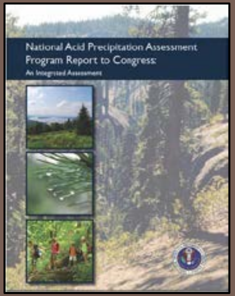
THE 2011 NATIONAL ACID PRECIPITATION ASSESSMENT PROGR REPORT TO CONGRESS

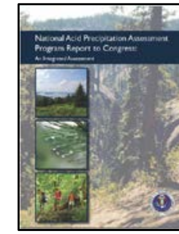


Douglas Burns, Jason Lynch,

Jack Cosby, Mark Fenn, Jill Baron,

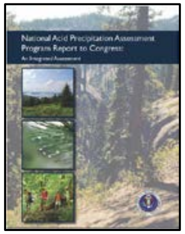
U.S. EPA Clean Air Markets Division

Current NAPAP Report



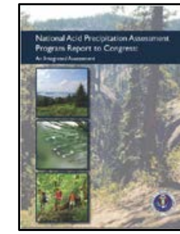
- Fifth NAPAP report(s) – previous in 2005
- Through peer review and review by Air Quality Research Subcommittee of Committee for Environ., Natural Resour. and Sustainability
- Currently with Office of Science and Technology Policy for final review
- Hopeful of late 2011 publishing date

Content



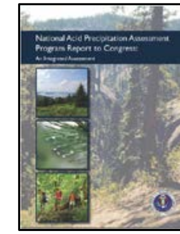
- Executive Summary and Introduction
- Chapter 1 – Overview of Acid Rain Program, costs and benefits
- Chapter 2 – Trends emissions and deposition, critical loads
- Chapter 3 – State-of-science, ecosystem effects of acid deposition
- Chapter 4 – Modeling future ecosystem effects, emissions/deposition scenarios

Acid Rain Program (ARP)



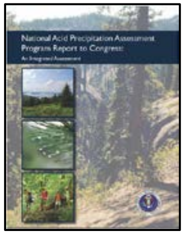
- EPA program that implements Title IV 1990 Clean Air Act Amendments
- SO_2 – Cap-and-trade, 8.95 Mt cap by 2010
- NO_X – Traditional emissions control, averaging
- Human health benefits – $174 to $427 billion/yr in 2010, primarily PM2.5 and secondarily O_3
- Costs – $1 to $3 billion/yr

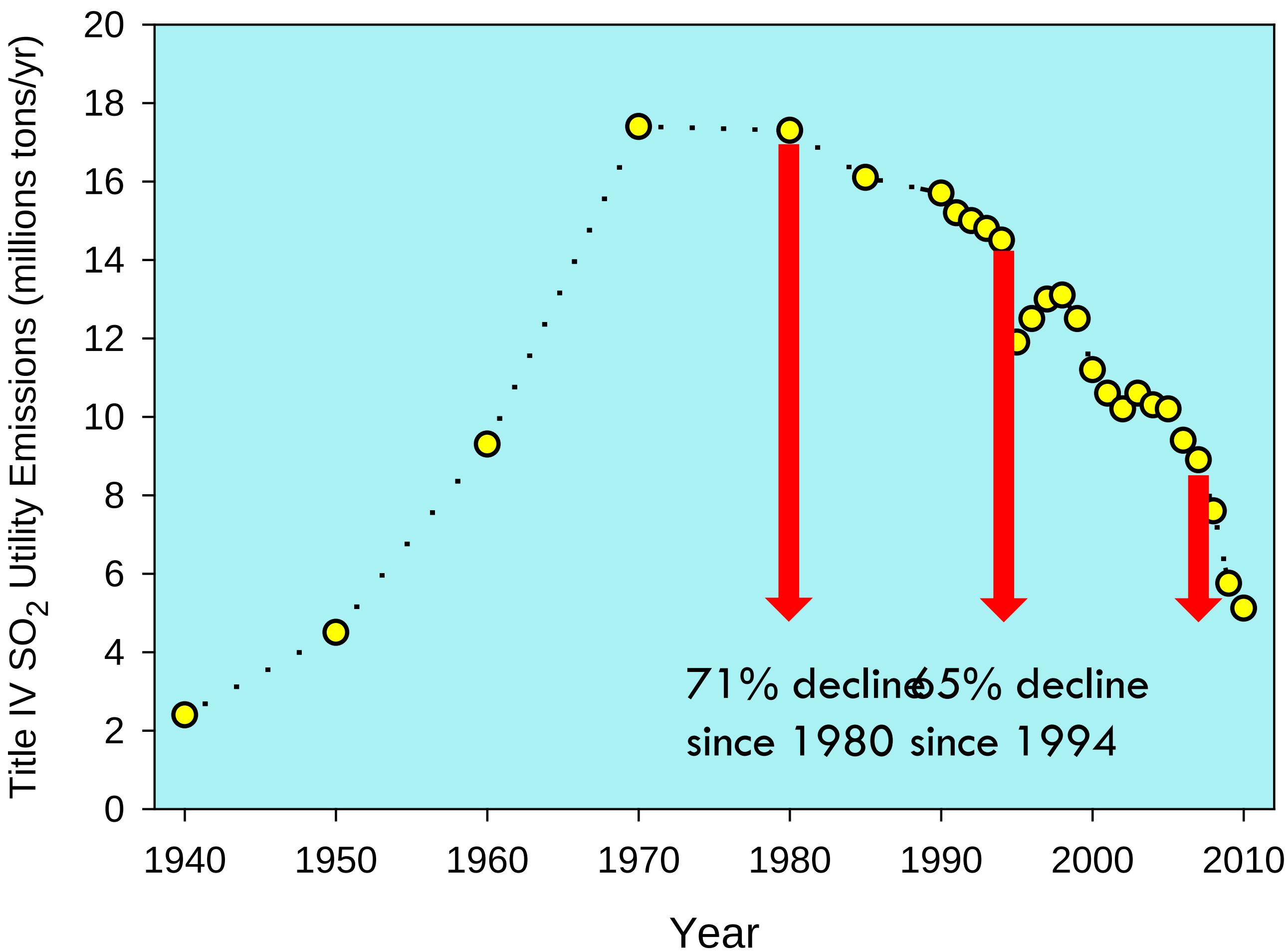
Additional Benefits of ARP



- Ecological and visibility improvement benefits not well quantified
- Case study for Adirondacks (Banzhaf et al., 2006) estimates ecological benefits of $336 - $749 million/yr
- Recent EPA study indicates visibility benefits of $40 billion/yr
- Need for more research to better quantify complete set of benefits

