performance and Results Act (GPRA). The NPS evaluates performance based on a few air quality goals established by the NPS or the U.S. Department of the Interior (DOI).

Long Term NPS Air Quality Goal: By September 30, 2008, air quality in 70% of reporting parks is stable or improved (NPS Goal Ia3)

- Target goal for 2005: Air quality in 64% of reporting parks is stable or improved.
- Actual performance in 2005: FY 2005 assessment indicated a performance measure of 68%, thus exceeding our target goal. Thirty-four of 50 reporting park areas met goal Ia3. See Figures 1 and 2 for national maps displaying overall trend as well as performance relative to the six air quality indicators.

DOI Ambient Air Quality Standards Goal: By September 30, 2005, 75% of reporting parks meet the national ambient air quality standards (NAAQS)(DOI Goal Ia3B - DOI #PEM1.010).

- Actual performance: For this fiscal year, 78% or 35 of 45 reporting NPS Class I areas met NAAQS, thus exceeding the performance goal. See also Figure 3.

DOI Visibility Goal: By September 30, 2005, 85% of reporting NPS Class I areas meet EPA visibility objectives. (DOI Goal Ia3C - DOI# PEM.1.011).

- Actual performance: All 26 reporting Class I areas are currently meeting visibility goal (100%), thus exceeding the performance goal. See also Figure 4.

NPS Goal Ia3 Performance Indicators

Determining progress toward meeting NPS Goal Ia3 requires an assessment whether park air quality is stable or improving. Assessing performance for this goal is based on a 10-year trend of three performance indicators: visibility, atmospheric deposition, and ozone. Six measures are used to assess performance under the three indicators.

Visibility: Particle measurements made at 30 NPS units were used to calculate the annual reconstructed atmospheric extinction in deciview for both clear and hazy days. (Extinction depends on the mass and chemical composition of the particles and is a quantitative measure of how the passage of light through the atmosphere is affected by air pollutants.)

Atmospheric Deposition: Annual precipitation-weighted means of sulfate, nitrate, and ammonium ion concentrations at 29 NPS areas were used to gauge air quality for this indicator. Changes in ammonium ion concentration in precipitation were included in the wet deposition indicator beginning last year because ammonium contributes to total nitrogen deposition and data indicate that ammonium concentrations are increasing at a faster rate than nitrate ion concentrations alone.

Ozone: This measure was modified in FY 2004 to correspond to the new national ambient air quality standard (i.e., the 3-year average of the annual fourth highest daily maximum 8-hour ozone concentration) and has been calculated at 32 NPS units.

Significance Levels Refined: The method used to determine statistical significance of trends was modified last year to use a value more commonly used in the literature. In past trend reporting, we had used a significance level of 0.15, meaning there was a 15% chance that we could wrongly conclude that there was a trend when in fact the change was due to chance. We decided to change the significance level to 0.05, which is commonly used by many researchers. This reduces the chance that we would incorrectly conclude that there is a trend from 15% to 5%.

Calculating Progress: To calculate a servicewide percentage to compare with the air quality goal, we first performed a trend analysis for each of the above six air quality measures (2 visibility, 1 ozone, 3 acid precipitation) over a ten-year period. The FY2005 analysis used 1995-2004 data and required each site to have a minimum of at least six years of data in this 10-year period. (Year 2005 data were not used in this FY2005 analysis because all of that year's data were not available. There is typically at least a three to six month lag between the time the data are collected in the field and when they are validated and available for analysis.) Our trend time period is a sliding 10-year window and will change to 1996-2005 for next year's analysis. A sliding 10-year trend window was chosen rather than a variable length trend from a single fixed baseline year because individual parks began monitoring in different years and thus there is no individual fixed baseline year that can be applied to all parks.

A few parks operate more than one ozone, visibility, or deposition monitor. This fiscal year we considered data from all monitoring sites at a park and if, for example, any one of the ozone monitors at a park showed a statistically significant degrading trend, the park was considered as not meeting the goal for that measure. In past years' analyses, the same park monitoring site was used for the trend analysis, even if other park site monitoring data were available. Initially when the GPRA air quality goal reporting started, we chose to use the park monitoring site with the longest period of data collection. Monitoring at parks with multiple sites has occurred long enough for there to be other park sites that can participate in the trend analysis.

Trend Analysis Results

The results of the trend analyses for the six individual measures appear in Table 1, and trend results for all parks and indicators are represented graphically in Figure 2. For FY2005, 34 of 50, or 68% of NPS parks with monitoring showed stable or improving trends. Thus, the annual air quality performance goal was met for this year.

Figure 5 through Figure 10 present maps illustrating the results of the individual trend analyses for visibility, acid deposition, and ozone. The solid green and red arrows or boxes in these figures represent statistically significant improving or degrading trends during 1995-2004, while the light green and yellow arrow or box symbols represent similar trends but not statistically significant with p values between 0.05 and 0.15. These last two colored symbols are included to indicate which parks had trends that would have been considered statistically significant under the procedures used in past years.

Trend calculation: A park is considered to have improving or stable air quality if none of the six measures show a statistically significant degrading trend (denoted in Table 1 with a red box). The tabulated values include the slope or change in the measure per year and a level of

statistical significance (p-value). Slopes with p values at 0.05 or less are considered statistically significant. The number of NPS areas not showing statistically significant deterioration in any of the performance indicators at the 0.05 level of significance is then divided by the total number of NPS units with monitoring to calculate a systemwide percentage which is then compared to the performance measure of the GPRA goal.

Visibility: The percent of reporting park visibility monitors showing stable or improving trends was 100% (30 of 30 parks) for both clear and hazy days. Acadia and Shenandoah National Parks showed statistically significant improving visibility trends for the clearest days at eastern national park monitoring sites. (Figure 5.) Great Smoky Mountains and Mammoth Cave National Parks, and Washington D.C. also had an improving trend on the haziest visibility days. (Figure 6.) Statistically significant improving trends for the clearest visibility days were observed at 13 sites in the northwest U.S., California, Colorado Plateau, and Rocky Mountain areas, and Alaska. No reporting NPS area had a significant worsening trend on either the clearest or haziest visibility days.

Wet Deposition: Twenty seven of 29 or 93% of reporting park wet deposition monitors showed stable or improving trends for sulfate in precipitation. (Figure 7.) Last fiscal year, no NPS monitoring site in the East or West demonstrated a statistically significant worsening trend in sulfate ion concentrations in precipitation. This year Yellowstone and Yosemite National Parks have such trends. The 10-year period used for trending in this fiscal year is 1995-2004. This 10-year period adds 2004 and deletes 1994 from the years used in last year's analysis. This change in years can account for the degrading trends because for both Yellowstone and Yosemite National Parks, the 1994 annual precipitation-weighted sulfate ion concentrations were significantly higher than they were in 1995. Furthermore, from 1998 to 2004, there was much less variability in the sulfate concentrations at both parks. These factors have the effect of changing the slope of the trend line from negative (improving) to positive (degrading).

Eighty three percent of reporting park wet deposition monitors (24 of 29) showed stable or improving trends for nitrate in precipitation. (Figure 8.) Western deposition monitoring sites continue to show rising nitrate ion concentrations. Gila Cliff Dwellings National Monument and Glacier, Grand Canyon, Rocky Mountain, and Yellowstone National Parks showed statistically significant worsening nitrate trends.

Spatial trends in ammonium ion concentration are similar to those for nitrate. Seventy six percent of reporting park wet deposition monitors (22 of 29) showed stable or improving trends for ammonium in precipitation. (Figure 9.) Seven park areas, Bandelier, Craters of the Moon, and Little Bighorn Battlefield National Monuments and Canyonlands, Glacier, Rocky Mountain and Yellowstone National Parks exhibited statistically significant worsening trends in ammonium ion concentrations.

