

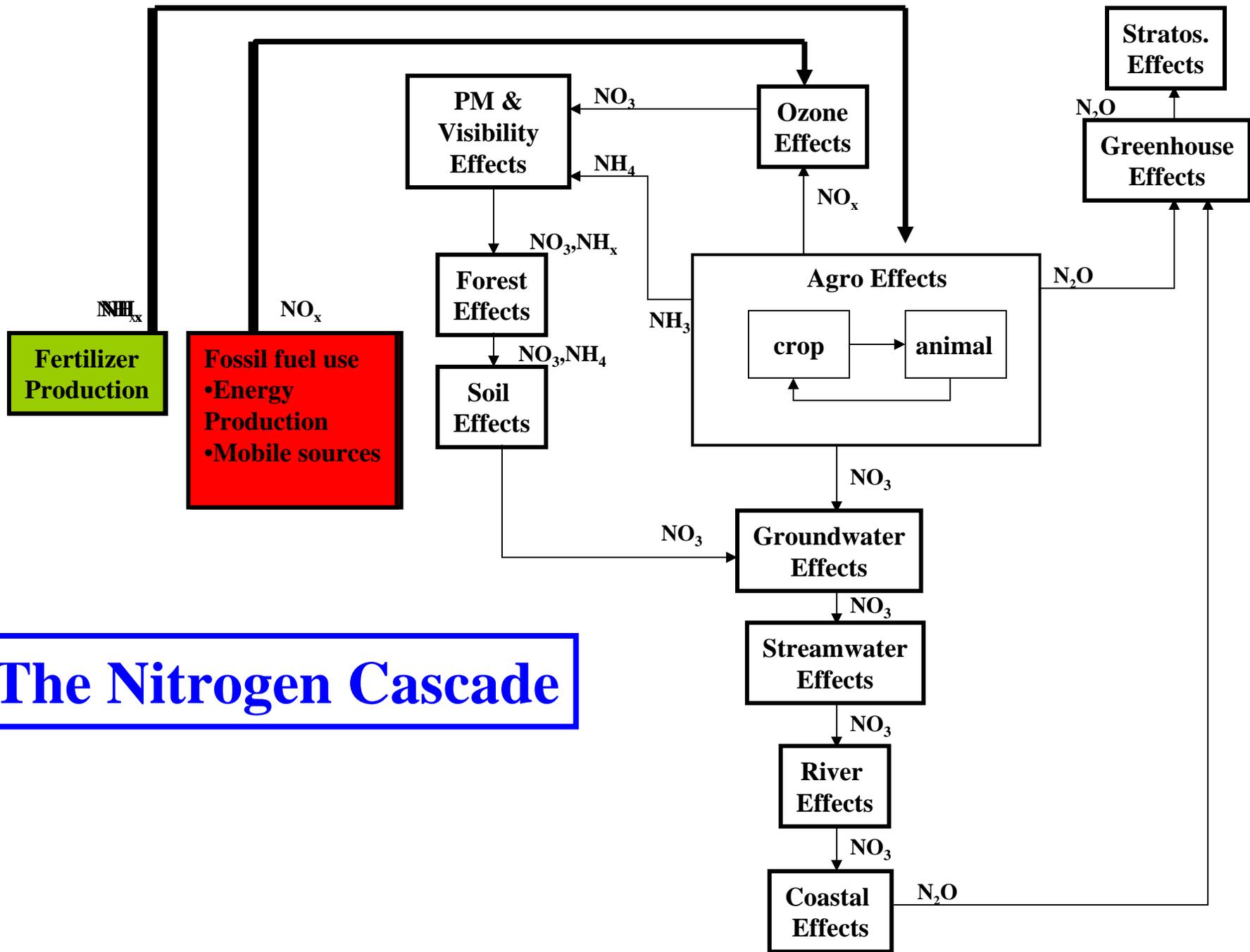
# *OAR Nitrogen Control Programs*

**Rick Haeuber  
Office of Air and Radiation  
U.S. Environmental Protection Agency  
January 2007**



# What We Will Cover

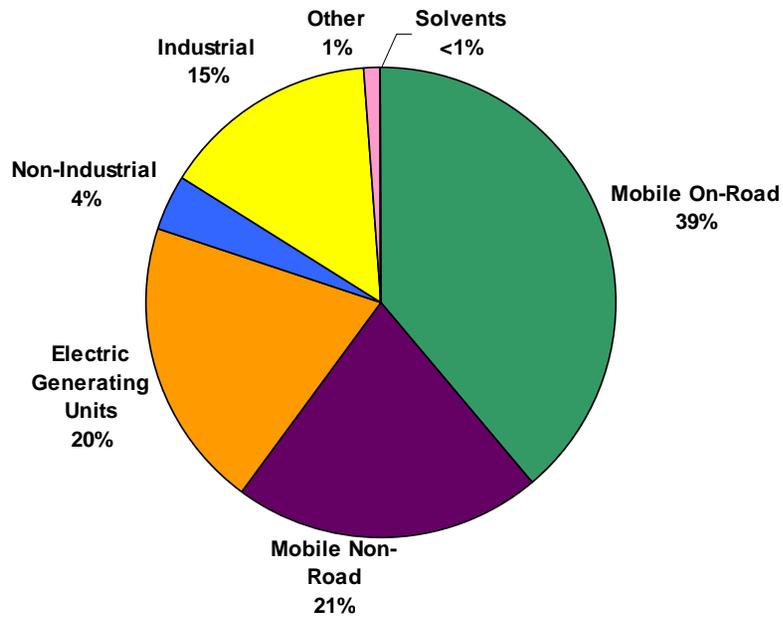
- Context for OAR nitrogen emission control programs
- Current OAR nitrogen control programs
  - Not covered – OAR accountability and program assessment activities
- Results of select NO<sub>x</sub> emission control programs
- Projected future results of OAR emission control programs



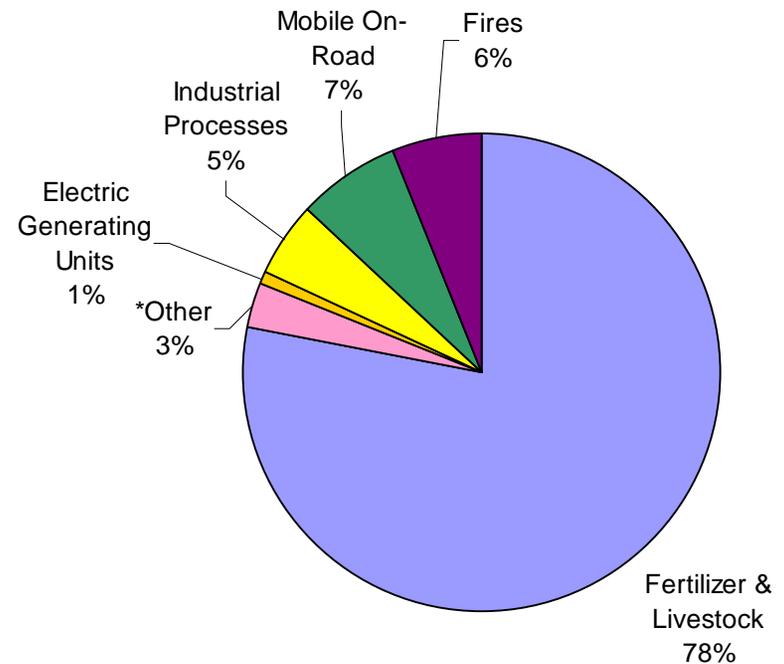
# Sources of NO<sub>x</sub> and NH<sub>3</sub>