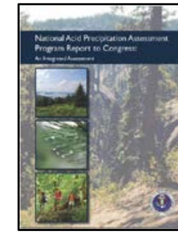
ARP SO_2 Emissions

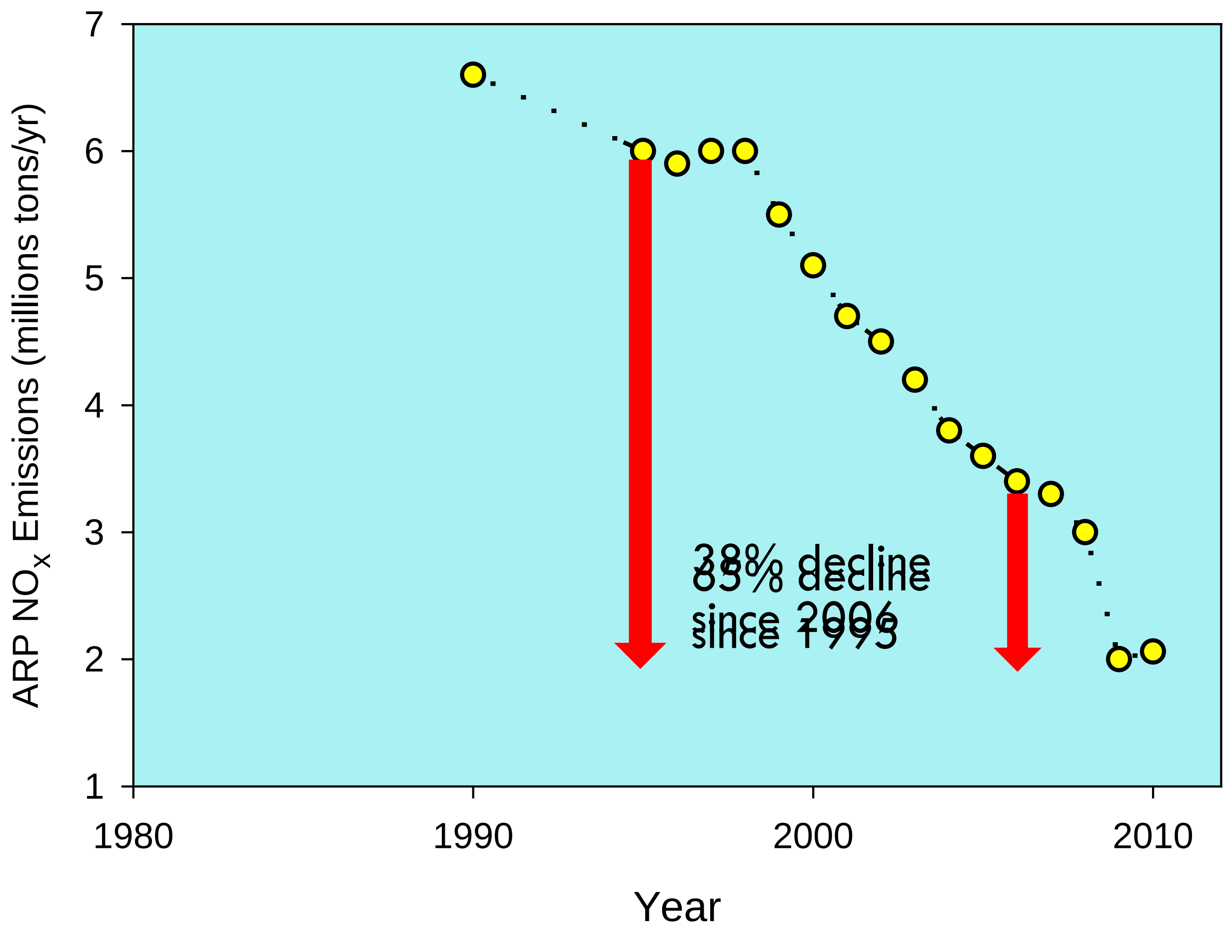




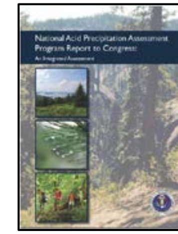
46% decline since 2006

ARP NO_x Emissions

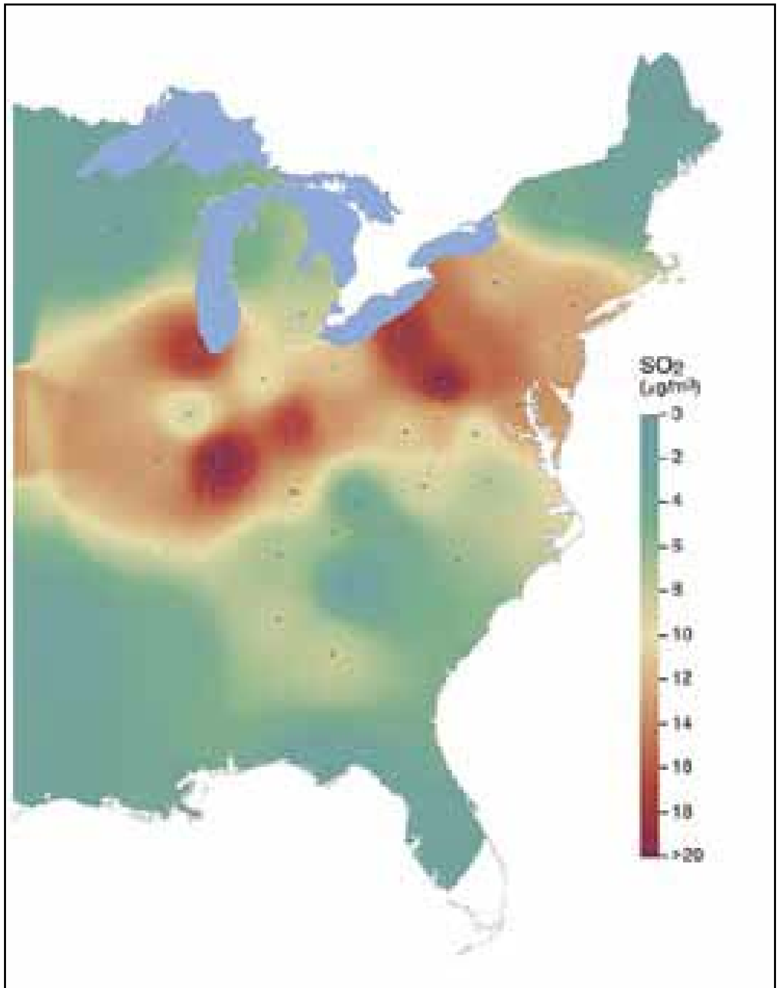




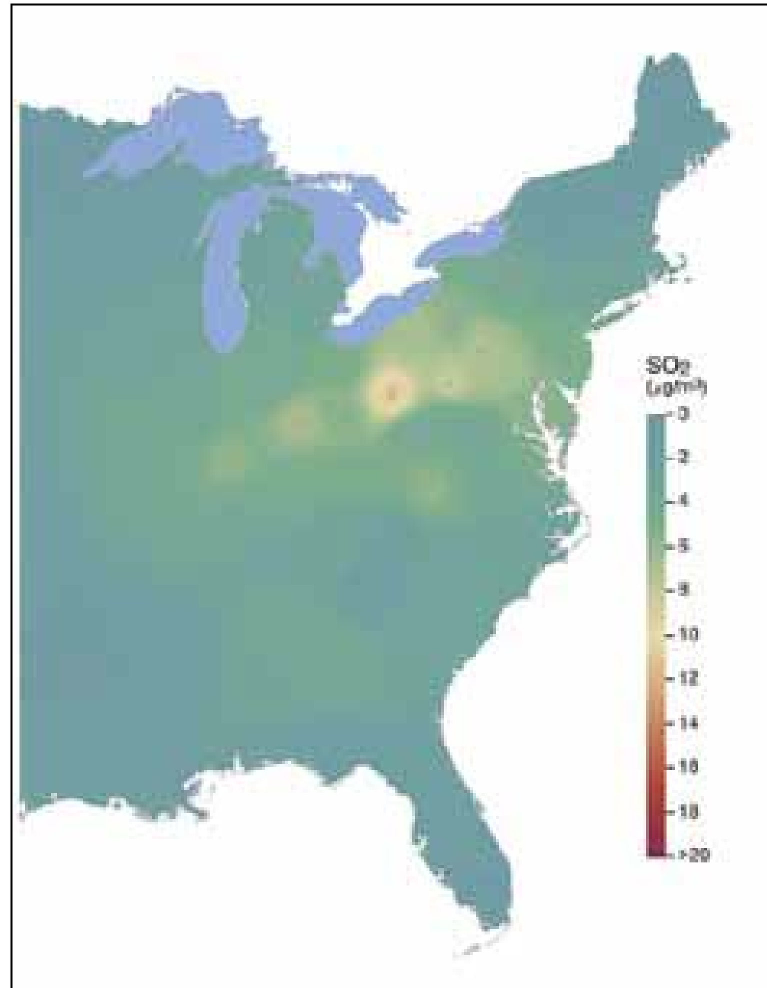
Air Quality – Ambient SO_2



