Experience with Air Trading Programs:

Lessons from the Acid Rain and NOx Budget Programs

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Overview

- Cap and trade basics
- Acid Rain, SO_2 Trading Program
- NO_X Budget Program
- Environmental monitoring, assessment, and accountability
- Lessons Learned

Why Use a Cap and Trade Approach?

- An alternative to traditional regulation and credit trading
  - Not simply a trading feature added to existing regulation
- An incentive for innovation, early reductions, and reducing cost
- Certainty that a specific emissions level is achieved and maintained
- More regulatory certainty, compliance flexibility, and lower permitting and transaction costs for sources
- Fewer administrative resources needed by industry and government (if kept simple)
  - Government focused on setting goals & assuring results, not on approving individual compliance actions
- Can be compatible with other mechanisms
- Lower costs make further improvements feasible

Basic Elements of Cap and Trade

- **Full sector coverage** – All sources (existing and new) included
  - Minimizes shifting of production and emissions ("leakage")
  - Assures achievement of emission reduction goal without case-by-case review
  - Reduces administrative costs to government and industry
- **Cap on emissions** – Government issuance of a fixed quantity of allowances
  - Limits emissions to achieve and maintain environmental goal
  - Limits creation of "paper credits" and "anyway tons"
  - Provides certainty to allowance market
- **Monitoring** – Accurate measurement and reporting of all emissions
  - Assures accountability and results
  - Establishes integrity of allowances and confidence in the market
- **Trading** – Unrestricted trading and banking (with source-specific limits allowed to protect local air quality
  - Allows companies to choose (and change) compliance options
  - Minimizes compliance cost
  - Ensures that trading will not cause "hotspots"

Cap and Trade: How Does It Work?

- A cap and trade program first sets an aggressive cap, or maximum limit, on emissions.
- Sources covered by the program then receive authorizations to emit in the form of emissions allowances, with the total amount of allowances limited by the cap.
- Each source can design its own compliance strategy to meet the overall reduction requirement, including sale or purchase of allowances, installation of pollution controls, implementation of efficiency measures, among other options.
- Individual control requirements are not specified under a cap and trade program, but each emissions source must surrender allowances equal to its actual emissions in order to comply.
- Sources must also completely and accurately measure and report all emissions in a timely manner to guarantee that the overall cap is achieved.

Emissions Measurement Goals

- Complete accounting with no underestimation
- Simplicity, consistency and transparency
- Incentives for accuracy and improvement
- Cost effectiveness
- Flexibility for small sources
  - Acid Rain Program – 36% of units must use Continuous Emissions Monitors (CEMS)
  - Accounts for 96% of total SO2 emissions
- Electronic reporting, feedback, and auditing
- Public access to data

Quality Assurance and Verification by EPA

- Certification of emissions monitoring systems
- Stringent daily, quarterly and annual QA checks and tests
- Conservative data substitution for missing data
  - Provides incentive for monitoring
  - Monitors running over 99% of the time
- Near 100% electronic auditing of emissions data
- Random on-site field audits and witnessing of QA tests

Compliance & Enforcement

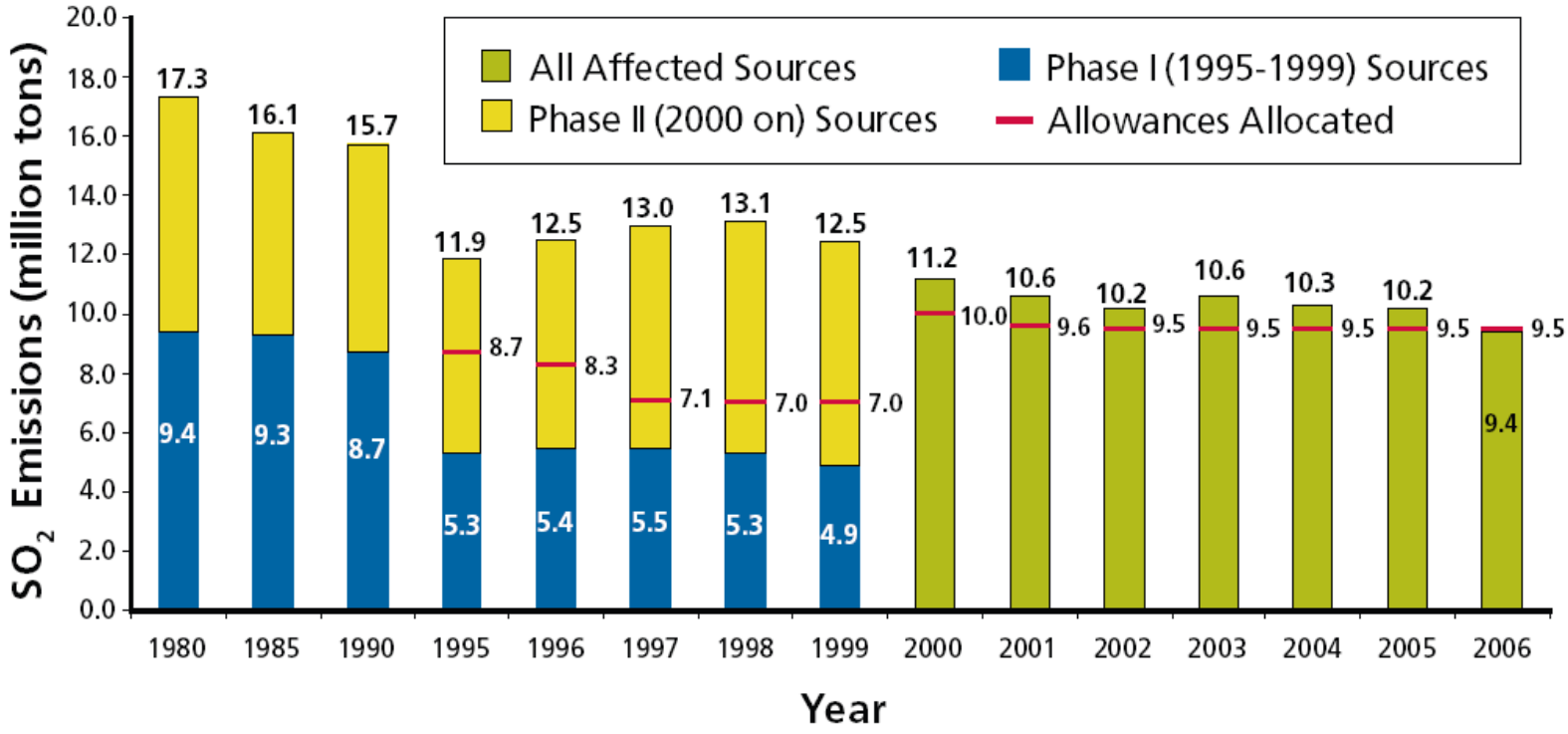
- Annual reconciliation: Compare emissions with allowances
- Penalties for non-compliance
  - SO_2 Program:
    - Automatic offset (deduct allowance from next year's allocation)
    - Automatic financial penalty ($2,900/ton of SO_2)
    - Possible civil and criminal penalties
  - NO_x Program
    - 3 allowances surrendered for each ton from next year's account (no automatic monetary penalty)
    - Possible civil and criminal penalties
- 99.9% compliance rate for both SO_2 and NOx programs
  - penalties have ranged from $3,000 to $1,500,000