Ozone: Sixty three percent of reporting park ozone monitors (20 of 32) showed stable or improving trends. (Figure 10.) Eastern park sites such as Great Smoky Mountains, Mammoth Cave, and Shenandoah showed no worsening or improving ozone trend for the 10-year period. In the shorter term, EPA reported that ozone levels at Great Smoky Mountains and Shenandoah National Parks have decreased by 14% and 12% since 1997 (www.epa.gov/airtrends/2005/ozonenbp.pdf#page=1). NPS also reported a short-term downward trend in ozone concentrations for Great Smoky Mountains and other eastern parks in its *2004 Annual Data Summary Report* (www2.nature.nps.gov/air/Monitoring/ads/docs/2004/GPMP-XX.pdf). These improving trends in ozone have been linked by the EPA to recently implemented control strategies for nitrogen

oxide emissions in the East. (Ozone is formed in the atmosphere by the reaction of nitrogen oxides and volatile organic compounds in the presence of sunlight. The availability of nitrogen oxides to react with volatile organic compounds is a limiting factor in the production of ozone.) A statistically significant degrading 10-year trend in ozone was observed at two eastern sites--Acadia National Park and Congaree National Park.

In the west, ten sites – Canyonlands, Craters of the Moon, Death Valley, Glacier, Grand Canyon, Mesa Verde, North Cascades, Rocky Mountain, Sequoia, and Yellowstone – showed increasing ozone air pollution trends, while levels at Big Bend, Channel Islands, Pinnacles, and Saguaro National Parks showed improving ozone trends. The trend toward increasing ozone at Intermountain West monitoring sites has been observed for several years. The 63 percent of reporting park ozone monitors with stable or improving trends was the lowest percentage of any of the six performance measures and was the driving factor for the overall goal percentage not being higher than 68%.

Department of the Interior Strategic Plan Air Quality Goals

The National Park Service Air Resources Division reports to two servicewide air quality goals in the Department of the Interior (DOI) strategic plan. One goal, Ia3B (DOI# PEM.1.010), deals with ambient air quality standards, while the other, Ia3C (DOI# PEM.1.011) involves meeting visibility objectives in Class I areas.

Ambient Air Quality Standards: For FY2005, goal Ia3B was achieved. The goal states that by September 30, 2005, 75% of reporting NPS Class I areas meet national ambient air quality standards (NAAQS). For this fiscal year, 78% or 35 of 45 reporting NPS Class I areas met NAAQS. Ten of the 45 NPS Class I areas either have measured levels of ozone, particulate matter (PM2.5), or sulfur dioxide above the level of the NAAQS or have levels that meet the NAAQS but are included in whole or in part in EPA-designated non-attainment areas for those pollutants. (Figure 11.) NPS Class I areas with monitored ozone levels above the level of the NAAQS and in EPA non-attainment areas include Acadia, Great Smoky Mountains, Joshua Tree, Sequoia, Kings Canyon, Shenandoah, and Yosemite National Parks. Rocky Mountain NP has monitored ozone levels below the level of the NAAQS but is part of an EPA ozone non-attainment area. Point Reyes does not have onsite ozone monitoring but is part of an EPA-designated ozone non-attainment area.

For PM2.5 particulate matter, no NPS Class I area with monitoring exceeds the level of the standard but the following five NPS areas are all or part in EPA's PM2.5 non-attainment areas: Great Smoky Mountains, Joshua Tree, Sequoia, Kings Canyon, and Yosemite National Parks.

Sulfur dioxide levels at Hawaii Volcanoes NP occasionally exceed the level of the NAAQS. Such exceedances of the standard are caused by natural volcanic, and not anthropogenic, emissions.

Visibility Objectives: For FY2005, the visibility goal Ia3C was also met. This goal states that by September 30, 2005, 85% of reporting NPS Class I areas meet visibility objectives. For FY2005, 100% or 26 of 26 reporting NPS Class I areas met visibility objectives. (Figure 4.) Meeting visibility objectives occurs when "reasonable progress" is made toward achieving EPA's regional haze regulation goal of restoring natural background visibility conditions over a 60-year period. The definition of reasonable progress will differ for each class I area because both

existing baseline visibility conditions and target natural background visibility conditions differ from area to area.

The states are responsible for developing plans to implement the regional haze regulations and track the progress toward meeting the natural background visibility goal. States are required to assess incremental progress toward meeting that goal every five years and revise their implementation plans every 10 years to incorporate revised or new strategies to continue to make progress toward meeting the goal.

States will not submit their plans to implement regional haze regulations until 2007 or early 2008. In the absence of published visibility objectives based on approved state regional haze control plans, a surrogate visibility objective is being used by NPS for reporting under this goal. The NPS visibility objective will be that "visibility in reporting NPS Class I areas has remained stable or improved". The surrogate visibility objective used by NPS for this DOI goal is thus a subset of the measure used for NPS air quality goal Ia3 which is applied to all parks with monitoring regardless of their air quality class designation. A reporting NPS Class I area's visibility has remained stable or improved if the area has not experienced a statistically significant deterioration in both clear and hazy day visibility in the most recent 10-year period measured, at the 0.05 level of significance.

NPS will revise the visibility objectives used in this goal as the implementation of the regional haze regulations proceeds. Such further work on the rule may warrant the revision or replacement of both the surrogate visibility measure used thus far in the DOI strategic plan as well as the annual goal targets. Furthermore, the FY2006-FY2008 DOI goal Ia3C annual targets have not been revised at this time because of changes to the EPA guidance on calculating visibility impairment expected in 2006 that will affect the calculation of the goal measure percentage.

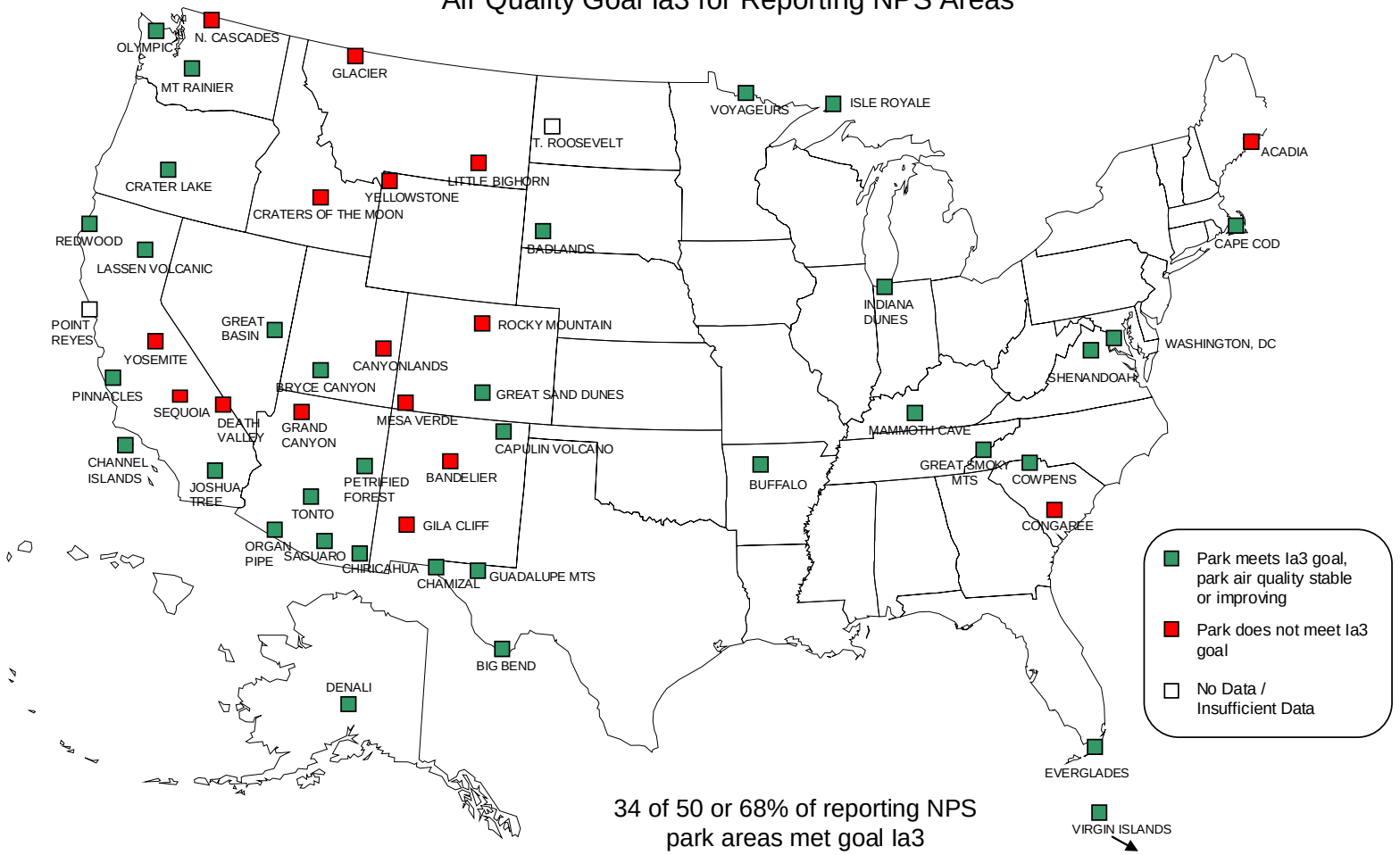
Table 1. Individual Park 1995-2004 Trend Results