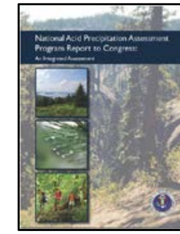
1989-91



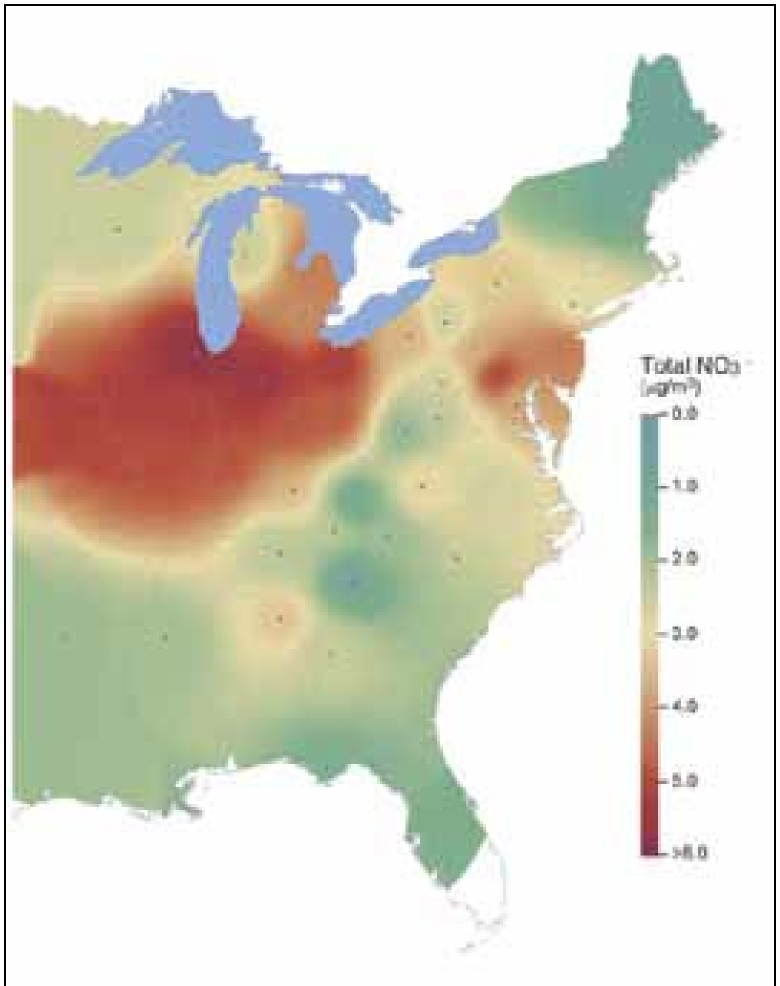
2007-09



Air Quality – Ambient NO_3



1989-91



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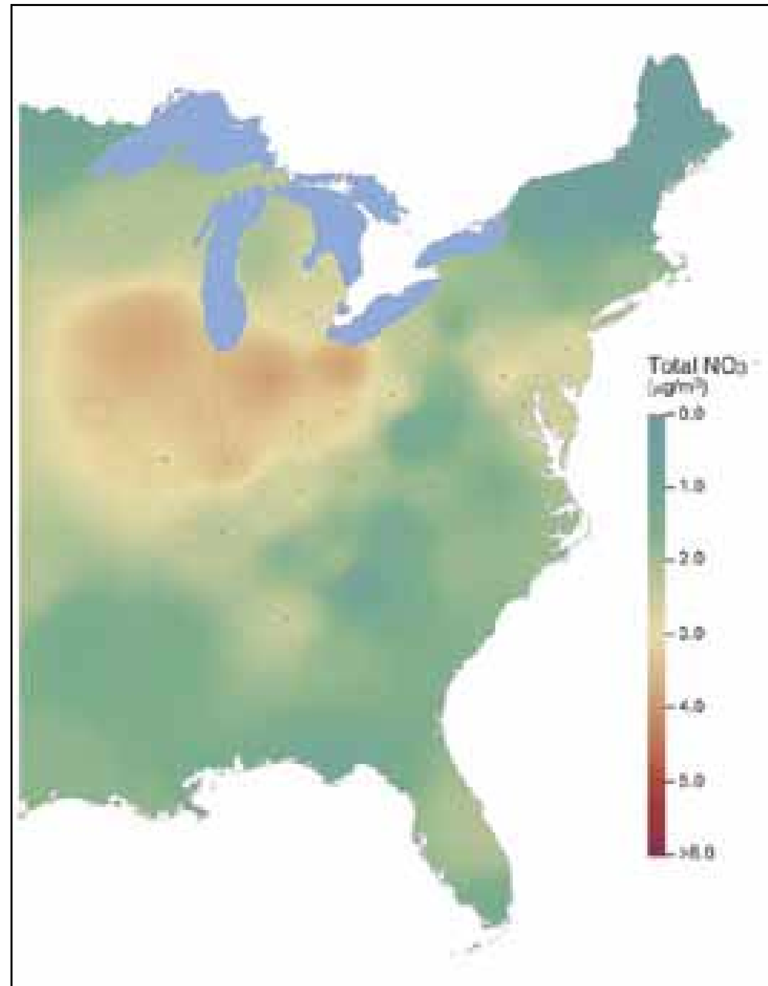
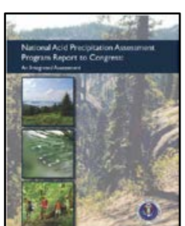
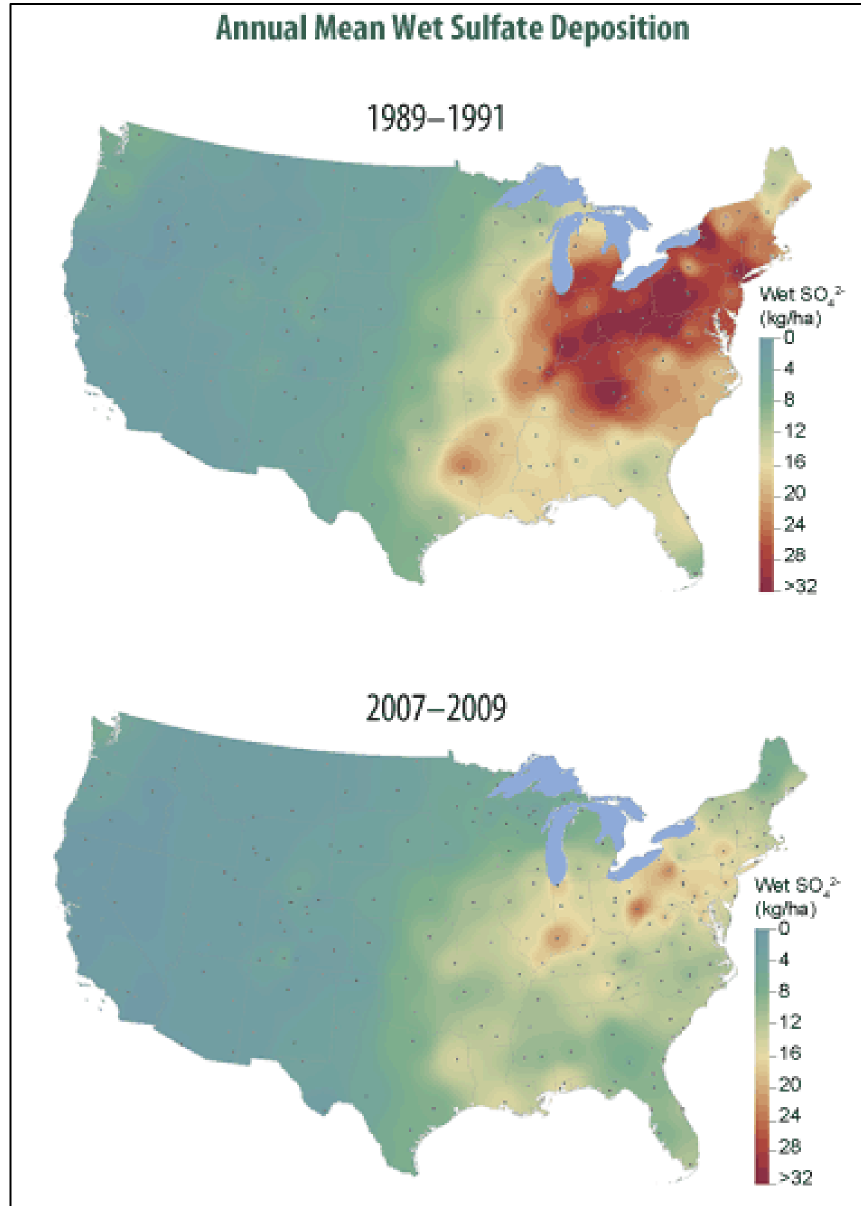