Acid Rain Program "First's"

- First to:
  - Have a cap on emissions
  - Account for all emissions from all sources in a program
  - Have a national program to require electronic reporting
  - Make emissions publicly available on a quarterly basis
  - Establish long term allocations to provide regulatory certainty
  - Support electronic transfers of allowances
  - Allow trading without government approval of each trade
  - Simplify permitting to standard one page form
  - Allow changes to compliance plan w/o government approval
  - Provide ongoing air quality and ecological assessment
- Unprecedented:
  - High compliance rate and low administrative costs

Emission reductions under the ARP

Figure 2: SO_2 Emissions from Acid Rain Program Sources



Source: EPA, 2007

Acid Rain Program Progress

Figure 20a: Annual Mean Wet Sulfate Deposition, 1989-1991

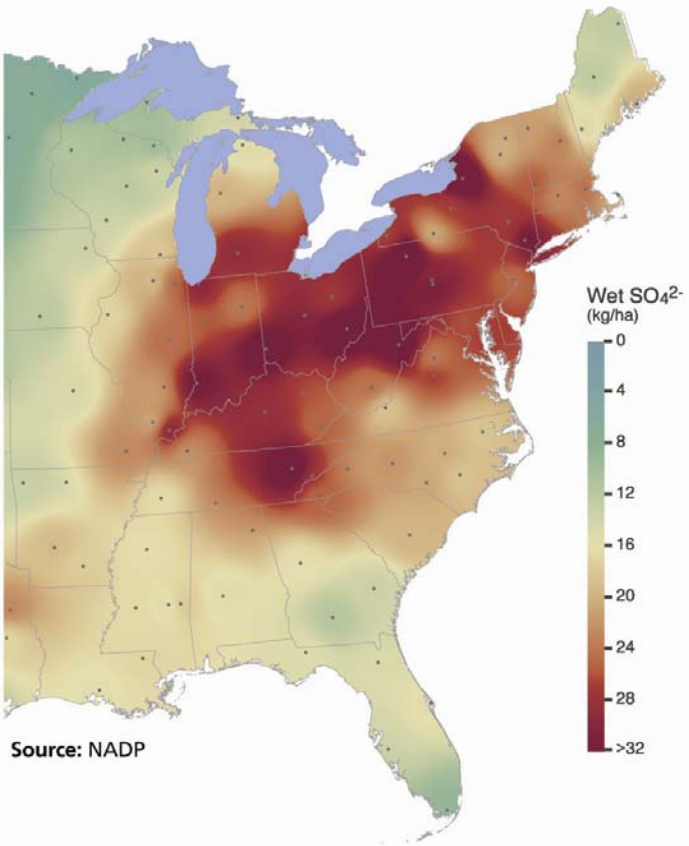
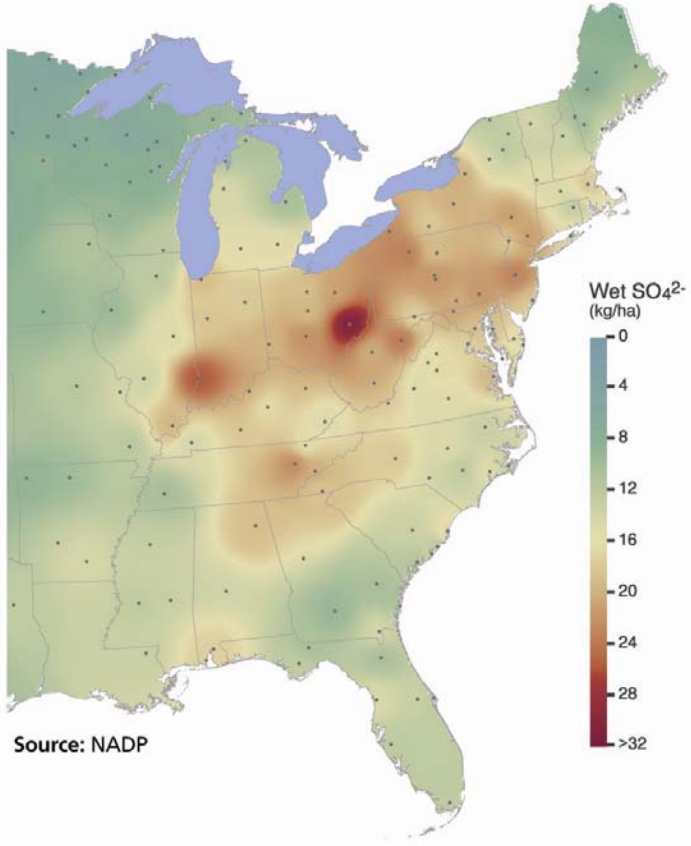