## Manmade Sources of NO<sub>x</sub> (2004) and NH<sub>3</sub> (2002) Annual Emissions

### NO<sub>x</sub>

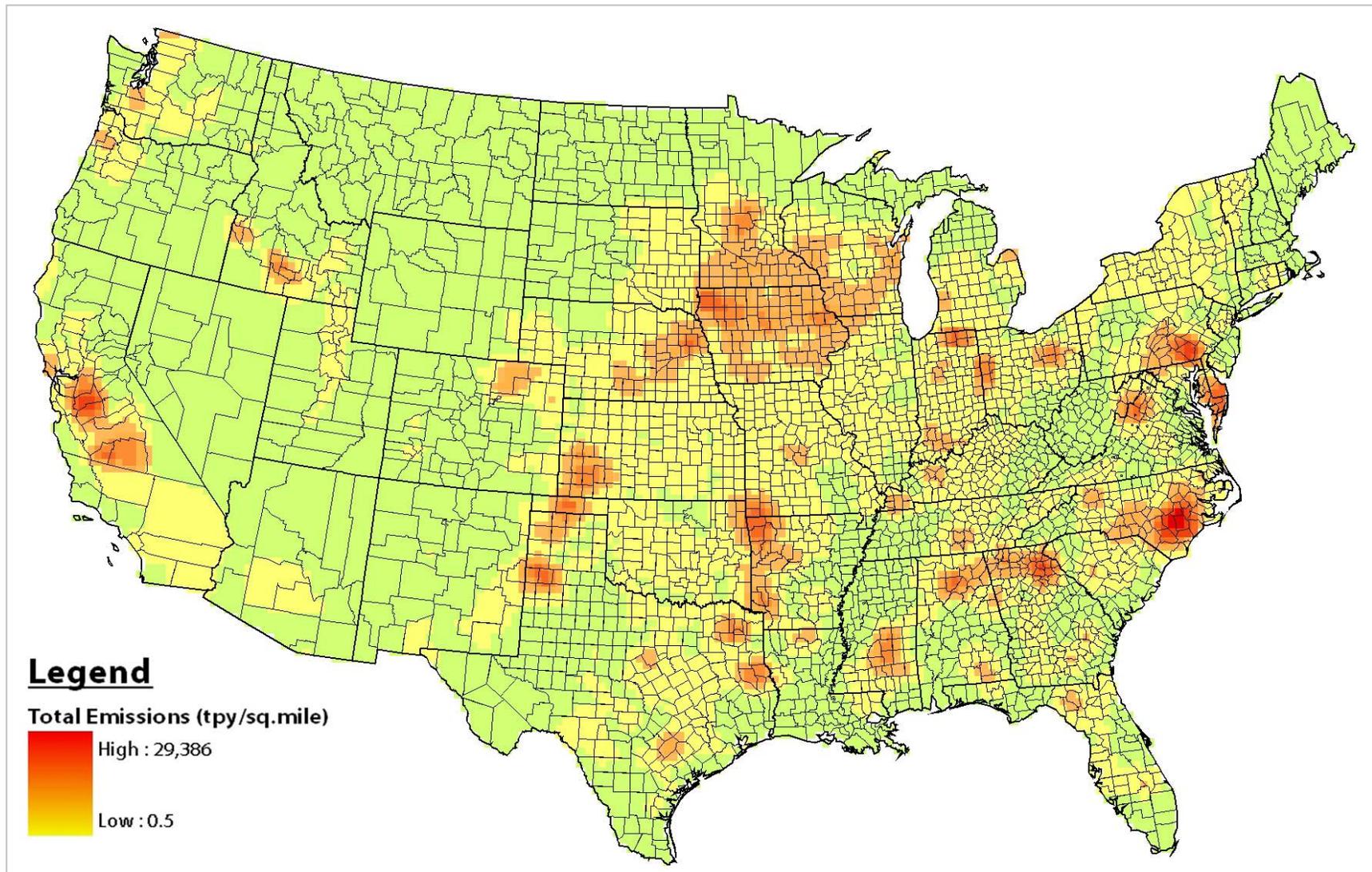


### NH<sub>3</sub>



\*Other includes fuels, mobile non-road, waste disposal and miscellaneous sources