Wet Deposition SO_4^{2-}

40%+ decline since early 1990s



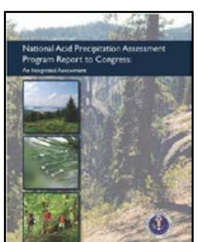


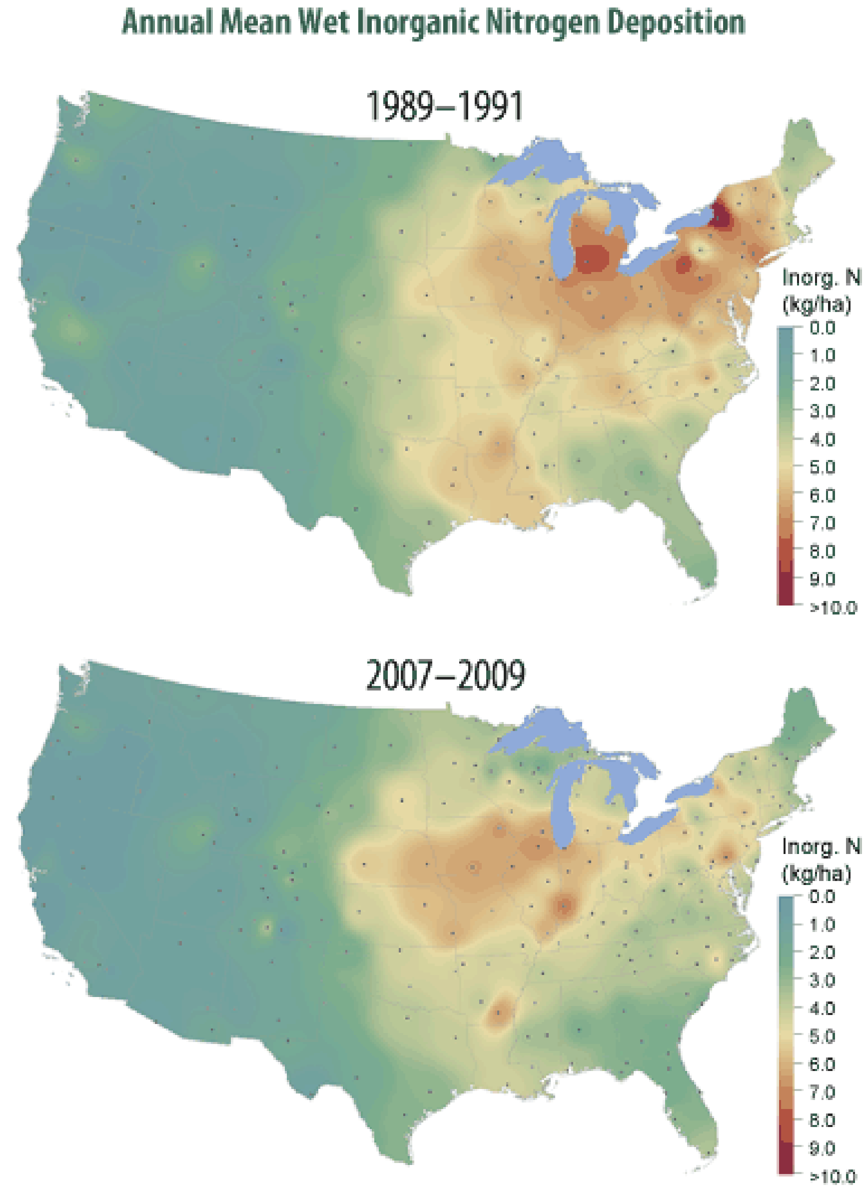
Source: NADP, 2010

Wet Deposition Inorganic N

20% to 25% decline since early 1990s except mid-west

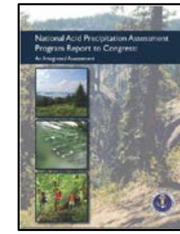
Role of NH_3/NH_4^+





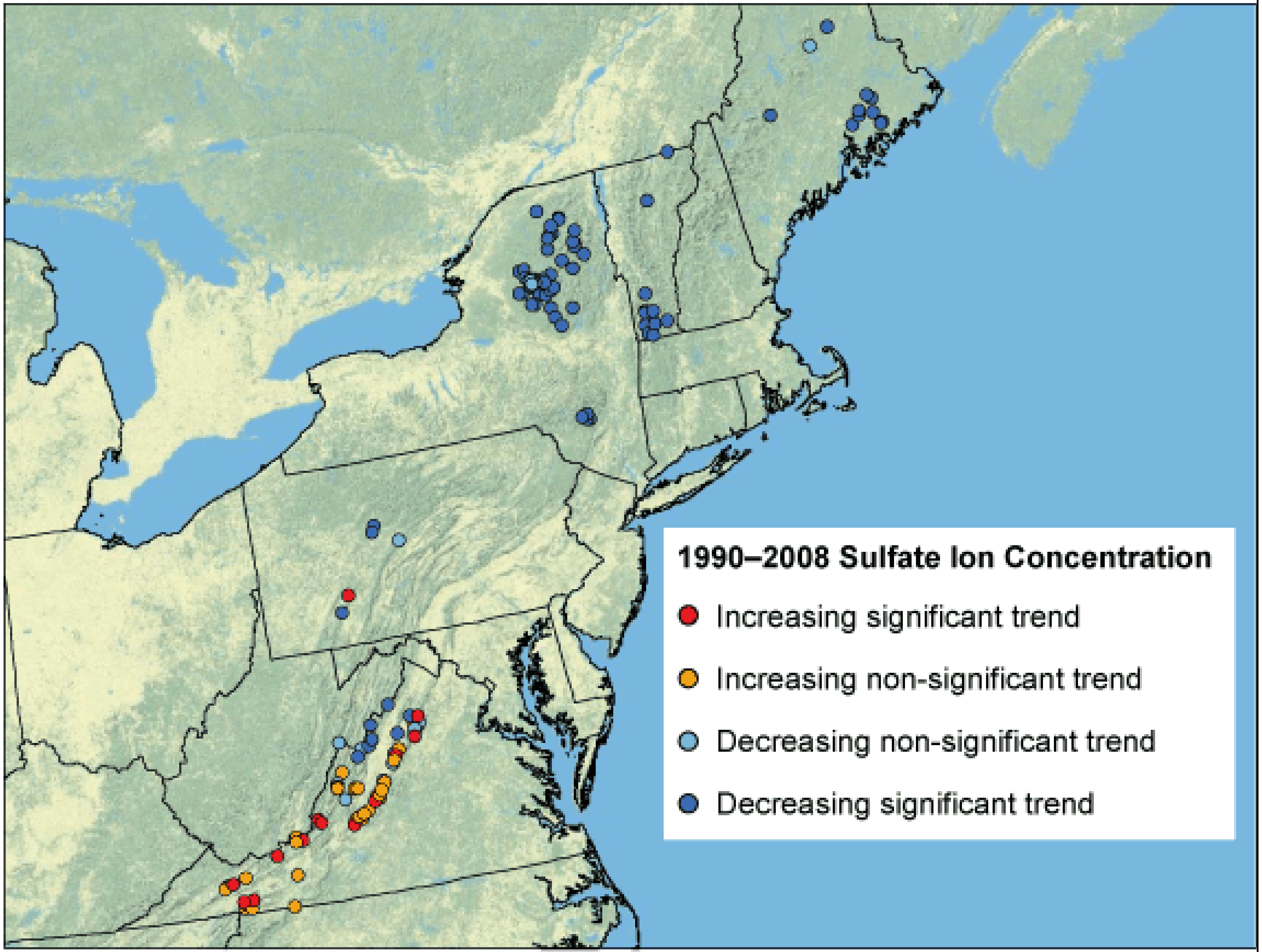
Source: NADP, 2010

Ecosystem Recovery



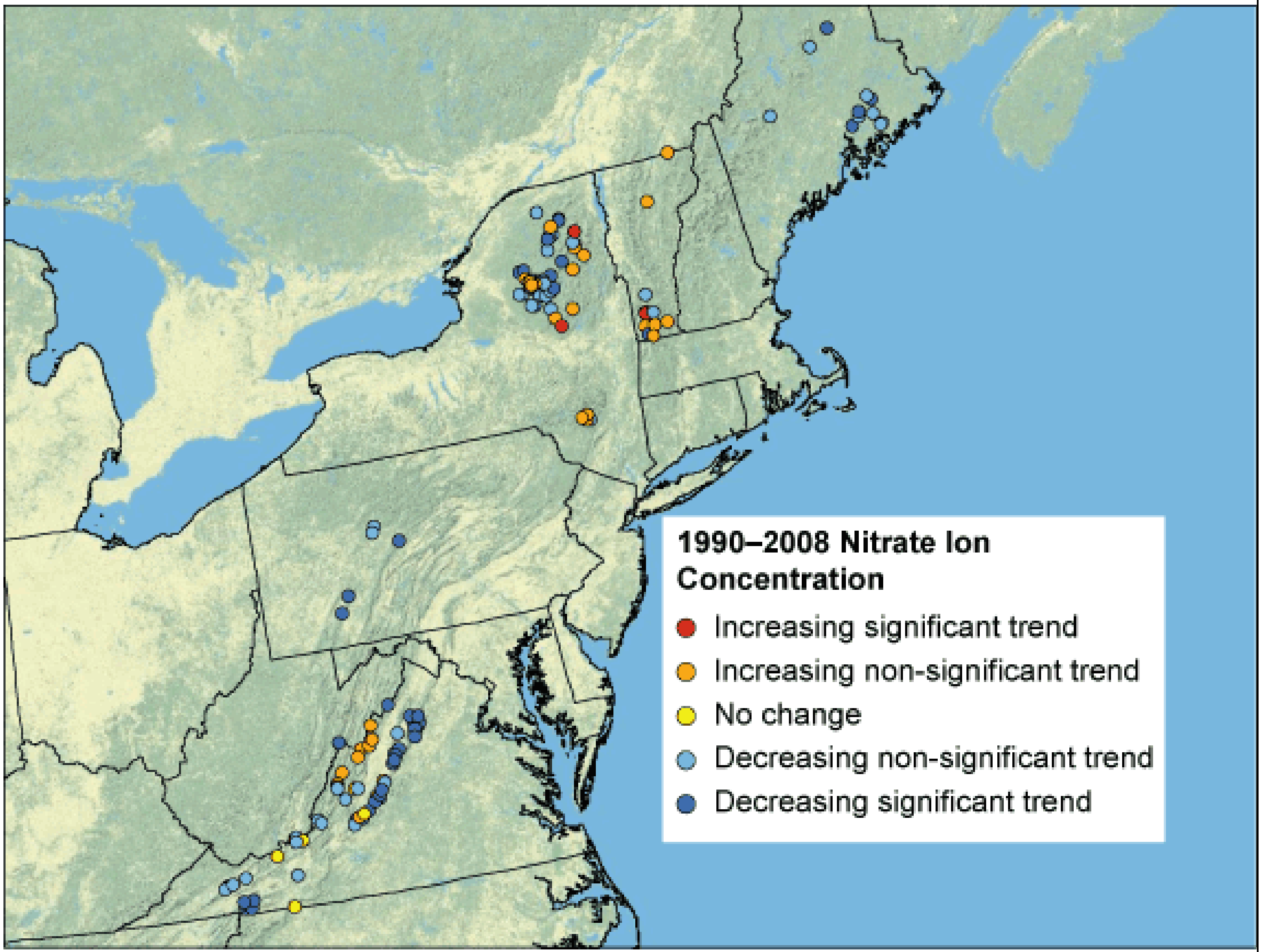
- More complex and nuanced story
- Aquatic ecosystems
  1. SO_4^{2-} decreasing everywhere except SE
  2. NO_3^- decreases at many sites, but less than SO_4^{2-} and no decreases at some sites
  3. ANC – increasing in NE, but not in SE
- Terrestrial ecosystems – most studies showing no recovery, continued declines in soil base saturation
- Little evidence to evaluate species recovery – some evidence that aquatic ecosystems beginning to recover

Trends in Lake and Stream Water Chemistry at LTM Sites, 1990-2008, Sulfate Ion Concentration (µeq/L/yr)