Figure 20b: Annual Mean Wet Sulfate Deposition, 2004-2006



Acid Rain Program Progress

Figure 21a: Annual Mean Wet Inorganic Nitrogen Deposition, 1989-1991

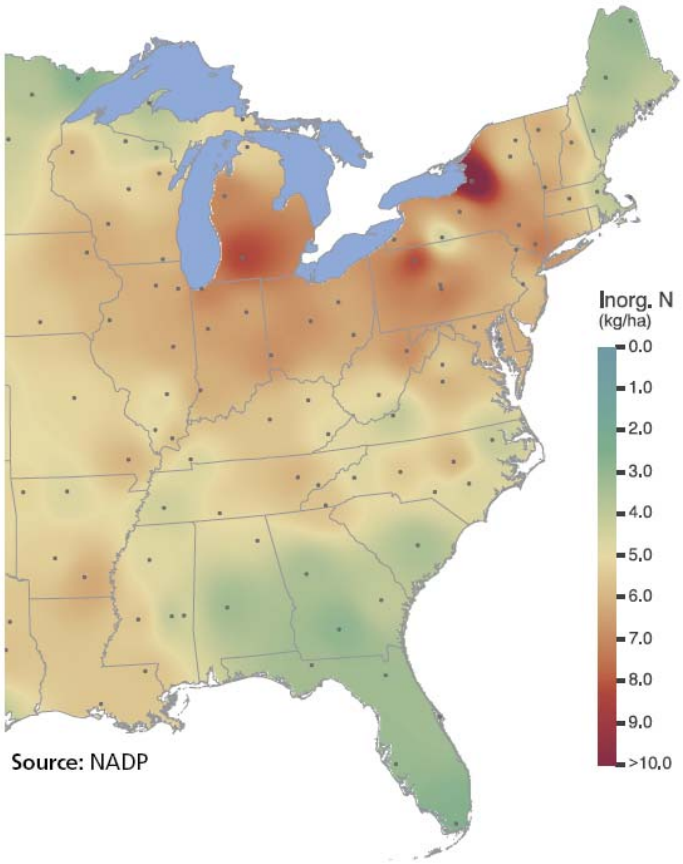
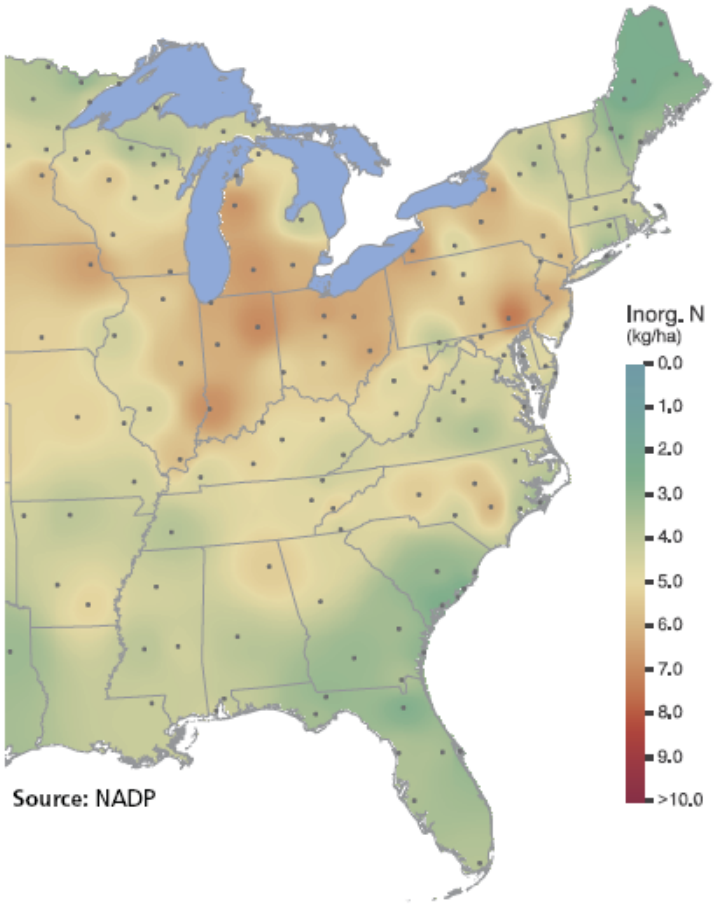
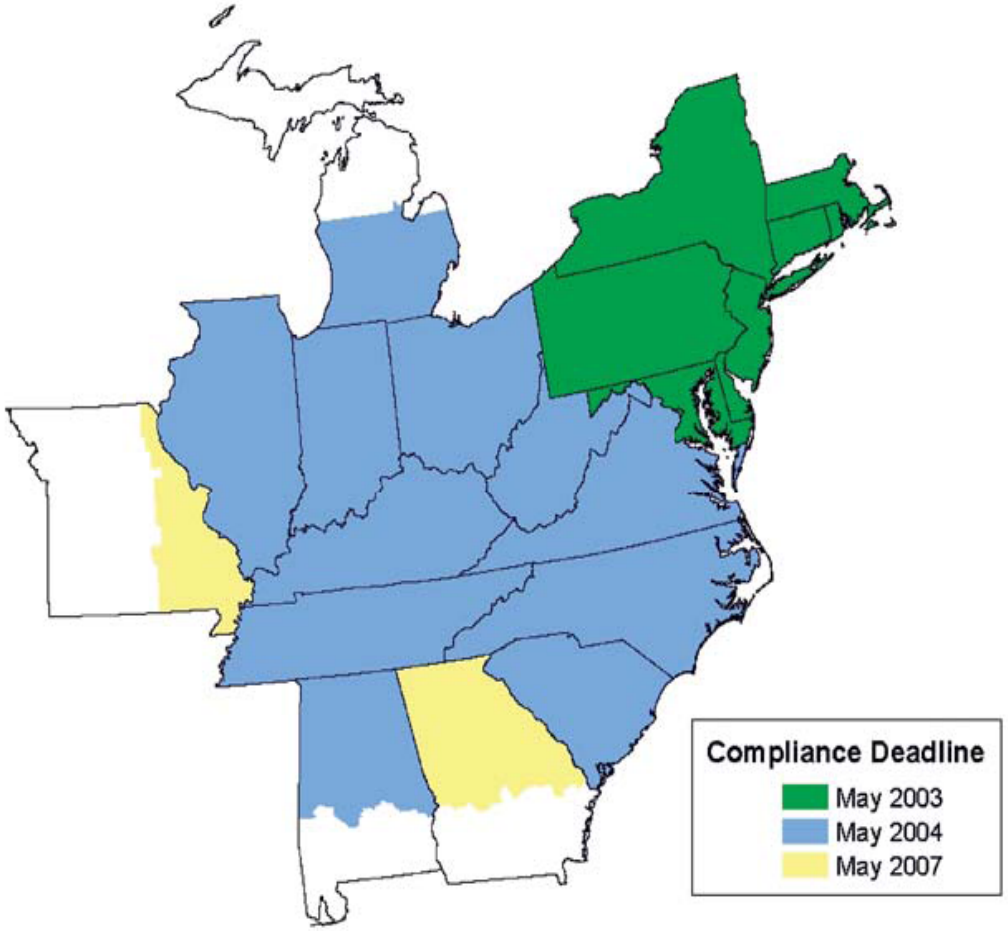