# 2002 Ammonia Emissions from Animal Agriculture



# 1990 Clean Air Act Amendments

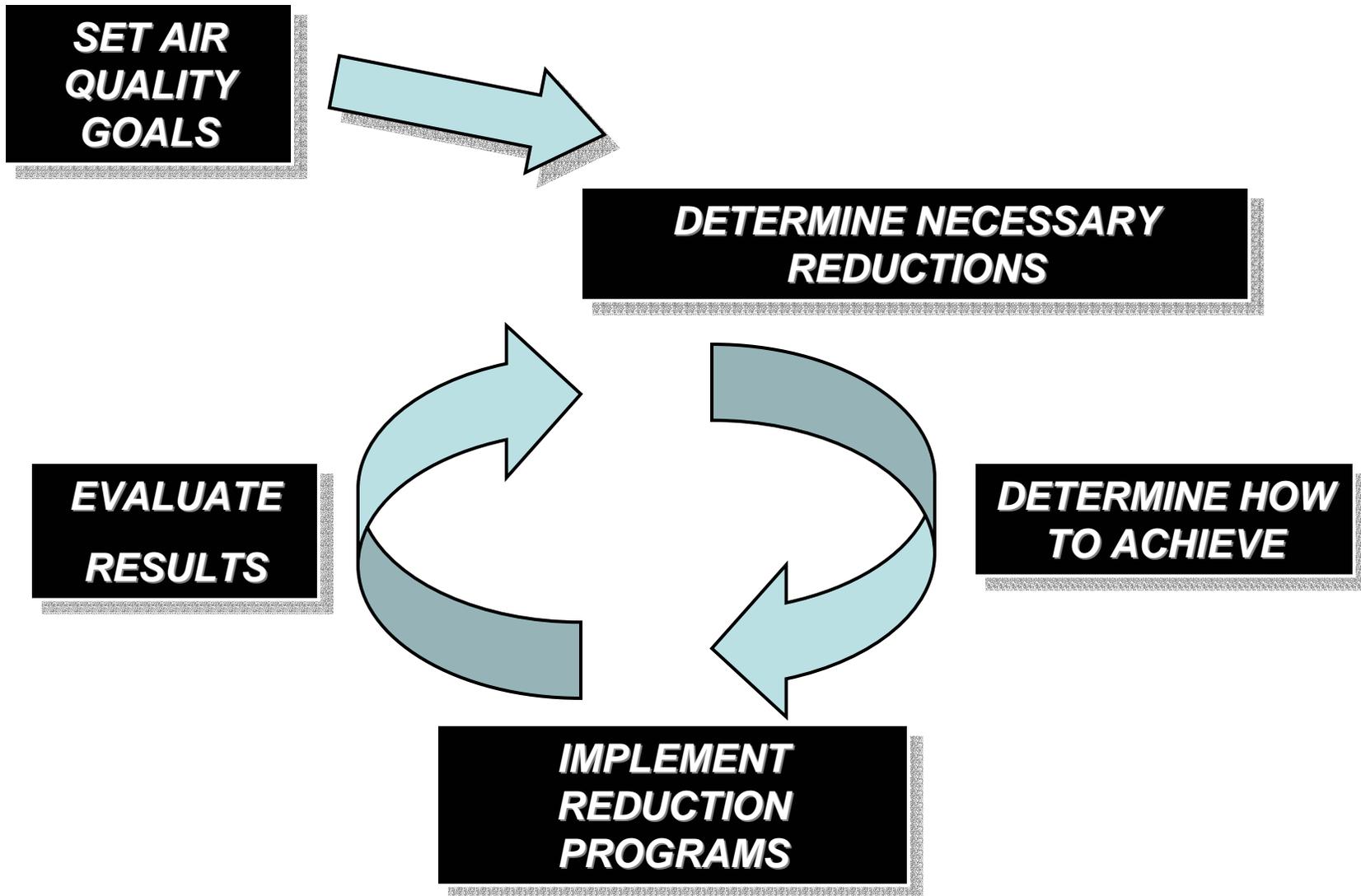
## Nitrogen-Related Titles

---

- Title I – Clean Air Standards (OAQPS, OAP, OTAQ)
- Title II – Mobile Sources (OTAQ)
- Title III – Air Toxics (OAQPS, OAP, OTAQ)
- Title IV – Acid Rain (OAP)
- Title V – Permits (OAQPS)

# Air Quality Management Cycle

---



# Office of Air Quality Planning and Standards

## Nitrogen- Related Programs

---

- National Ambient Air Quality Standards – standard setting and implementation
- New Source Review
- Prevention of Significant Deterioration (PSD)
- Regional Haze – Clean Air Visibility Rule
- Emission standards for industrial stationary sources and area sources
- Agriculture program strategy
- International programs

# Office of Atmospheric Programs

## Nitrogen- Related Programs

---

- Programs focus on power sector emissions sources
- Acid Rain Program
- NO<sub>x</sub> Budget Trading Program
  - Driven by Ozone NAAQS attainment
- Clean Air Interstate Rule
  - Driven by PM<sub>2.5</sub> and Ozone NAAQS attainment
- International relationships

# Office of Transportation and Air Quality

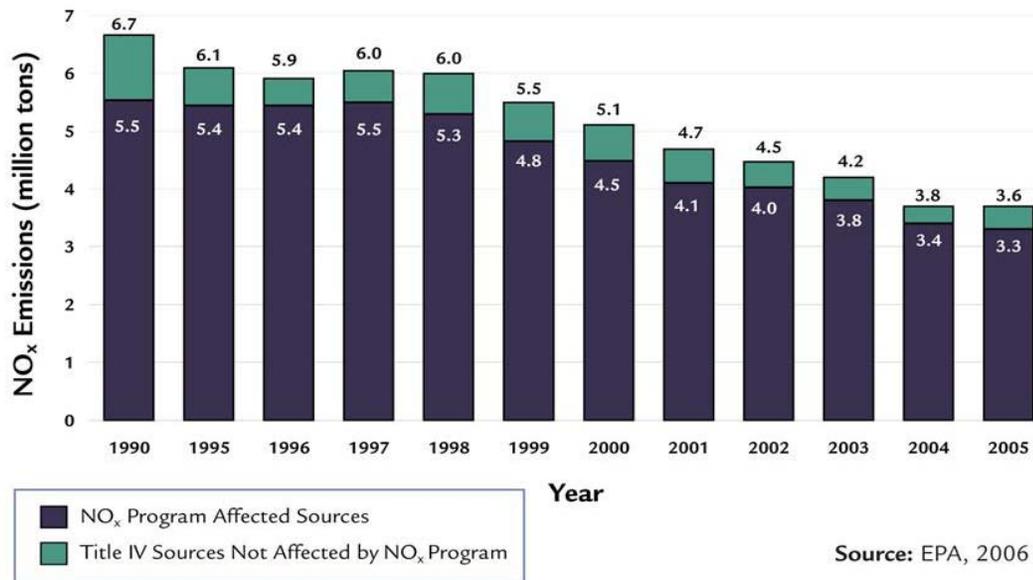
## Nitrogen- Related Programs

---

- Programs focus on mobile sector emissions source
- On-road Vehicles/Engines
  - Gasoline light-duty vehicles and trucks
  - Heavy-duty diesel trucks
  - Increasingly stringent standards since 1973 model year
  - About 99% control from uncontrolled engines
- Non-road diesel engines – substantial control
- Locomotives, commercial marine
  - Standards to be proposed shortly

# NO<sub>x</sub> and the Acid Rain Program (ARP)

NO<sub>x</sub> Emission Trends for Acid Rain Program Units, 1990–2005

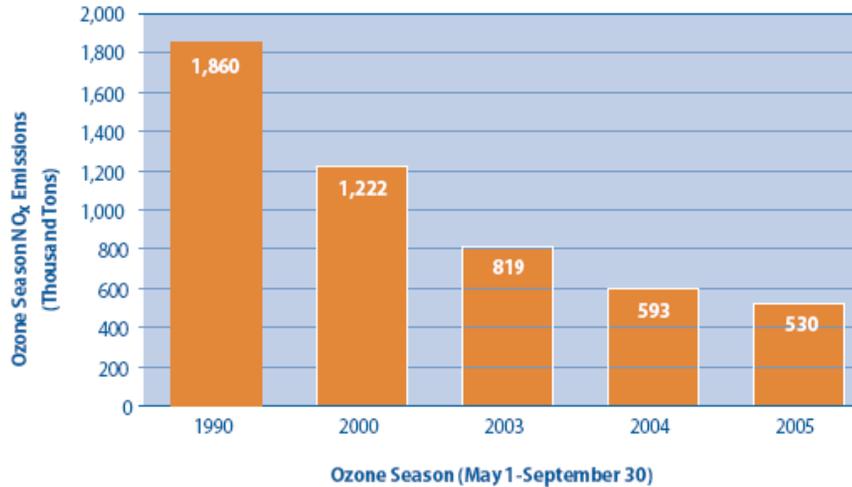


Note: Other programs such as the NO<sub>x</sub> SIP Call and the OTC NO<sub>x</sub> Budget Program, described below, as well as state laws also contribute to reductions, especially after 2000.