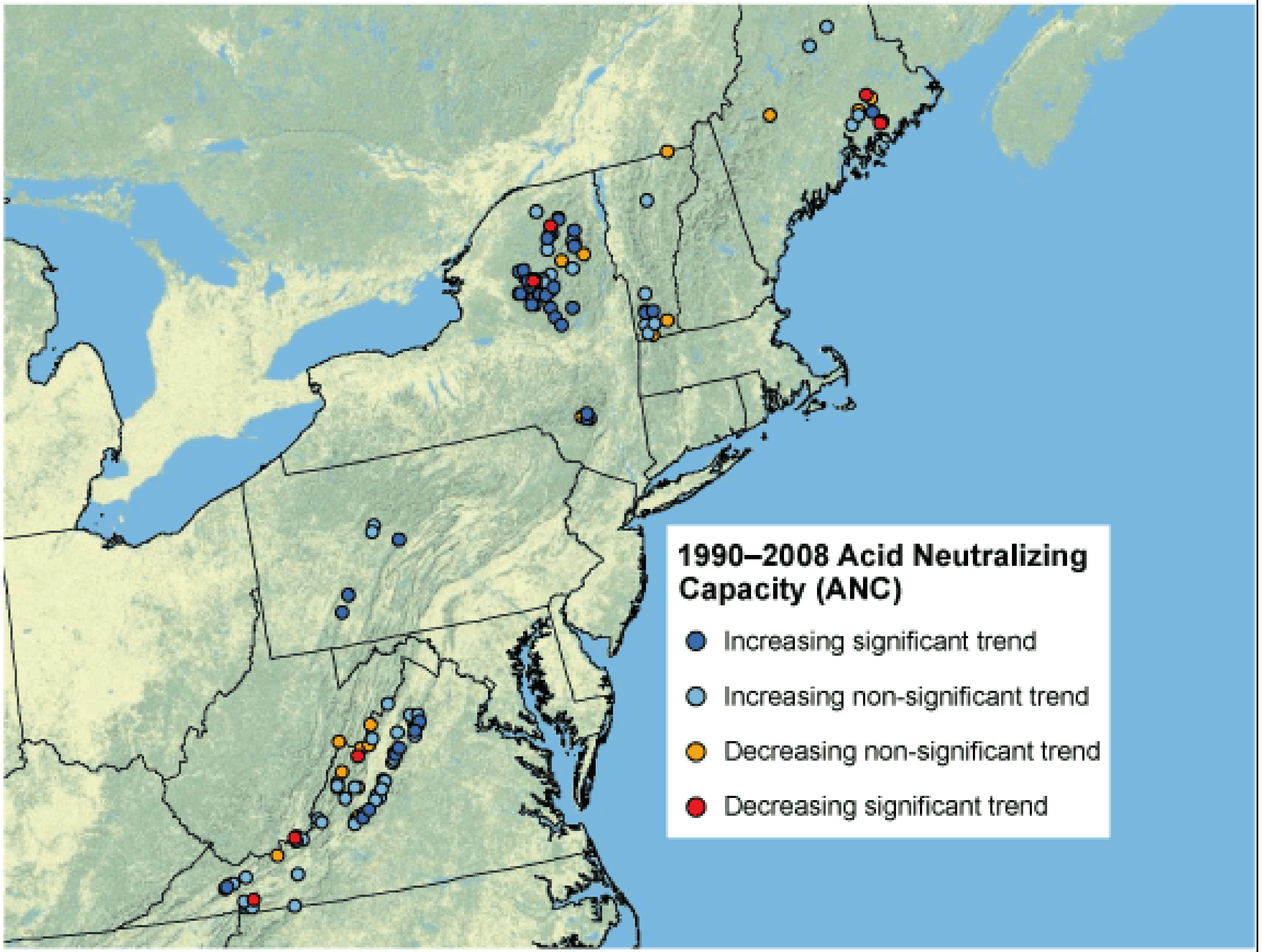
Source: EPA, 2010

Trends in Lake and Stream Water Chemistry at LTM Sites, 1990-2008, Nitrate Ion Concentration (μeq/L/yr)



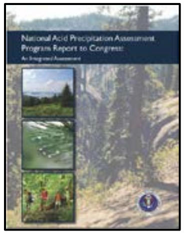
Source: EPA, 2010

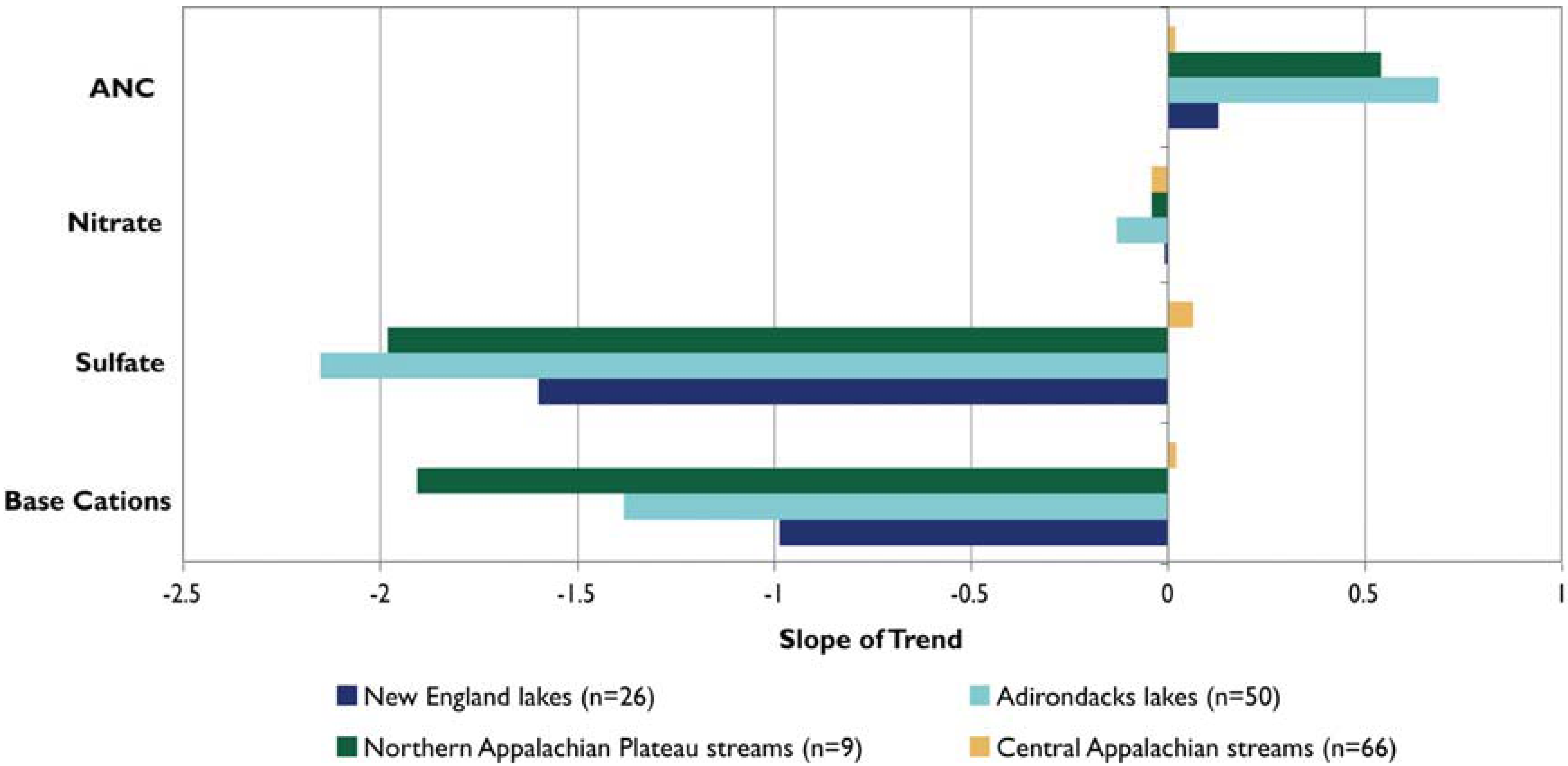
Trends in Lake and Stream Water Chemistry at LTM Sites, 1990-2008, ANC Levels (μeq/L/yr)