Parks in red do not meet the NPS Air Quality Goal Ia3	Visibility				Acid Precipitation						Ozone	
	Clear Days		Hazy Days		Ammonium		Nitrate		Sulfate		Average 3-Year 4th Highest 8-Hour	
	dv/yr	p-value	dv/yr	p-value	µeq/liter/yr	p-value	µeq/liter/yr	p-value	µeq/liter/yr	p-value	ppb/yr	p-value
Acadia	-0.20	0.00	-0.07	0.08	0.03	0.43	-0.16	0.19	-0.64	0.11	1.37	0.03
Badlands	-0.10	0.05	-0.10	0.08								
Bandelier	-0.02	0.24	-0.10	0.19	0.47	0.04	0.40	0.18	0.09	0.46		
Big Bend	-0.43	0.03	-0.15	0.20	-0.77	0.13	-0.49	0.06	-0.78	0.04	-0.83	0.00
Bryce Canyon	-0.06	0.15	0.10	0.11	0.60	0.14	0.14	0.45	-0.55	0.05		
Buffalo					-0.20	0.31	-0.06	0.46	-0.54	0.04		
Cape Cod											-0.50	0.19
Canyonlands	-0.11	0.05	-0.04	0.50	2.77	0.01	1.84	0.07	0.38	0.14	0.50	0.01
Capulin Volcano					0.64	0.14	0.28	0.23	0.08	0.36		
Chamizal											0.33	0.24
Chiricahua	-0.18	0.00	0.06	0.50							0.00	0.24
Channel Islands											-1.00	0.01
Congaree Swamp											1.00	0.01
Cowpens											0.00	0.57
Crater Lake	-0.16	0.03	0.00	0.55								
Craters of the Moon					1.08	0.01	0.23	0.24	0.14	0.30	0.83	0.00
Denali	-0.20	0.00	-0.07	0.43	0.19	0.15	0.11	0.11	0.15	0.19	0.25	0.24
Death Valley											0.50	0.01
Everglades					0.09	0.38	0.08	0.31	0.17	0.24	0.00	0.43
Gila Cliff	-0.16	0.02	-0.17	0.09	1.11	0.05	1.09	0.01	0.10	0.36		
Glacier	-0.11	0.05	0.17	0.14	0.35	0.01	0.23	0.04	-0.04	0.30	0.60	0.04
Great Basin	-0.07	0.15	0.00	0.57	0.43	0.07	0.09	0.39	-0.08	0.39	0.25	0.11
Grand Canyon	-0.25	0.02	-0.01	0.54	0.61	0.07	1.02	0.03	0.15	0.12	0.50	0.00
Great Sand Dunes	0.08	0.15	0.14	0.19								
Great Smoky Mtns	-0.17	0.11	-0.23	0.01	-0.19	0.24	-0.25	0.08	-0.41	0.19	-0.20	0.30
Guadalupe Mtns	-0.14	0.04	0.26	0.08	0.35	0.31	0.11	0.46	-0.77	0.18		
Indiana Dunes					-0.38	0.30	-0.83	0.05	-1.51	0.01		
Isle Royale (Chassell)					0.07	0.45	-0.18	0.02	0.02	0.55		
Joshua Tree											-1.00	0.19
Lassen Volcanic	-0.18	0.01	0.11	0.19							0.00	0.50
Little Bighorn					0.55	0.01	-0.08	0.43	-0.22	0.19		
Mammoth Cave	0.08	0.24	-0.12	0.04							-0.11	0.50
Mesa Verde	0.02	0.38	0.17	0.31	0.22	0.08	0.05	0.50	-0.72	0.02	0.67	0.02
Mount Rainier	-0.10	0.13	-0.15	0.04	0.00	0.55	0.05	0.14	0.20	0.27	0.33	0.43
North Cascades					-0.04	0.30	0.03	0.19	-0.08	0.24	1.33	0.01
Olympic					-0.02	0.27	-0.01	0.45	-0.03	0.36	-0.43	0.15
Organ Pipe					0.17	0.36	0.29	0.45	-0.50	0.14		
Petrified Forest	-0.06	0.19	0.10	0.11								
Pinnacles	0.00	0.55	-0.10	0.27							-0.50	0.04
Redwood	-0.21	0.00	-0.23	0.11								
Rocky Mountain	-0.16	0.00	0.08	0.30	1.23	0.00	0.58	0.00	0.01	0.50	1.00	0.00
Saguaro											-1.00	0.01
Sequoia	0.02	0.50	-0.23	0.36							0.50	0.03
Shenandoah	-0.37	0.02	-0.04	0.38	0.08	0.45	-0.62	0.09	-0.75	0.20	0.00	0.50
Tonto	-0.17	0.03	-0.07	0.45								
Virgin Islands					0.29	0.14	-0.12	0.50	-0.10	0.50		
Voyageurs											-0.33	0.30
Washington	-0.13	0.18	-0.13	0.01								
Yellowstone	-0.15	0.01	-0.14	0.13	0.68	0.02	0.41	0.01	0.22	0.02	0.83	0.04
Yosemite	-0.20	0.01	0.09	0.30	0.52	0.05	0.24	0.19	0.22	0.02	0.00	0.50

= Improving air quality trend, statistically significant (p<=0.05)
= Degrading air quality trend, statistically significant (p<=0.05)
= Improving air quality trend, not significant (0.05<p<=0.15)
= Degrading air quality trend, not significant (0.05<p<=0.15)

Figure 1

FY2005 Annual Performance Report for NPS Government Performance and Results Act (GPRA)
Air Quality Goal Ia3 for Reporting NPS Areas