- The ARP was created under Title IV of the 1990 Clean Air Act Amendments to reduce the effects of acid deposition through reductions in annual emissions of SO<sub>2</sub> and NO<sub>x</sub> from the power sector.
- NO<sub>x</sub> reductions are achieved through rate-based emission limits
- The ARP NO<sub>x</sub> program seeks to achieve a 2 million ton reduction from levels projected to occur in 2000 without Title IV and the ARP
- In 2005, the ARP cut NO<sub>x</sub> emissions by about 3 million tons, so that emissions in 2005 were less than half the level anticipated without the program. Other regulations, such as the NO<sub>x</sub> Budget Trading Program in the eastern U.S., also contributed significantly to this reduction
- The ARP NO<sub>x</sub> program affected 982 operating coal-fired units operating in 2005.

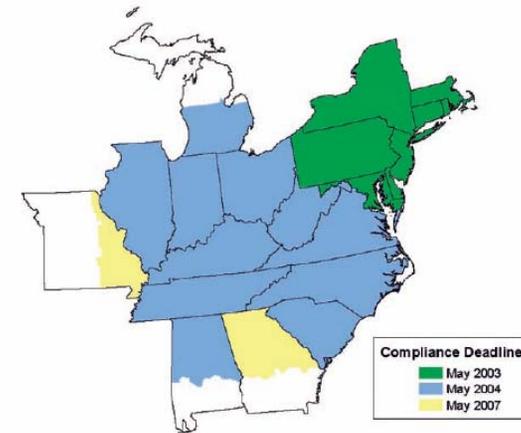
# NO<sub>x</sub> Budget Trading Program (NBP)

Ozone Season Emissions under the NO<sub>x</sub> Budget Trading Program



Source: EPA

NO<sub>x</sub> SIP Call Program Implementation



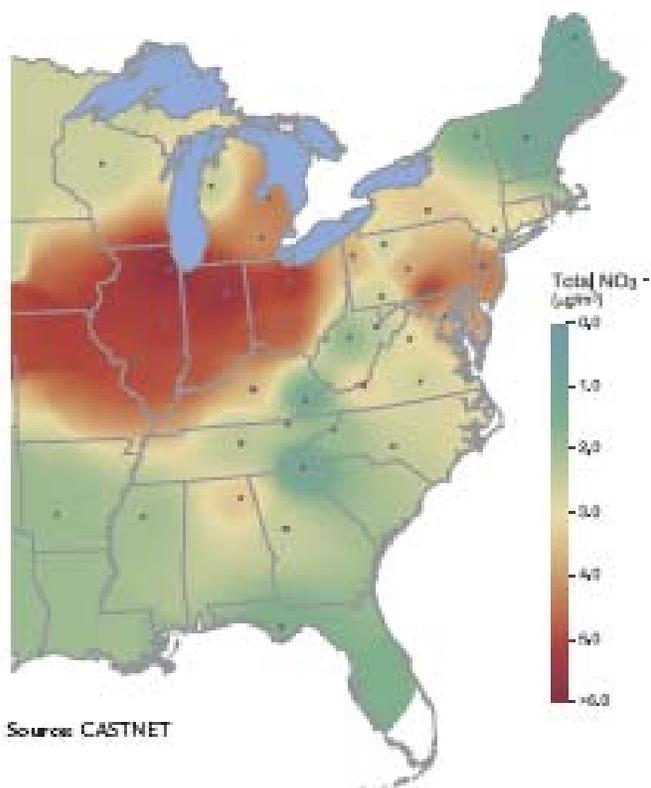
Source: EPA

- The NBP is a market-based cap and trade program created to reduce NO<sub>x</sub> emissions from power plants and other large combustion sources in the eastern United States.
- NBP states reduced ozone season (May 1 – September 30) NO<sub>x</sub> emissions about 72% from 1990, 57% from 2000, and 11% from 2004 (despite a 7% increase in heat input). Total NBP Emissions in 2005 were 530,000 tons.
- The NBP affected 2570 units in 2005.

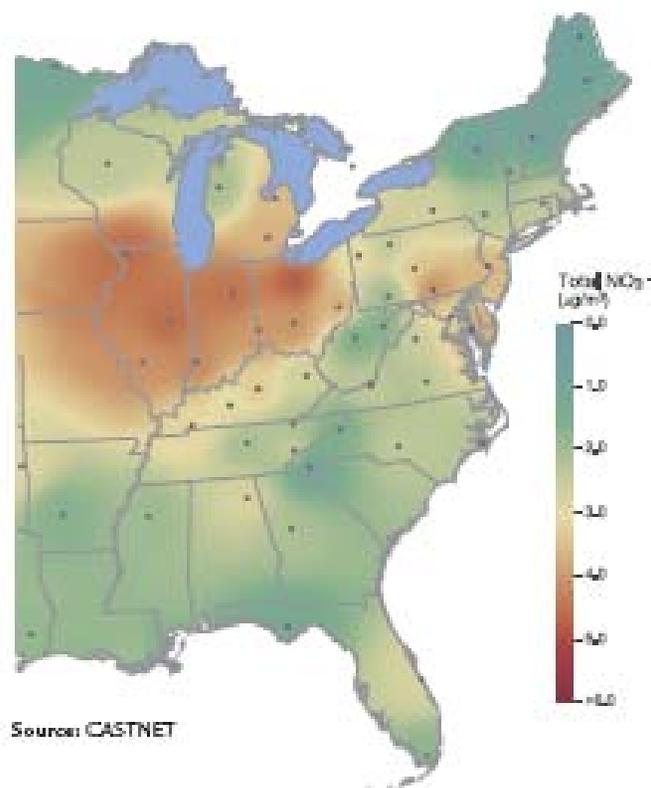
# Changes in Ambient Nitrate Concentrations

---

**Annual Mean Total Ambient Nitrate Concentration, 1989-1991**



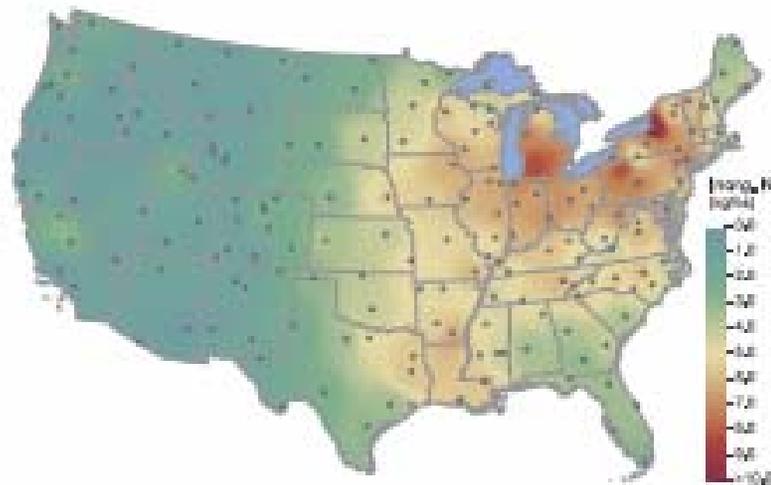
**Annual Mean Total Ambient Nitrate Concentration, 2003-2005**