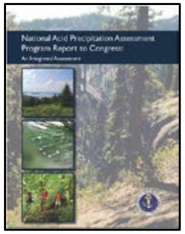
Source: EPA, 2010

Trend Magnitude by Region



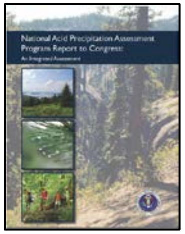


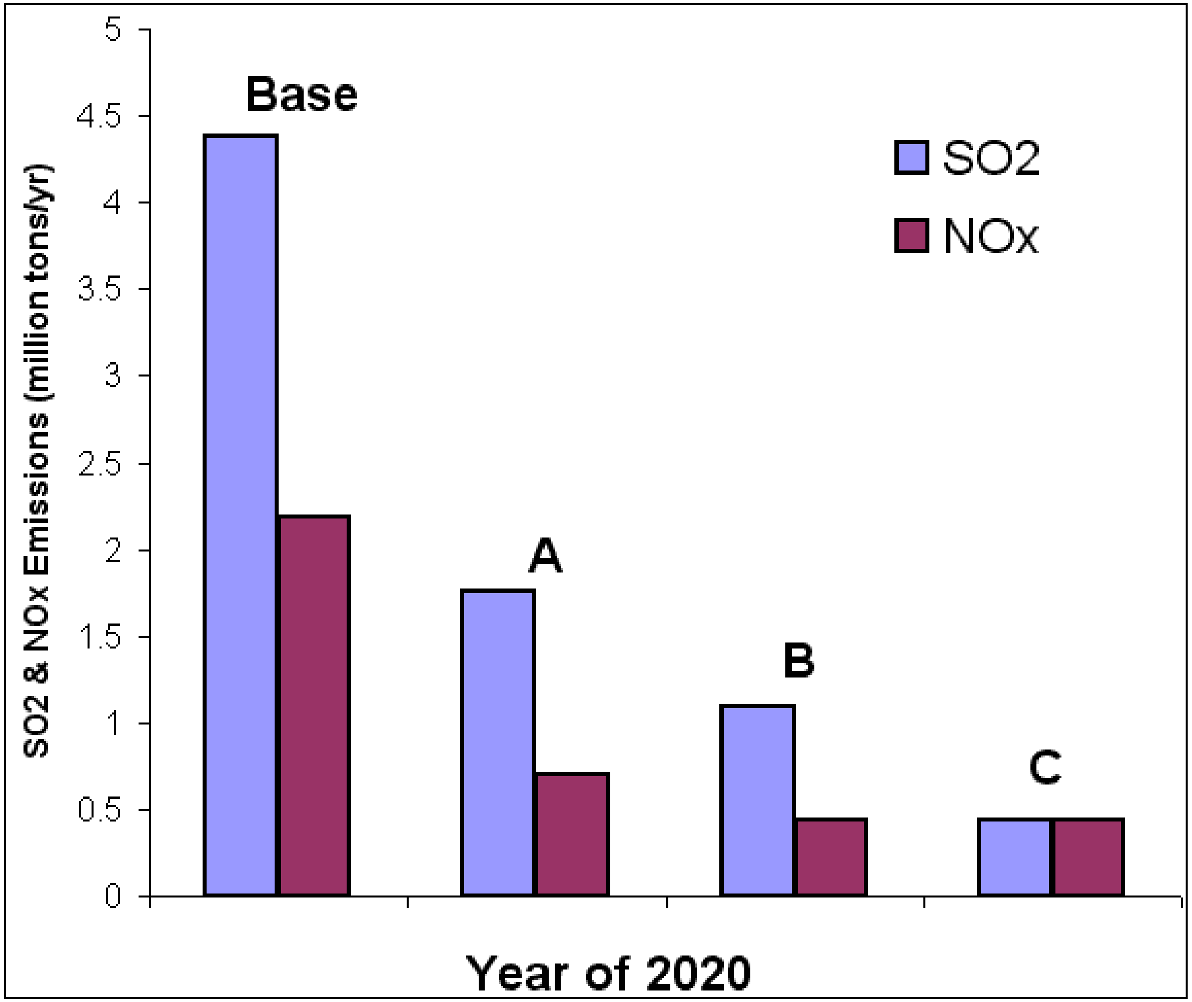
Critical Loads



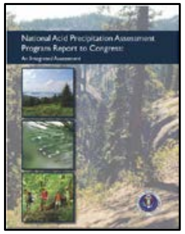
- First NAPAP report to extensively discuss CLs
- Case studies steady-state CLs
  1. ADK lakes – 45% lakes in exceedance in 1989-91, 30% in exceedance in 2006-08
  2. Central Appl. Streams – 41% in exceedance in 1989-91, 31% in exceedance in 2006-08
- Report emphasizes value of critical loads as policy-informing tool

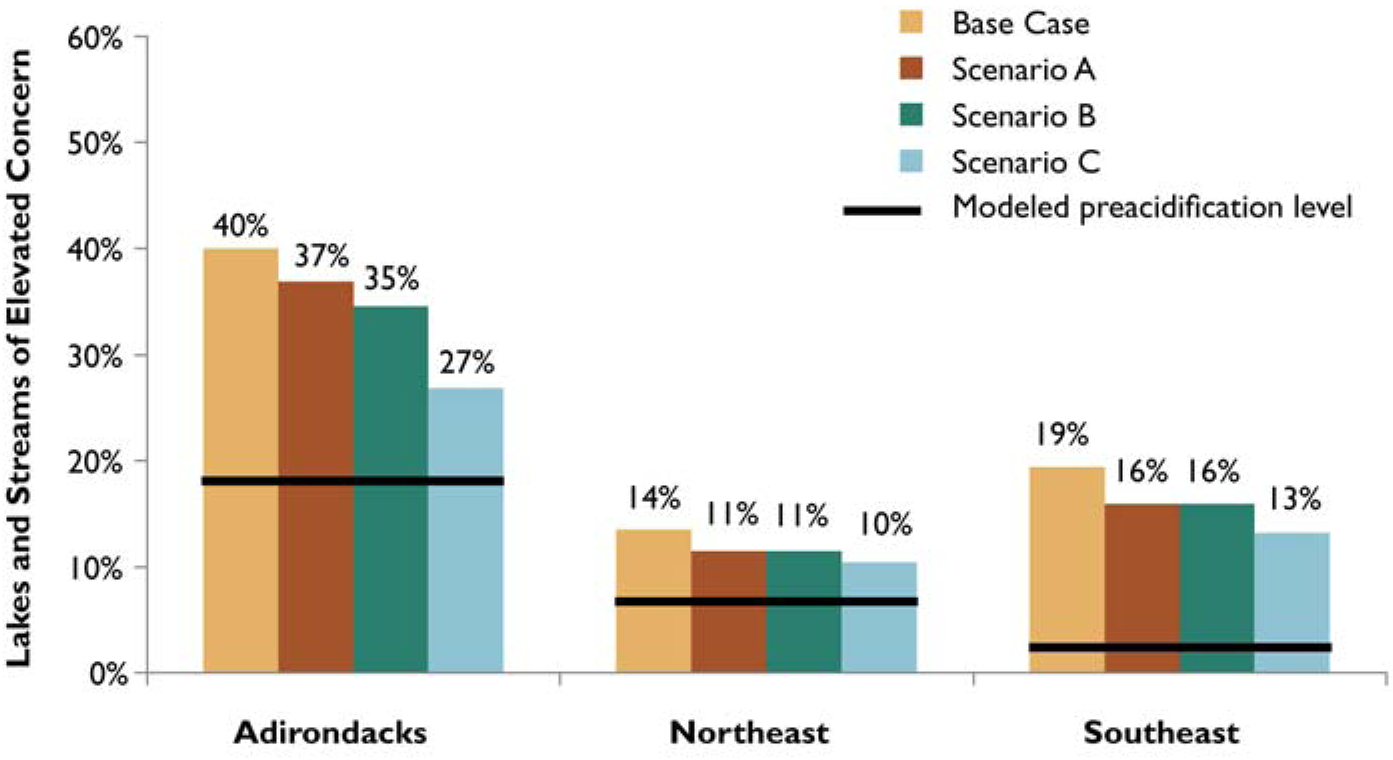
Future Deposition Scenario Modeling to 2020 - MAGIC