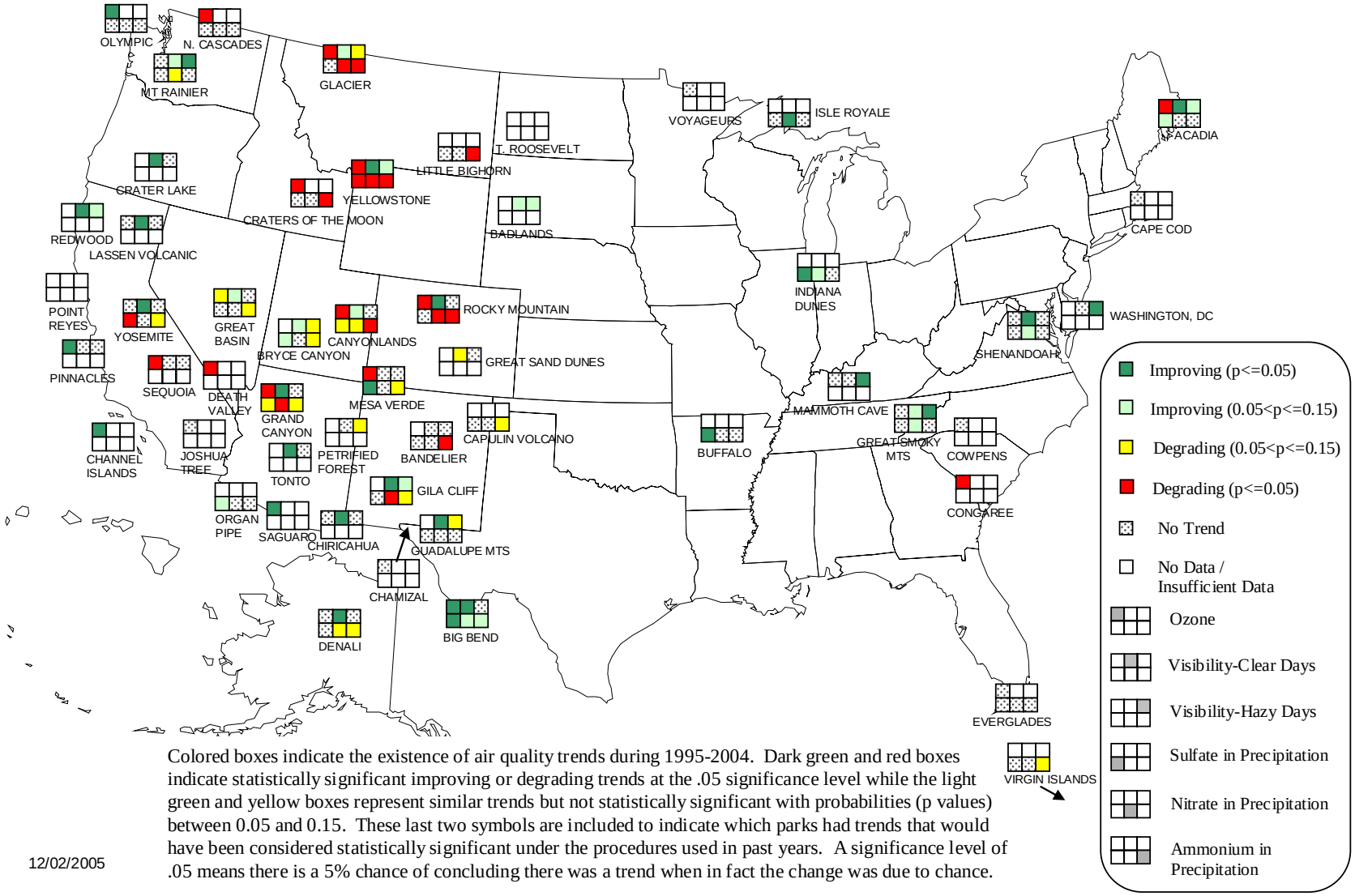
34 of 50 or 68% of reporting NPS park areas met goal Ia3

12/05/2005

Figure 2

Air Quality Trends in National Parks, 1995-2004

FY2005 Annual Performance Report For NPS Government Performance and Results Act (GPRA) Air Quality Goal Ia3

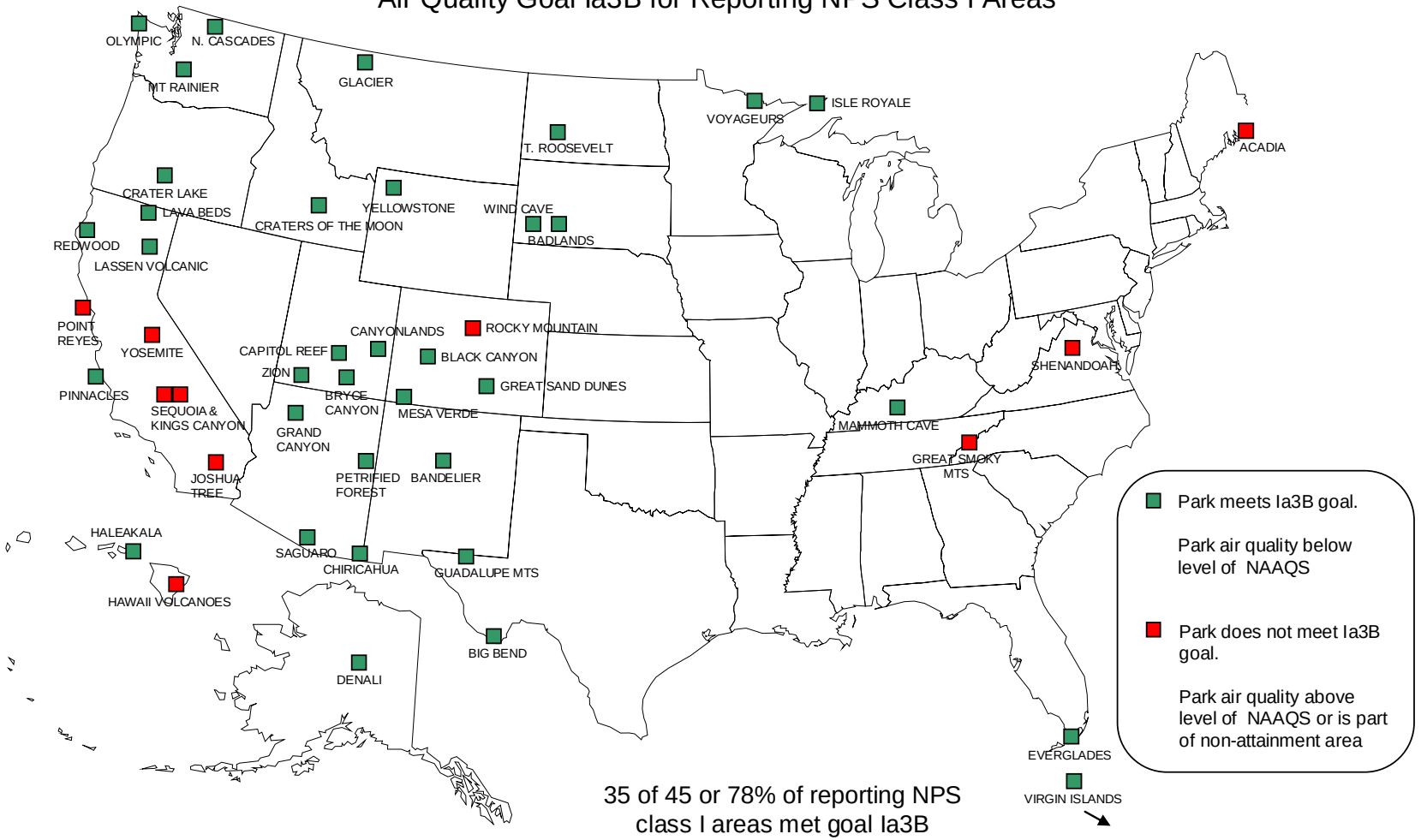


Colored boxes indicate the existence of air quality trends during 1995-2004. Dark green and red boxes indicate statistically significant improving or degrading trends at the .05 significance level while the light green and yellow boxes represent similar trends but not statistically significant with probabilities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

12/02/2005

Figure 3

Annual Performance Report for DOI Government Performance and Results Act (GPRA)
Air Quality Goal Ia3B for Reporting NPS Class I Areas