# Changes in Inorganic Nitrogen Deposition

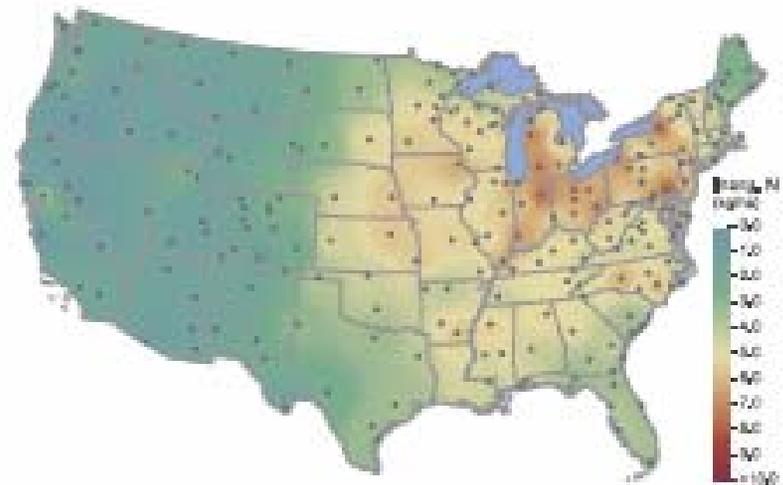
---

**Annual Mean Wet Inorganic Nitrogen Deposition, 1989-1991**



Source: National Atmospheric Deposition Program

**Annual Mean Wet Inorganic Nitrogen Deposition, 2003-2005**

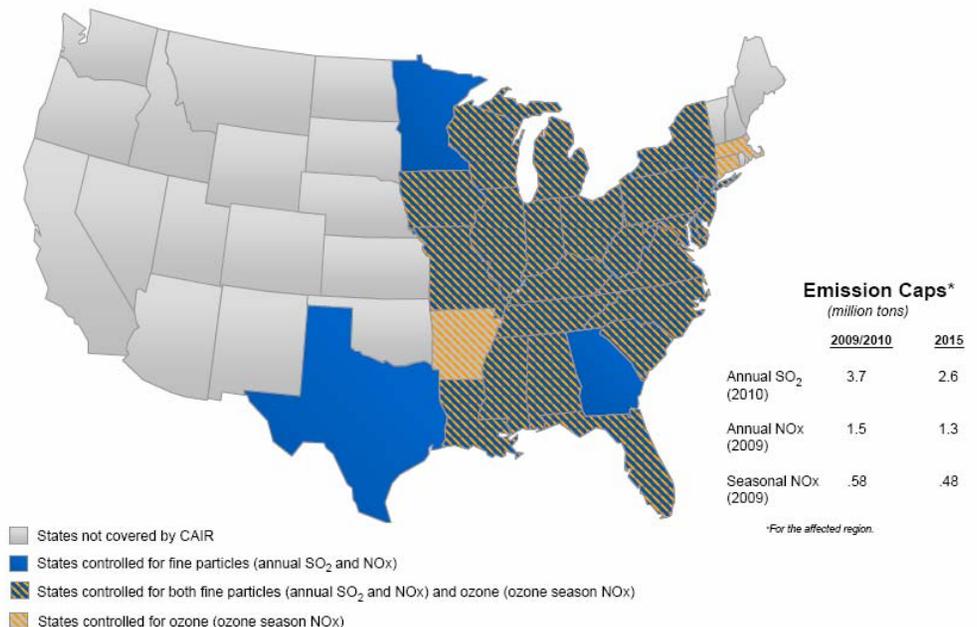


Source: National Atmospheric Deposition Program

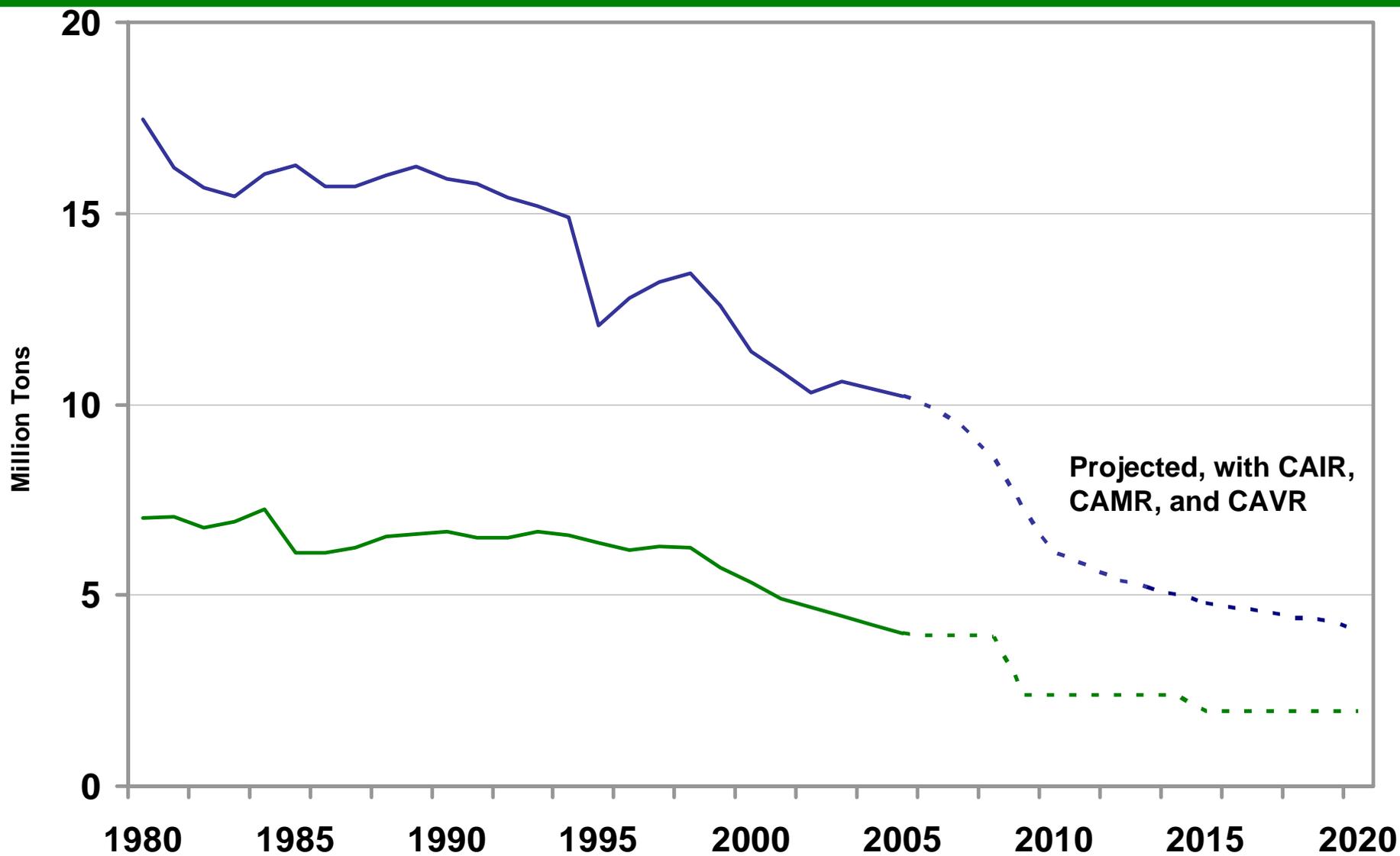
# NO<sub>x</sub> and the Clean Air Interstate Rule (CAIR)

- 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 by reducing SO<sub>2</sub> and NO<sub>x</sub> emissions which contribute to fine particle pollution (PM<sub>2.5</sub>) and ground level ozone.
- Includes two phases of reductions for ozone season and annual NO<sub>x</sub> in 2009 and 2015
- Emission caps are divided into state NO<sub>x</sub> and SO<sub>2</sub> 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<sub>x</sub> programs, is projected to reduce power sector ozone season NO<sub>x</sub> emissions by 40% and annual NO<sub>x</sub> emissions by 55 % from 2005 levels.