Figure 21b: Annual Mean Wet Inorganic Nitrogen Deposition, 2004-2006



NOx Budget Trading Program (NBP)



- Problem: Reduce summer ozone levels for NAAQS compliance
- Scope: Eastern U.S.
- Target: Reduce NOx emissions from electric generators and industrial boilers by 1 million tons (70% below 1990 levels)
- Coverage: 2,570 units

NOx Budget Program Design Elements

- Timing:
  - Five-month compliance period: May 1 –September 30 ozone season
  - Finalized in 1998, monitoring required in 2002 and reductions in 2003
    - Court order moved compliance date for all states back to 2004
- Applicability
  - Fossil fuel fired electric generators > 25 MW
  - Industrial boilers and turbines >250 mmBtu/hr
- Allowance Distribution
  - Allocations from state, who have discretion
  - Allocations must be within state trading budget
  - States may also set aside a portion of the budget (Renewables, new sources)
- Allowance Use
  - Allowance is defined as authorization to emit one ton of NOx during ozone season
  - Unrestricted trading can occur between sources
  - Progressive Flow Control if necessary
    - Requires portion of banked allowances to be surrendered 2:1 if needed to cover emissions

NOx Budget Program Design Elements

- Monitoring and Reporting Emissions
  - Sources required to continuously monitor emissions in accordance with Part 75–Updated Acid Rain Program monitoring regulations
- Compliance and Enforcement
  - All sources must hold allowances sufficient to cover emissions
    - Compliance and overdraft accounts
  - Automatic excess emissions offset
    - 3 allowances for each ton of excess emissions
  - Other enforcement action possible

Summary of NBP Report Major Findings

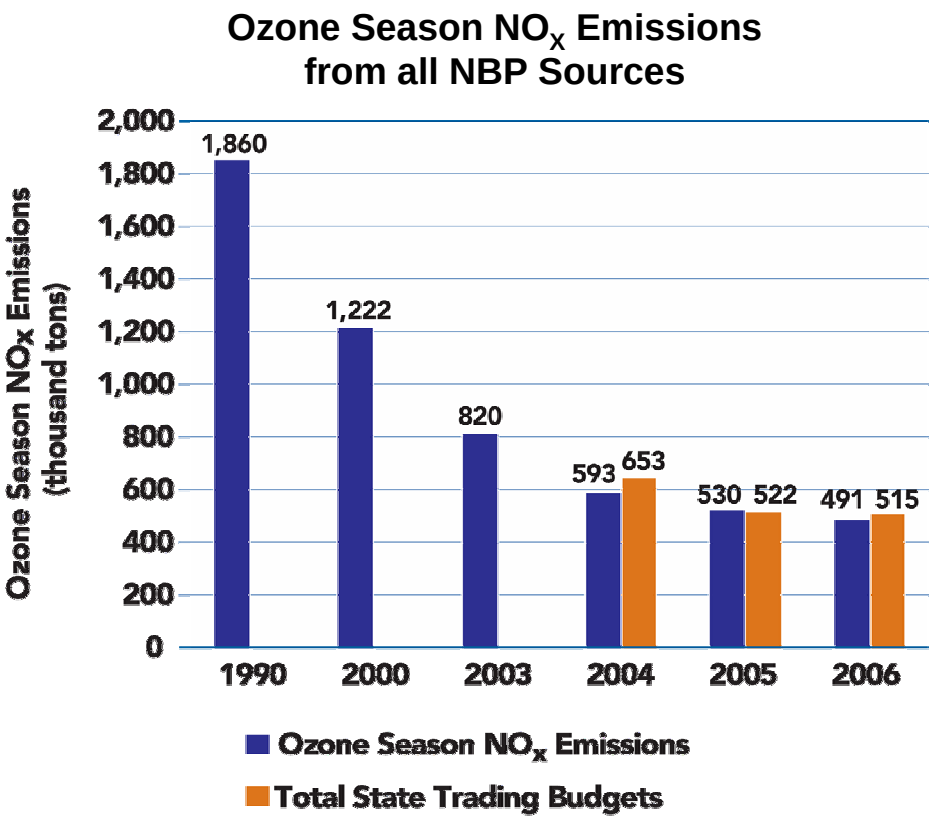
- In 2004, EPA designated 104 Eastern areas as 8-hour ozone standard non-attainment areas. By 2006, four out of five areas met the standard and the majority of remaining areas also came closer to attainment. These improvements provided cleaner air for 55 million people.
- The NBP is the most significant contributor among several EPA programs leading to these recent improvements in ozone.
- The greatest improvement in ozone levels were seen in areas downwind from sites with the greatest NO_X emissions reductions.
- Through a wide range of pollution control strategies and an active NO_X allowance market, affected sources achieved almost 100% compliance with the NBP in 2006.
- Federal and state efforts continue to focus on ozone reduction in the East. EPA's CAIR program will further lower ozone levels, in conjunction with State actions included in Ozone SIPs currently being submitted for EPA approval.

Ozone Season NO_X Emissions Have Declined across the Region

Total NBP NO_x Emissions in 2006 were 491 thousand tons

NBP states reduced ozone season (May - September) NO_X emissions by approximately