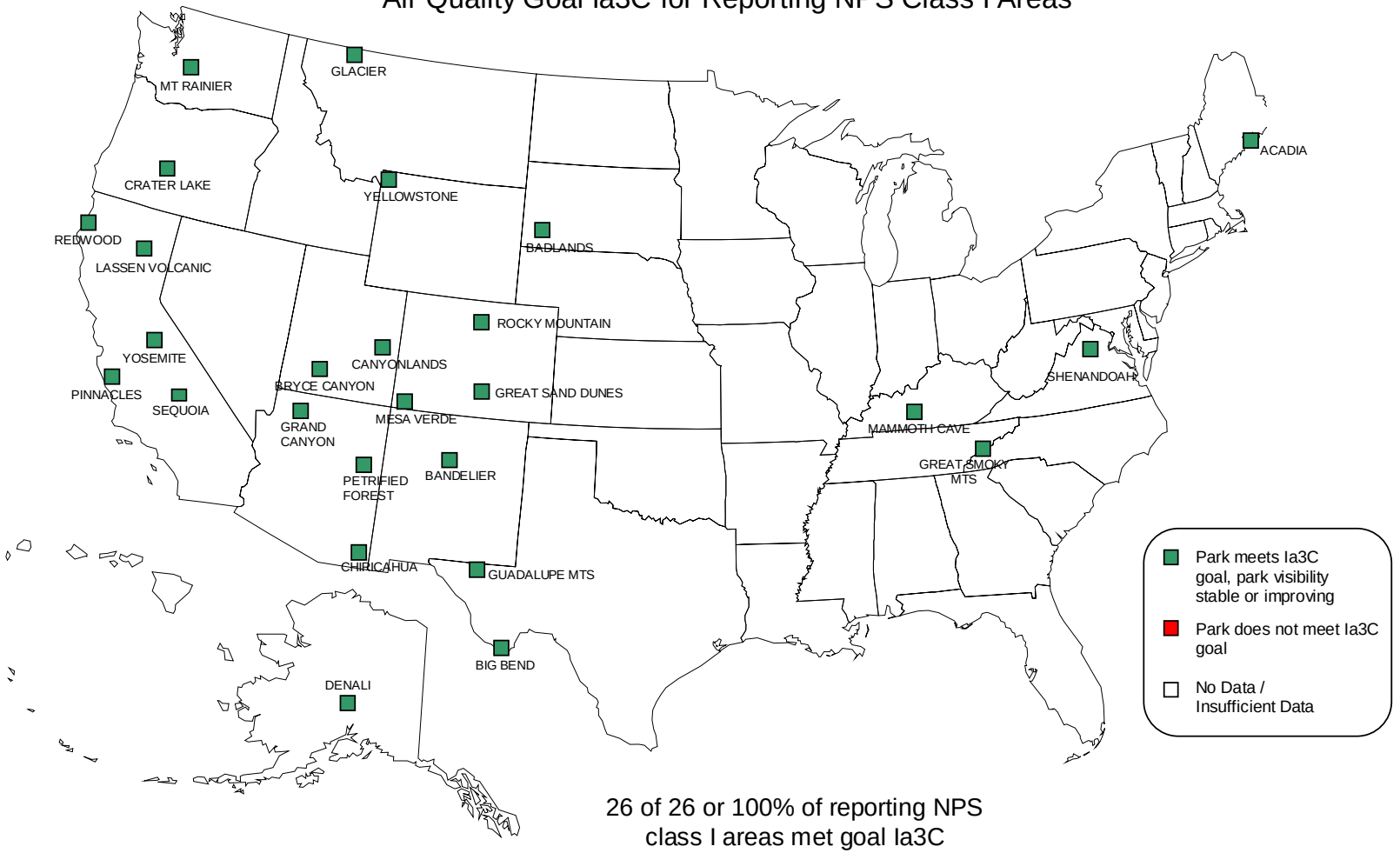


35 of 45 or 78% of reporting NPS class I areas met goal Ia3B

12/06/2005

Figure 4

Annual Performance Report for NPS Government Performance and Results Act (GPRA)
Air Quality Goal Ia3C for Reporting NPS Class I Areas



26 of 26 or 100% of reporting NPS class I areas met goal Ia3C

12/06/2005

Figure 5

Trends in Haze Index (Deciview) on Clearest Days, 1995-2004

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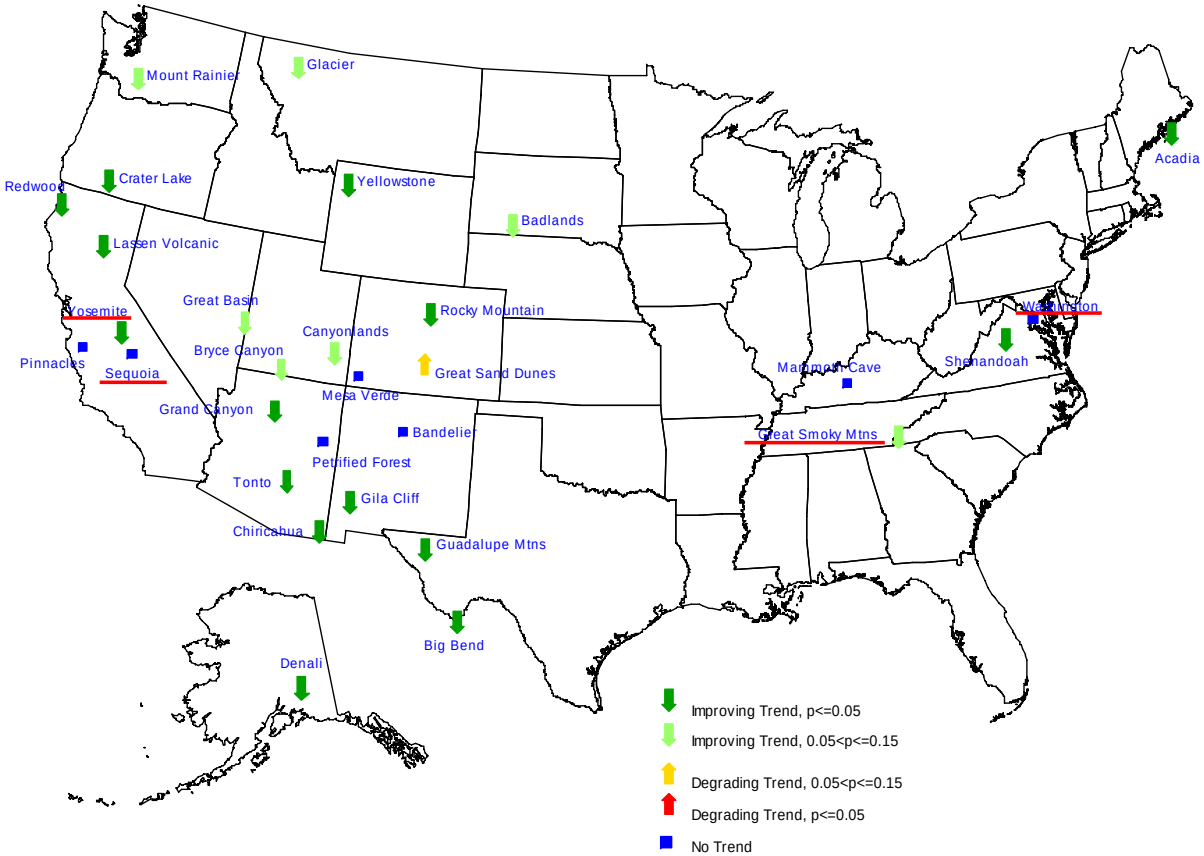
Air Quality Goal Ia3



Downward pointing arrows denote trends toward decreasing haze index (deciview). Because the haze index is a measure of visibility impairment, with lower deciview levels corresponding to better visibility, a trend toward decreasing deciview means a trend toward improving air quality. Similarly, the up arrows correspond to trends toward higher values of deciview and hence worsening air quality. Park names underlined in red denote parks where monitored fine particulate matter (pm2.5) levels do not exceed the level of the NAAQS but are part of a pm2.5 non-attainment area.