## States Affected by CAIR

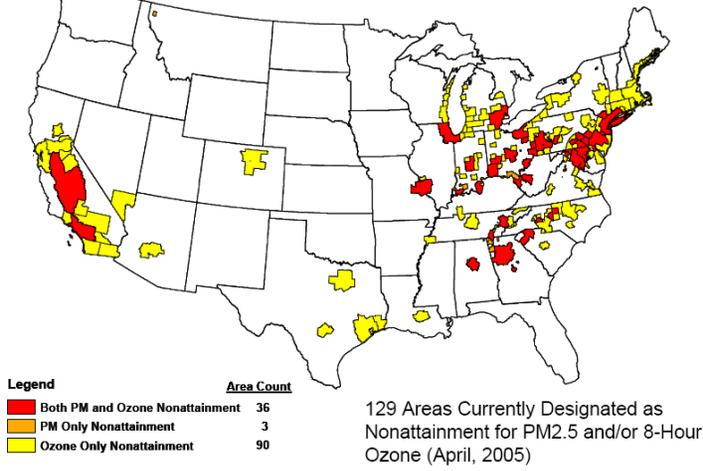


# Nationwide SO<sub>2</sub> and NO<sub>x</sub> Emissions from the Power Sector

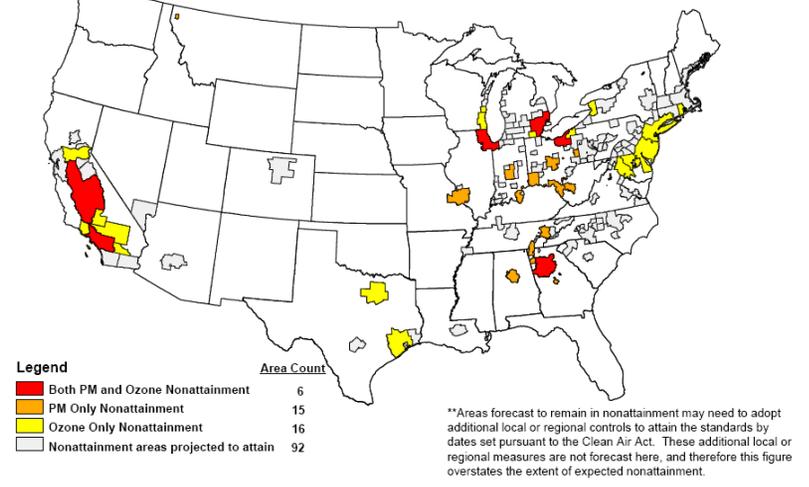


# CAIR and NAAQS Attainment

Nonattainment areas in 2005

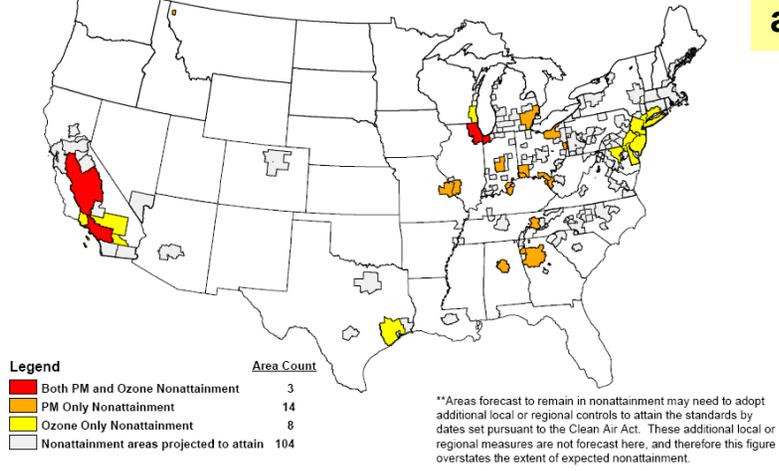


Nonattainment areas in 2010

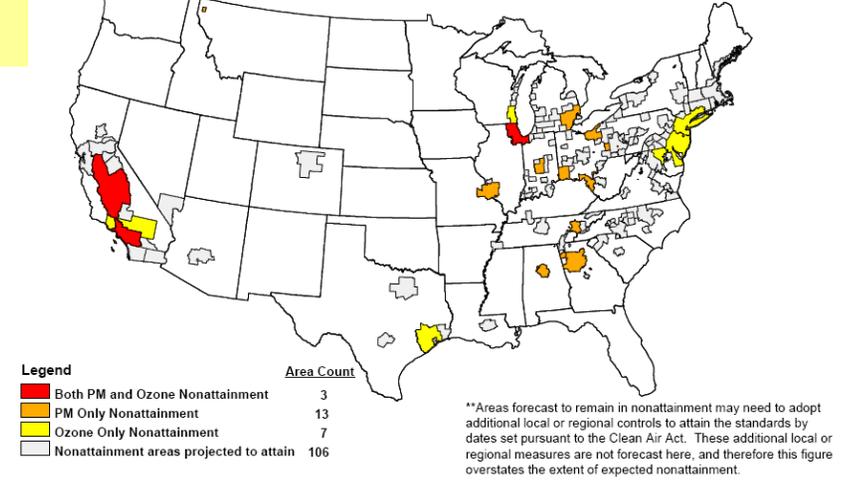


EPA also projects that CAIR and other programs will reduce the number of 8-hour ozone and PM<sub>2.5</sub> nonattainment areas by 2020.