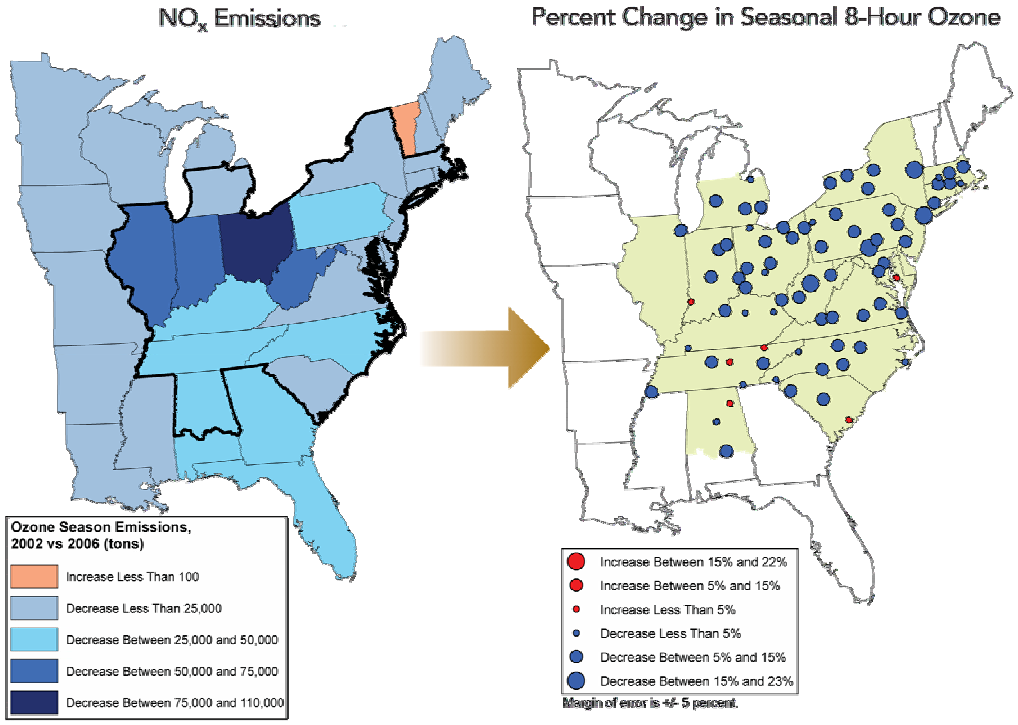
- 74% from 1990 (before implementation of the Clean Air Act Amendments)
- 60% from 2000 (before implementation of the NBP)
- 7% from 2005



Note: EPA Title IV NO_X program and state actions produced reductions from 1990 to 2003.

Emissions and Ozone

Decreases in Ozone Season NO_X Emissions and Ozone Concentrations, 2002 vs. 2006 (adjusted for meteorology)



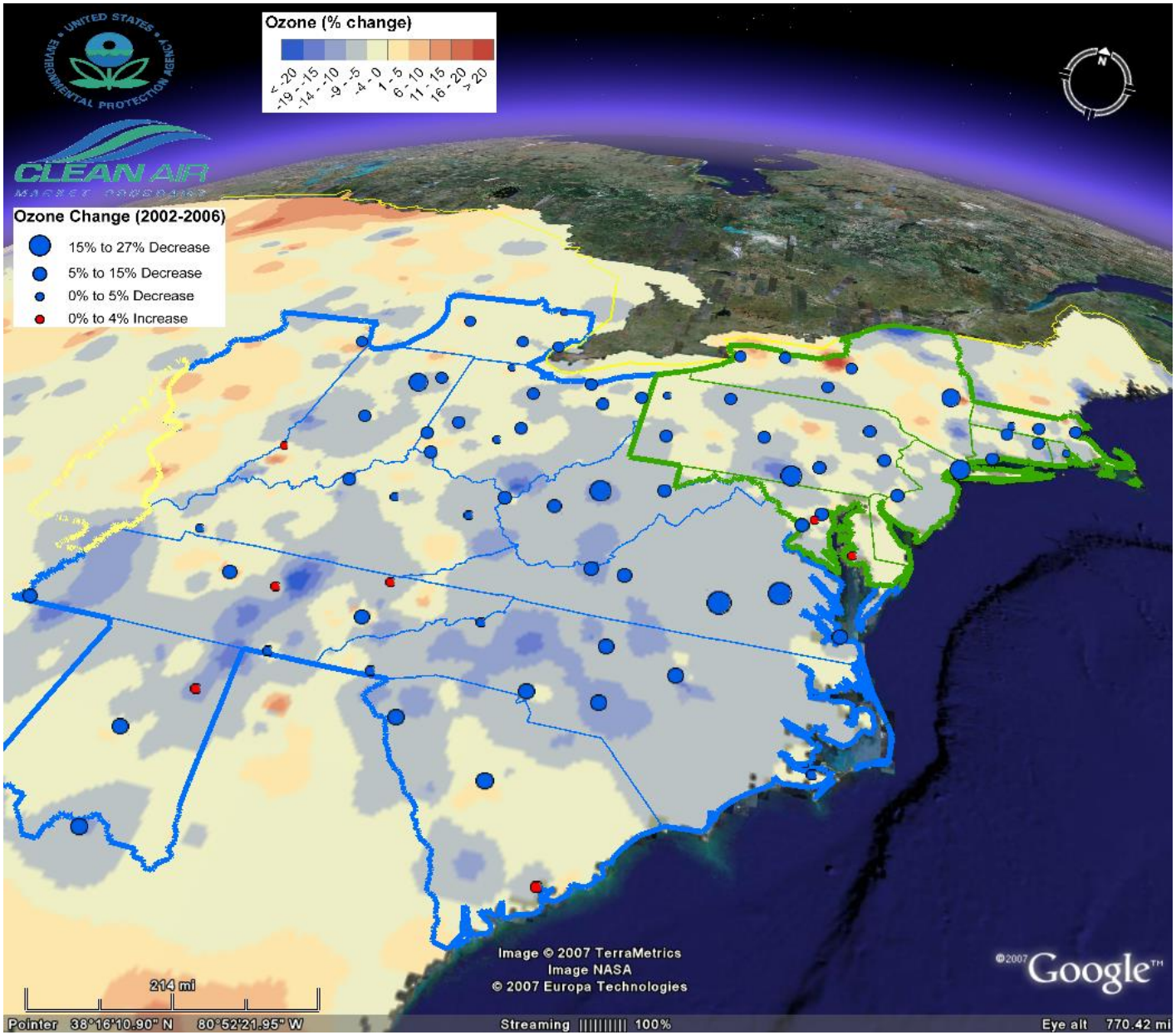
Notes:

- States participating in the NBP in 2006 are shown inside the black boundary line on the emission map (left). NBP states are shaded in green in the ozone percent change map (right).
- From 2002 to 2006, Vermont (35 tons) shows a small increase in ozone season NO_x emissions.

Source: EPA, 2007.