11/22/2005

Figure 6

Trends in Haze Index (Deciview) on Haziest Days, 1995-2004

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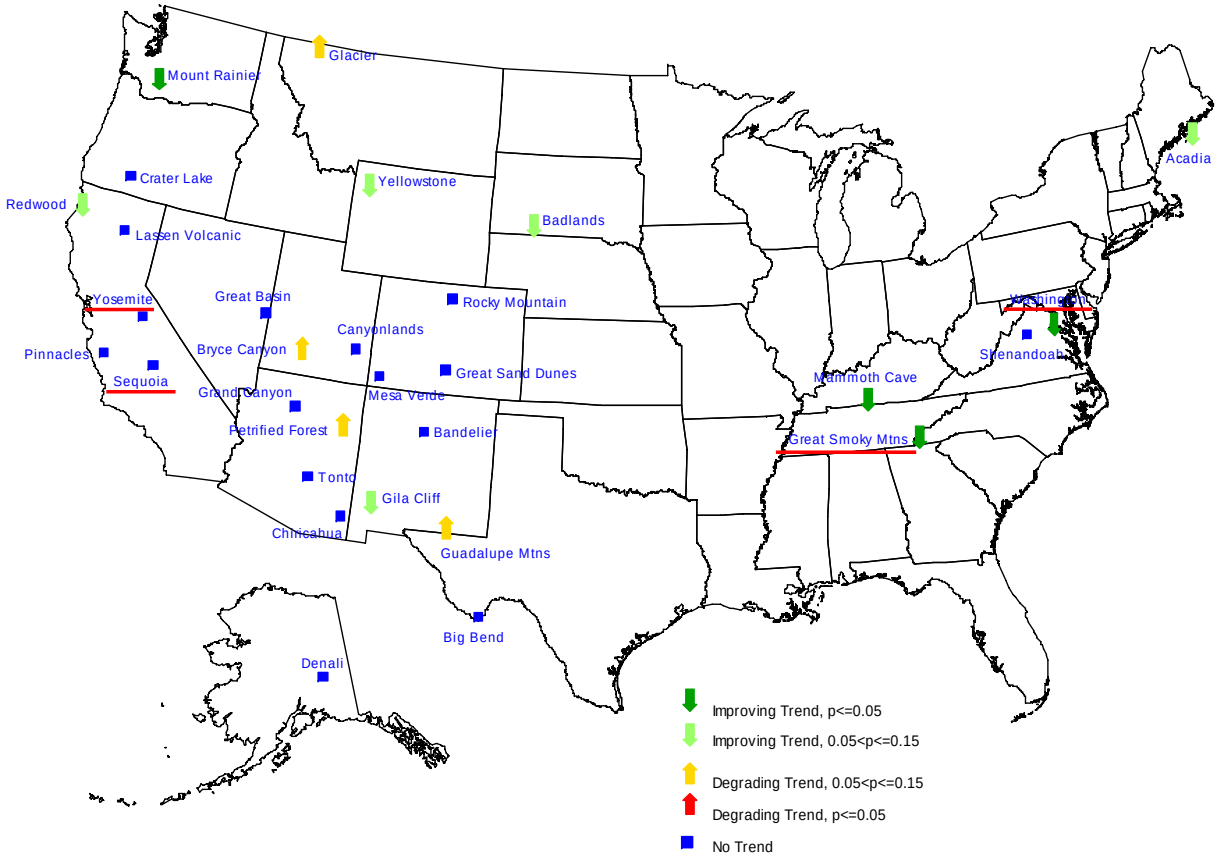
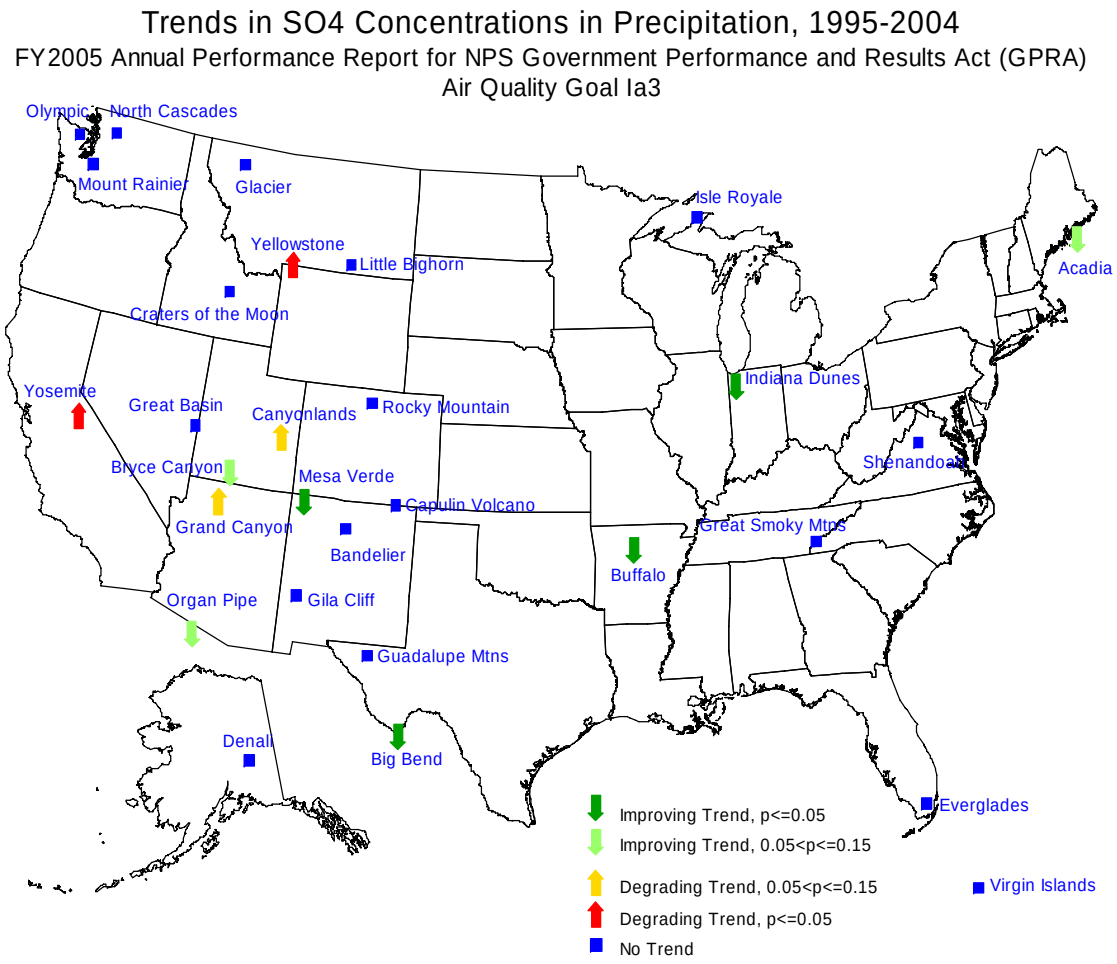
Air Quality Goal Ia3



Downward pointing arrows denote trends toward decreasing haze index (deciview). Because the haze index is a measure of visibility impairment, with lower deciview levels corresponding to better visibility, a trend toward decreasing deciview means a trend toward improving air quality. Similarly, the up arrows correspond to trends toward higher values of deciview and hence worsening air quality. Park names underlined in red denote parks where monitored fine particulate matter (pm2.5) levels do not exceed the level of the NAAQS but are part of a pm2.5 non-attainment area.