Water Bodies with ANC 0 – 50 μeq/L in 2050

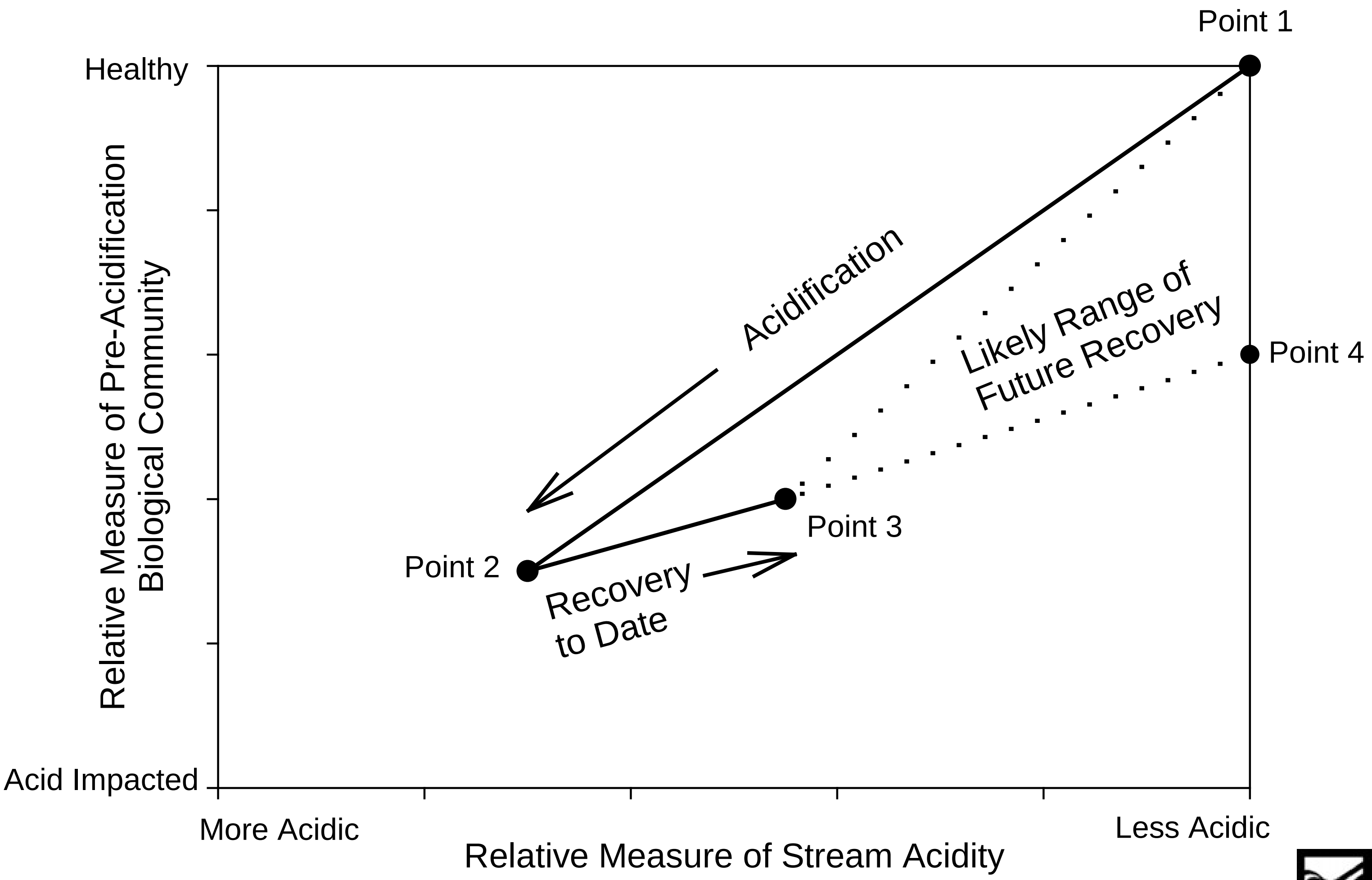




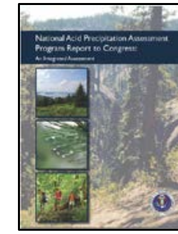
Notes: The area of the Northeast modeled by MAGIC includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York (not including the Adirondacks), and northeastern Pennsylvania. The area of the Southeast includes Virginia, West Virginia, North Carolina, eastern Tennessee, northern Georgia, and northwestern South Carolina.

The amount of acidification projected in the Base Case scenario includes emission reductions as result of CAIR and other mobile source regulations finalized after 2005.

Ecosystem Recovery - Hysteresis

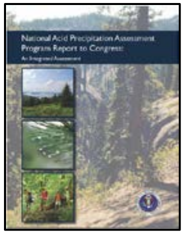


Acid Deposition and Climate Change



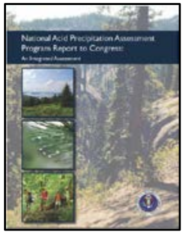
- Challenging to make quantitative predictions – numerous interactions
- **Temperature** sensitive biogeochemical processes
- **Water**/moisture availability – rapid oscillations
- Role of **N deposition** as regulator of C uptake
- Climate change will be another **source of stress** to ecosystems
- Global change should be considered in future forecasts of S and N deposition effects

Conclusions



- Large decreases in S and N emissions and deposition since implementation of Title IV
- Ecosystems beginning to recover – time lags, soil base cation loss, hysteresis
- Deposition still in excess of critical load in many sensitive regions
- Continued decreases in deposition needed to spur more widespread recovery

Final Thoughts



- Thank the following for support:
  - Rick Haeuber – US EPA
  - Mark Nilles – USGS
  - Tamara Blett – NPS
  - Rick Artz - NOAA
- This is likely the final NAPAP report and the end of NAPAP