Ozone concentrations decreased by 5-8% in the NBP region since implementation

- **There is a strong association between areas with the greatest reductions in NO_X emissions and nearby downwind sites exhibiting the greatest improvements in ozone**
- **Areas with the largest NO_X emissions reductions include**
  - **Illinois**
  - **Indiana**
  - **Kentucky**
  - **Ohio**
  - **Tennessee**
  - **West Virginia**



Changes in ozone concentration, 2000-2002 vs. 2004-2006

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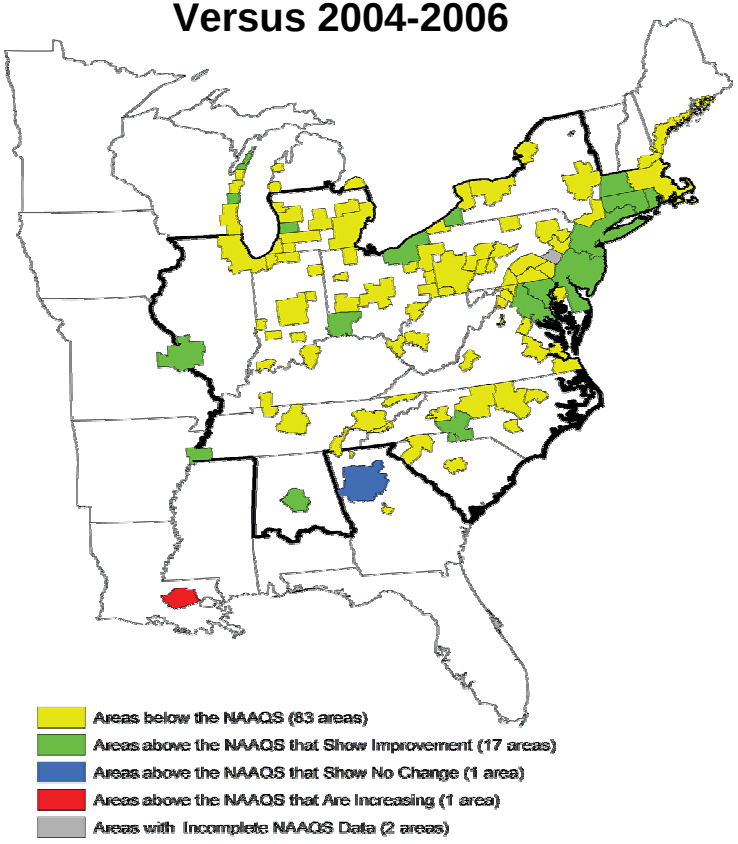
Improvements in Nonattainment Areas in the East since Implementation of the NBP

Much of the improvement in ozone in the East is attributable to the NBP

- In 2004, the EPA officially designated 104 areas in the East as 8-hour ozone nonattainment areas
- Data from 2004-2006 show ozone air quality improvements in all of these areas, bringing cleaner air to over 55 million people
- In 2006, four out of five of the original nonattainment areas now meet the ozone standard

Changes in 8-Hour Ozone Nonattainment Areas in the East 2001-2003 (Original Designations) Versus 2004-2006



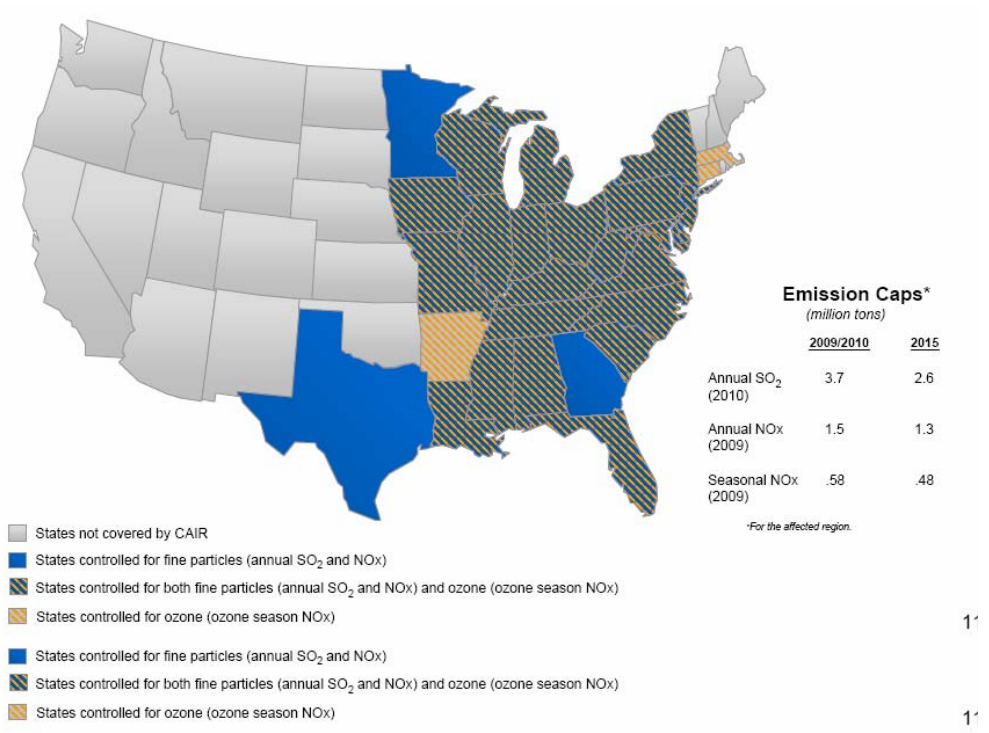
Note: States participating in the NBP in 2006 are shown inside the black boundary line.

Source: EPA, 2007.

Future Reductions: NO_X and the Clean Air Interstate Rule (CAIR)