Nonattainment areas in 2015

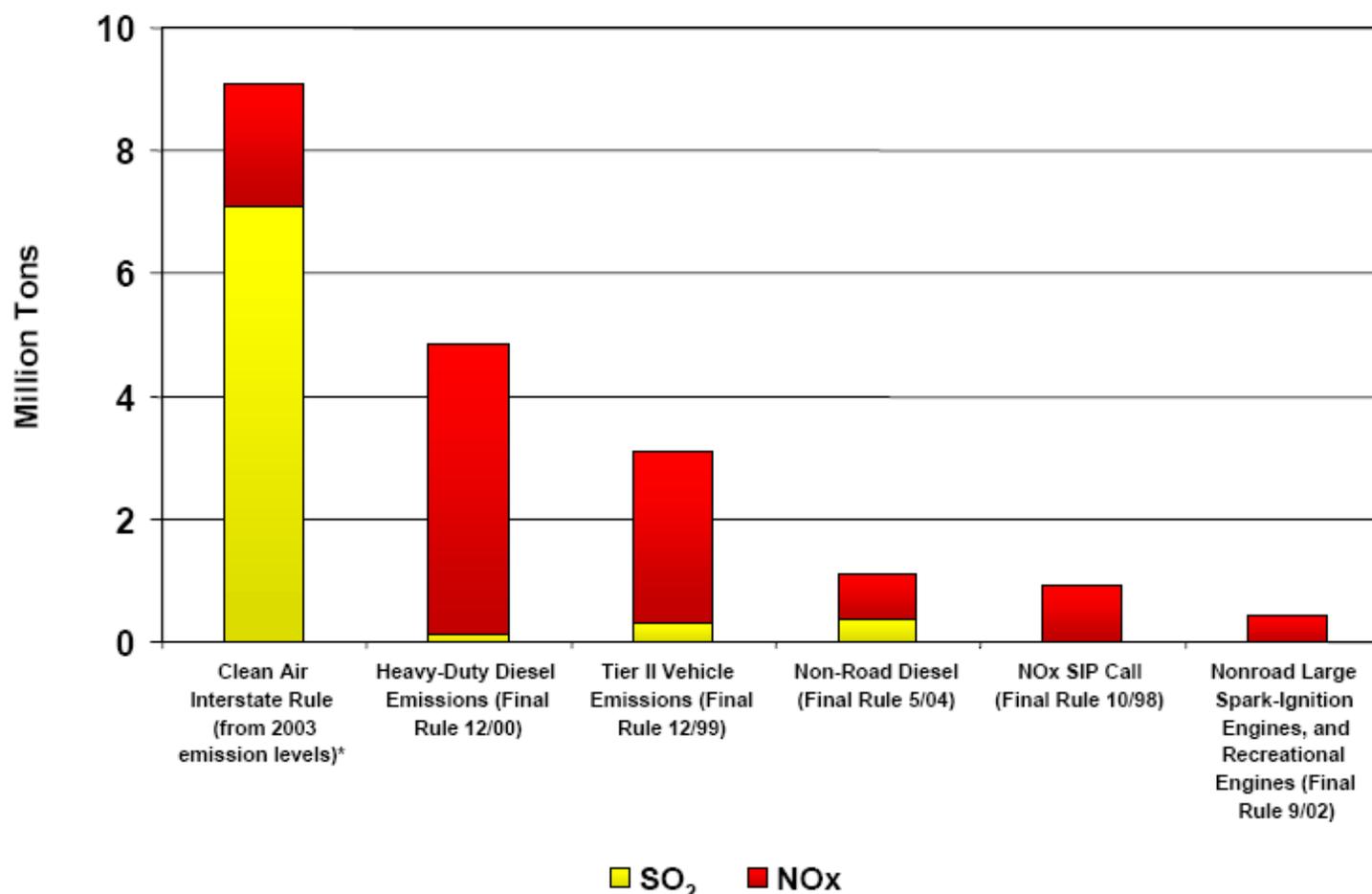


Nonattainment areas in 2020



# NO<sub>x</sub> and Recent Rules

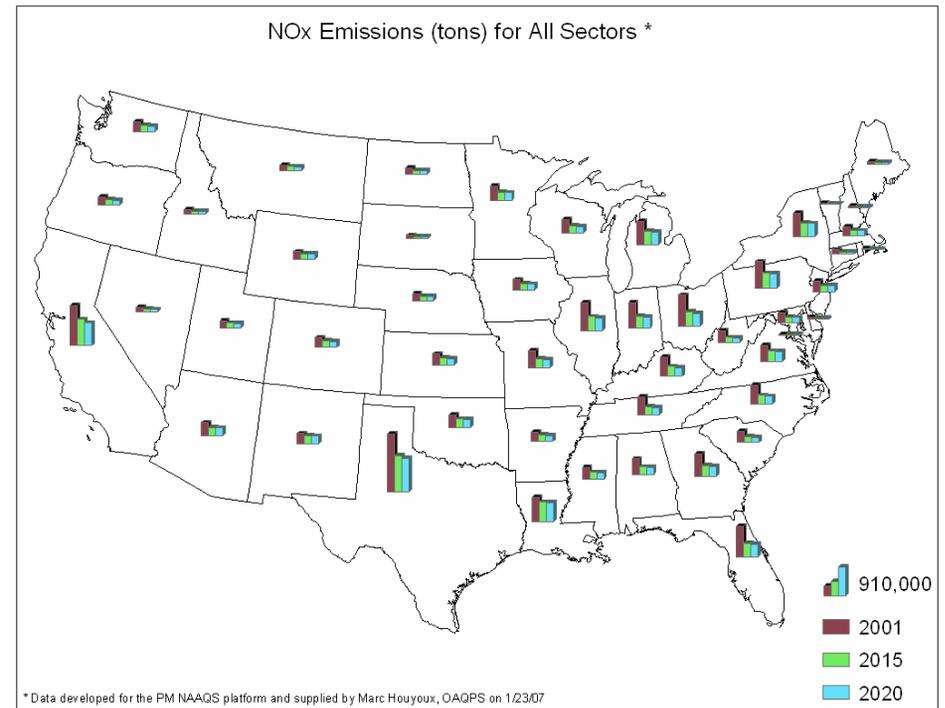
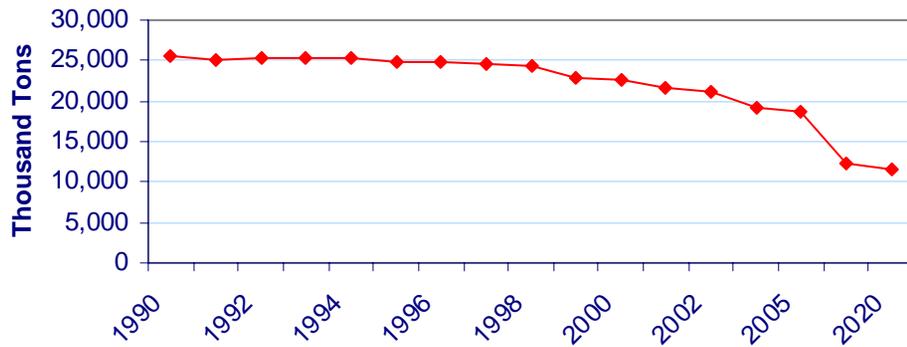
## Annual Emission Reductions at Full Implementation\* for CAIR and Other Major Air Pollution Rules Since 1990