11/22/2005

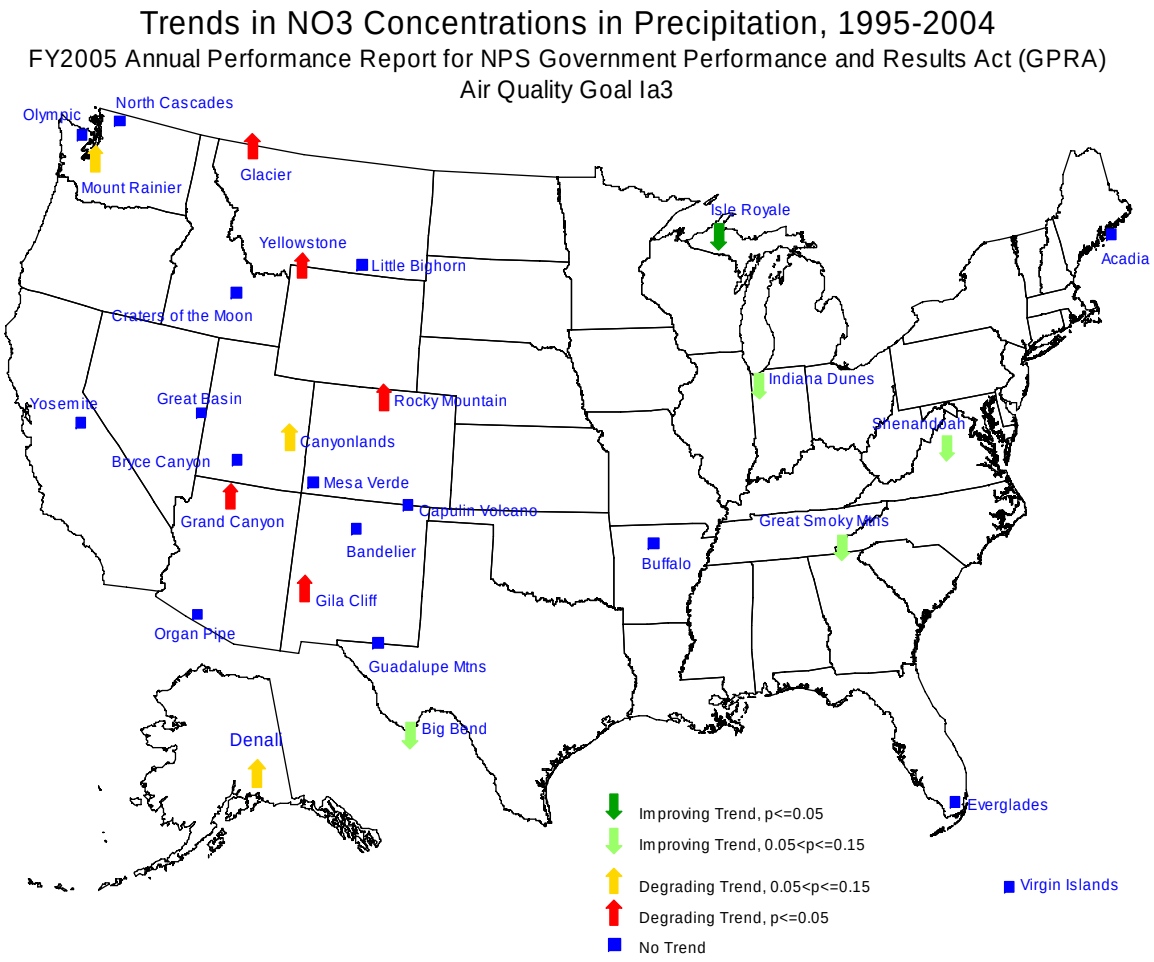
Figure 7



Downward pointing arrows denote trends toward decreasing sulfate (SO_4) concentrations and improving air quality. Similarly, the up arrows correspond to trends toward higher sulfate concentrations and hence worsening air quality.

10/12/2005

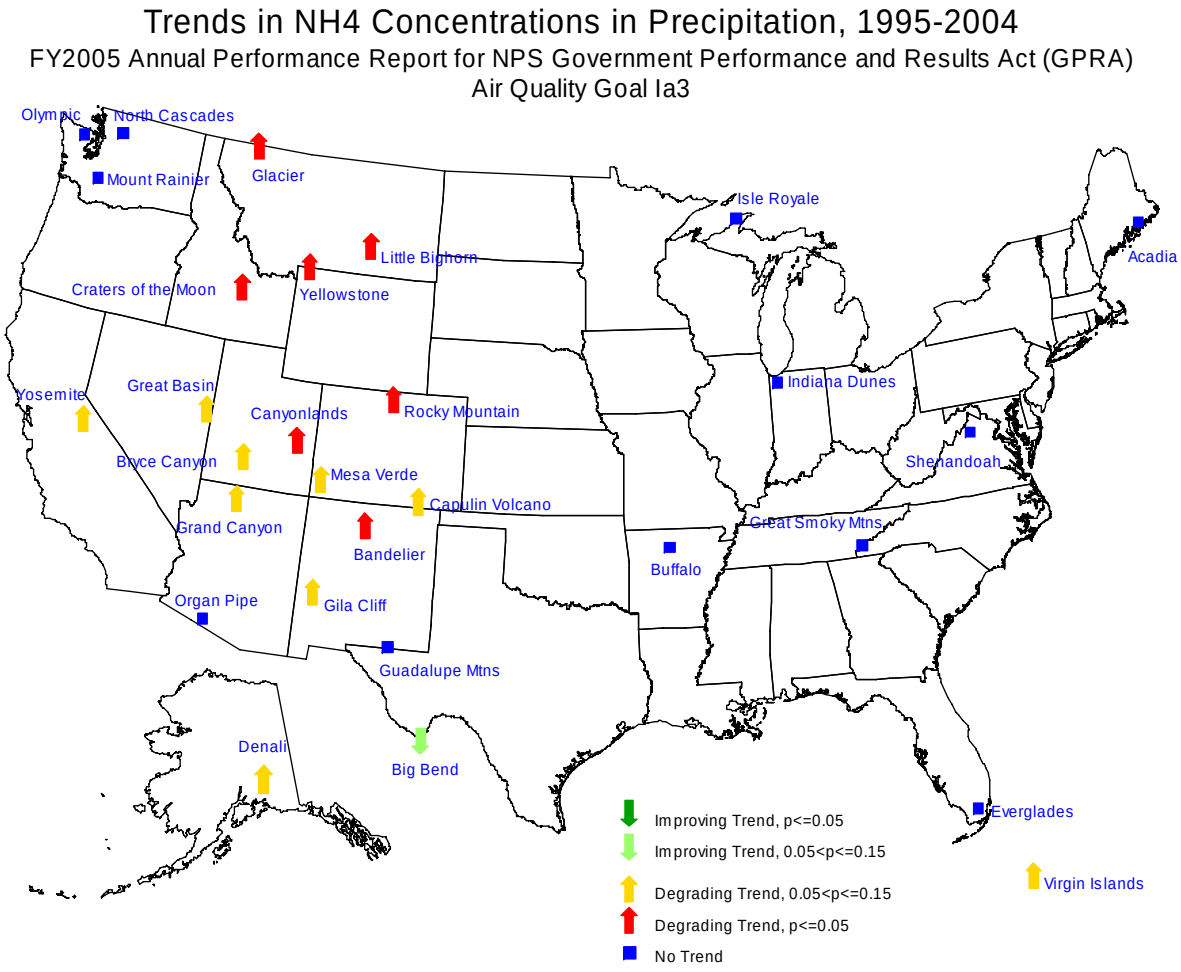
Figure 8



Downward pointing arrows denote trends toward decreasing nitrate (NO_3) concentrations and improving air quality. Similarly, the up arrows correspond to trends toward higher nitrate concentrations and hence worsening air quality.

10/12/2005

Figure 9



Downward pointing arrows denote trends toward decreasing ammonium (NH_4) concentrations and improving air quality. Similarly, the up arrows correspond to trends toward higher ammonium concentrations and hence worsening air quality.