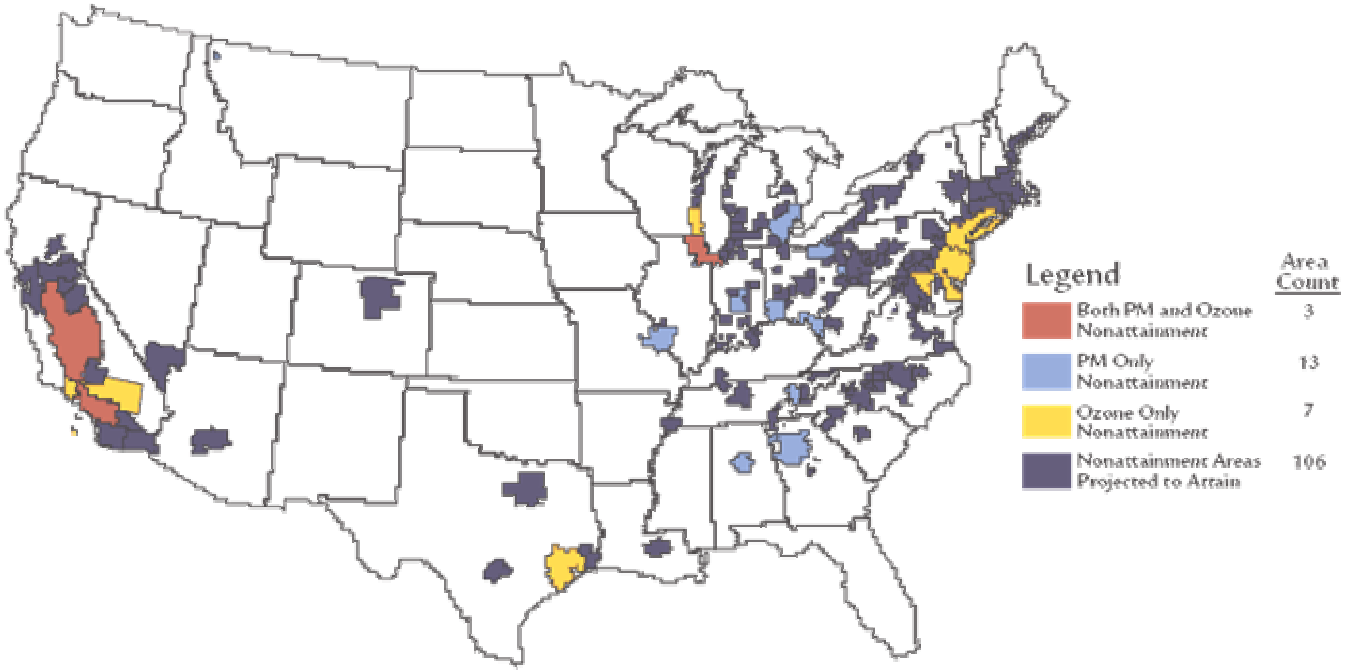
- **CAIR was designed to help cities and states in the East meet new, more stringent national ambient air quality standards (NAAQS) for ozone and fine particles.**
- **Includes two phases of reductions for ozone season and annual NO_X in 2009 and 2015**
- **In 2009, NBP states, affected under CAIR, will transition to the CAIR ozone season program**
- **Emission caps are divided into state NO_X and SO_2 budgets with an optional cap and trade program**
- **Allows states flexibility on how to achieve the reductions, including which sources to control and whether to join the trading program**
- **CAIR, in conjunction with existing NO_X programs, is projected to reduce power sector ozone season NO_X emissions by 40% and annual NO_X emissions by 55 % from 2005 levels.**

States Affected by CAIR



Future Reductions: CAIR and Non-attainment

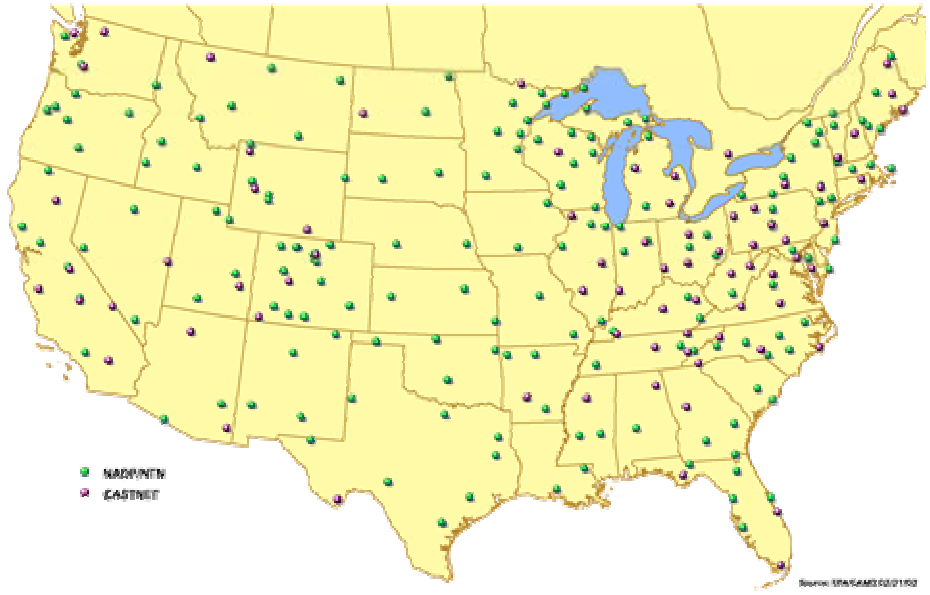
Figure 25: Projected Nonattainment Areas in 2020 After Reductions From CAIR, CAVR, and Clean Air Act Programs