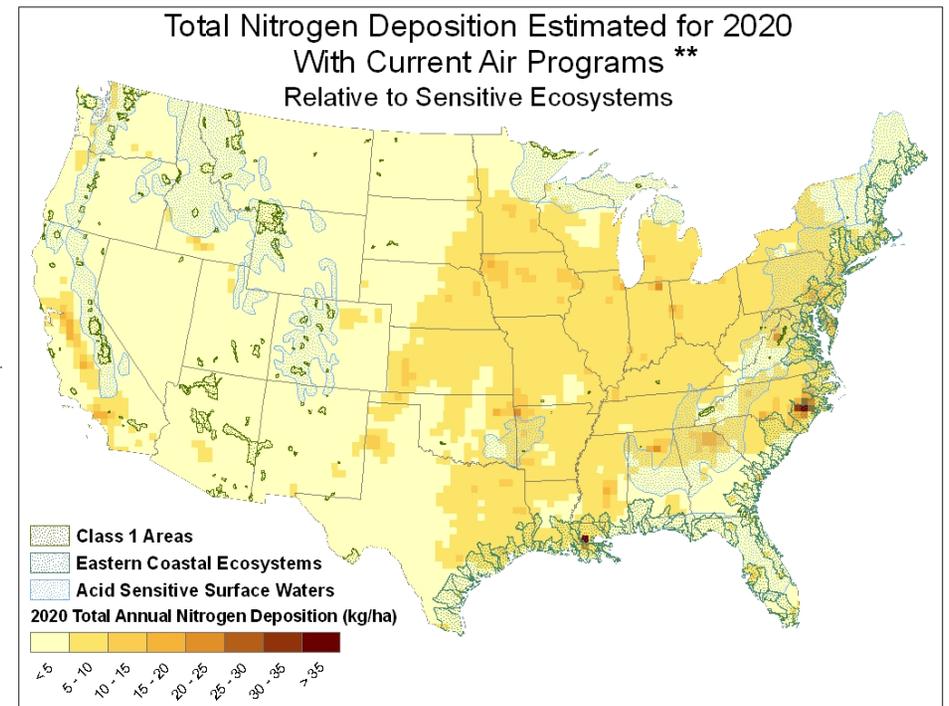
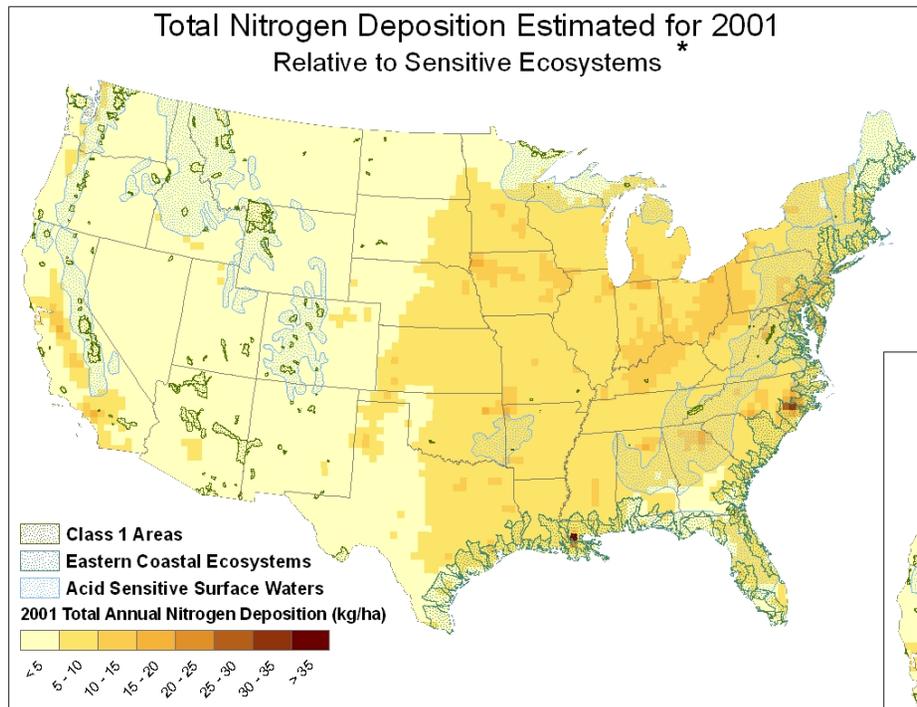
\*These reductions are calculated from 2003 levels and do not reflect the full phase in of the acid rain program. Full implementation for mobile source rules is 2030. Full implementation for the CAIR is between 2020 and 2025.

# Projected NO<sub>x</sub> Emissions in 2020

Total NO<sub>x</sub> Emissions in the United States from All Sources, 1990-2020



# Change in Nitrogen Deposition for the Nation

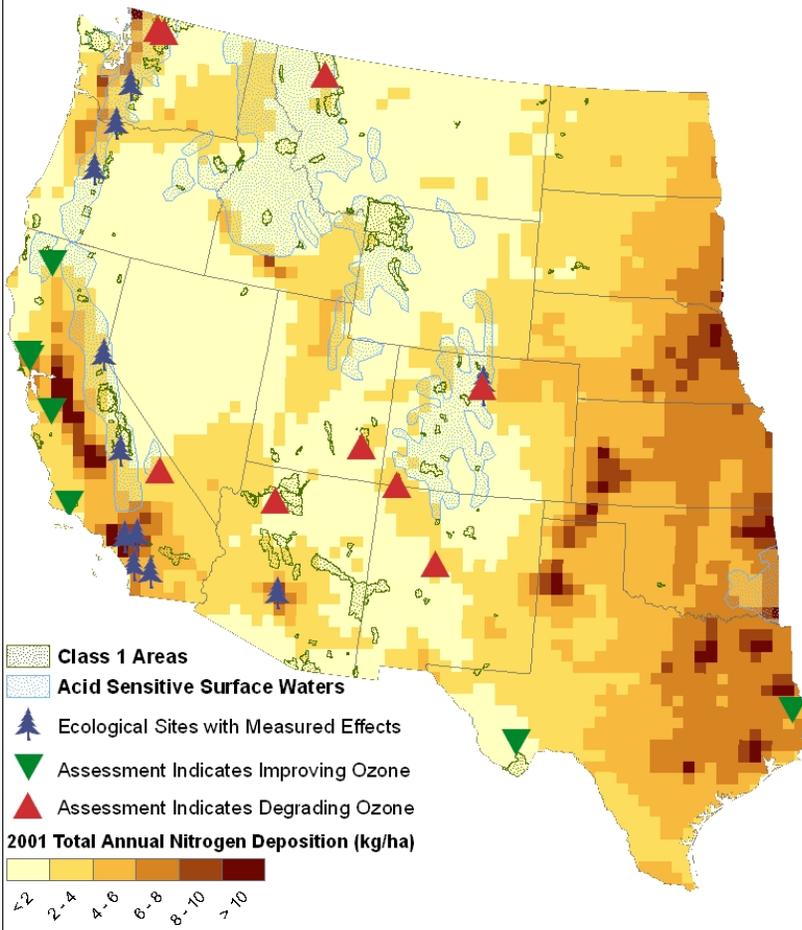


\*Includes only the ARP and NBP

\*\*Includes the ARP, NBP, CAIR, CAMR, CAVR, and mobile source rules.

# Change in Nitrogen Deposition for the West

Total Nitrogen Deposition Estimated for 2001  
Relative to Sensitive Ecosystems



Total Nitrogen Deposition Estimated for 2020  
With Current Air Programs  
Relative to Sensitive Ecosystems