10/12/2005

Figure 10

Trends in 3-Year Average 4th Highest 8-Hour Ozone Concentrations, 1995-2004

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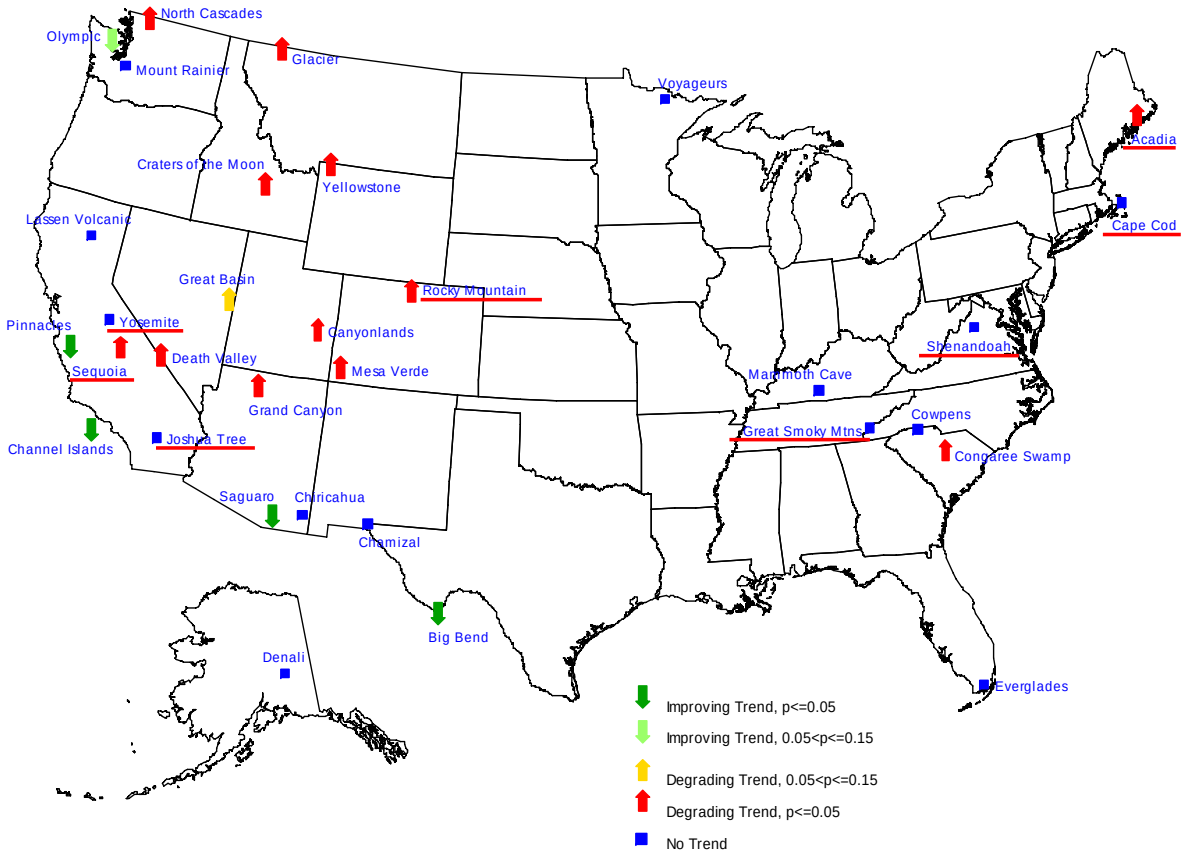
Air Quality Goal Ia3

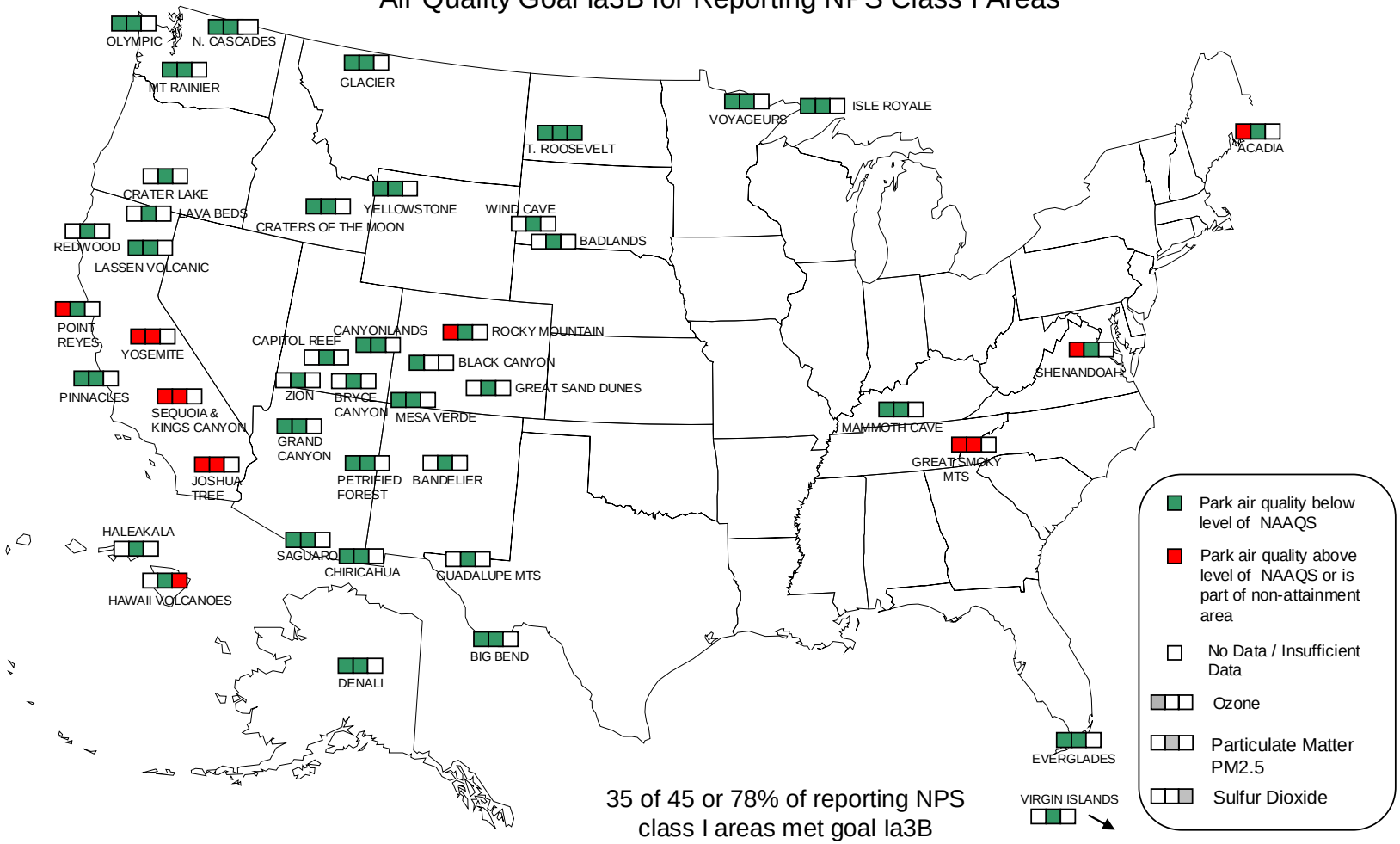


Downward pointing arrows denote trends toward decreasing ozone concentrations and improving air quality. Similarly, the up arrows correspond to trends toward higher ozone concentrations and hence worsening air quality. Park names underlined in red denote parks where monitored ozone levels exceed the level of the NAAQS or are part of an ozone non-attainment area.

11/29/2005

Figure 11

FY2005 Annual Performance Report for DOI Government Performance and Results Act (GPRA)
Air Quality Goal Ia3B for Reporting NPS Class I Areas



12/06/2005