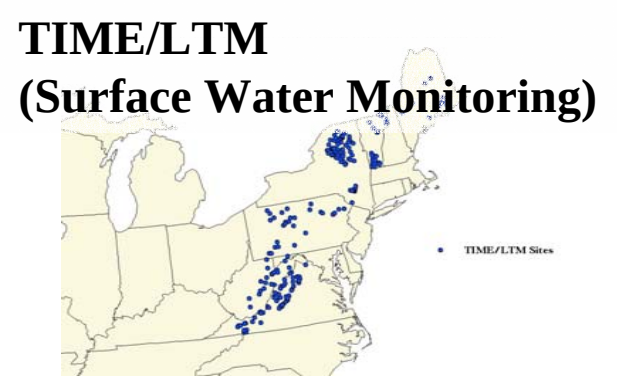


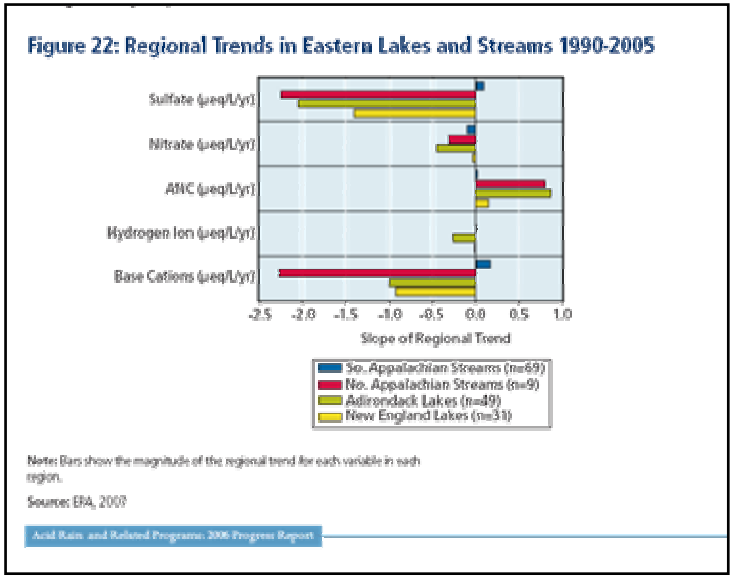
Note: Figure 25 depicts 129 areas that, as of April 2006, were in nonattainment of the $PM_{2.5}$ or ozone NAAQS (or both). As indicated in the legend, 106 of those areas are projected to attain the applicable NAAQS by 2020 as a result of existing programs, such as Title IV of the Clean Air Act, the NO_x SIP Call, and some existing state rules, and the addition of CAIR and CAVR. Note that the 23 areas that are forecast to remain in nonattainment may need to adopt additional local or regional controls to attain the dates set pursuant to the CAA. These additional local or regional measures are not forecast in Figure 25, and therefore the figure overstates the extent of expected nonattainment in 2020.

Source: EPA, 2006

Environmental Accountability







- Assessing environmental response is integral to evaluating the efficacy of cap and trade programs
- Measuring Results
  - Changes to deposition and water quality
- Comparing to Goals
  - Are additional actions needed?

Critical Loads and Ecosystem Protection

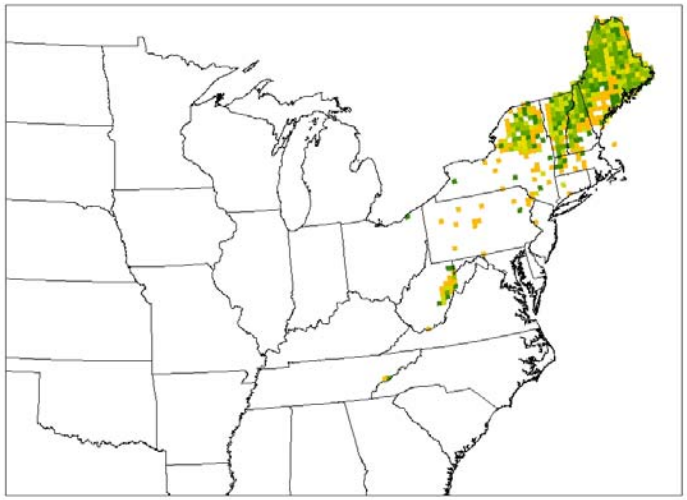
"Critical Load" is a term used to describe:

- Has air pollution reached a tipping point (threshold) for causing harmful effects to plants, animals, soils, or water?
- What amount of sulfur and nitrogen deposition causes that tipping point?

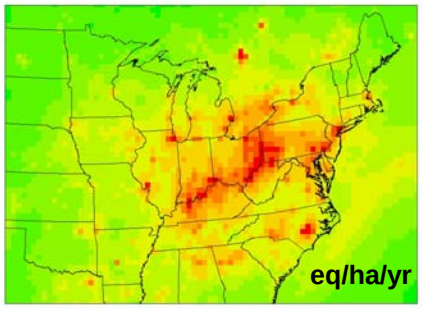
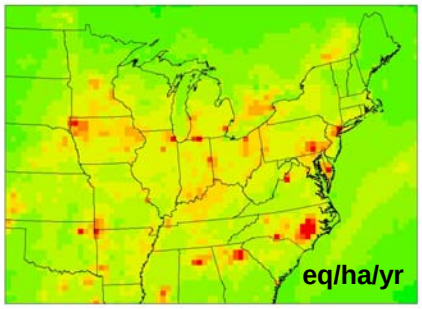
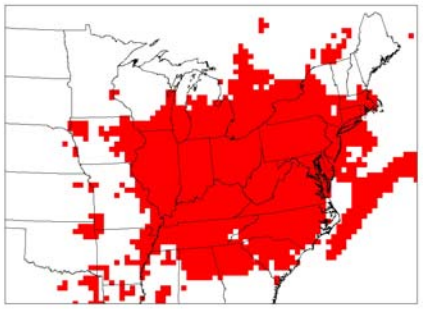
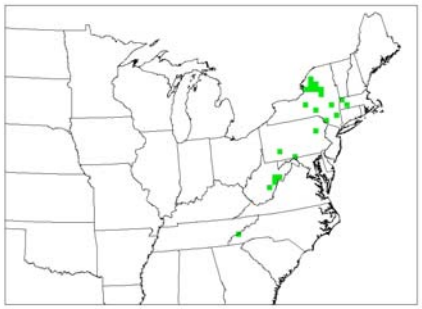
Critical loads can be used in policy and management contexts to determine:

- Are current policies and programs protecting ecosystems from reaching the tipping point or, if the point has been reached, assisting in recovery?

Ecological Endpoint (e.g. Red spruce)



Critical Loads and Ecosystem Protection

	Before CAIR	After CAIR
Sulfur and nitrogen Deposition (acidity)		
Deposition that exceeds the critical load		
At Risk areas		

To Trade or Not to Trade…

- Can the problem be addressed with a flexible approach?
  - Local or regional problem?
  - Episodic or cumulative problem?
- Can emissions be measured accurately and consistently?
- Do abatement costs differ among facilities?
- Is there an appropriate number of sources?
- Do the necessary governmental and market institutions exist?

Lesson: Program Compatibility and Design

- Cap & trade programs should complement, not contradict, existing environmental regulations
- An unambiguous legal framework defining the relationship between cap & trade programs and other policy instruments should be established before a trading program begins
- Programs are less confusing, less expensive, and more likely to succeed if they are simple

Lesson: Emissions Monitoring and Measurement is Key

- Complete accounting with no underestimation
- Simplicity, consistency and transparency
- Incentives for accuracy and improvement
- Cost effectiveness
- Flexibility for small sources
  - 36% of units must use Continuous Emissions Monitors (CEMS)
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For More Information

Visit **http://www.epa.gov/airmarkets/**

- NO_x/SO_2/CO_2 emissions data
- Allowance transfers
- Program information, rules, and reports