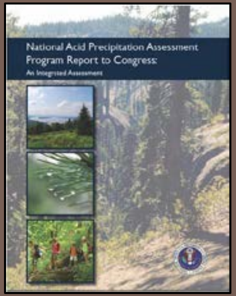
THE 2011 NATIONAL ACID PRECIPITATION ASSESSMENT PROGR REPORT TO CONGRESS

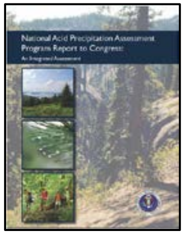


Douglas Burns, Jason Lynch,

Jack Cosby, Mark Fenn, Jill Baron,

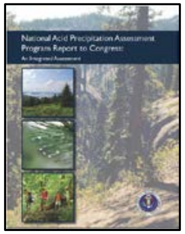
U.S. EPA Clean Air Markets Division

Status of Report



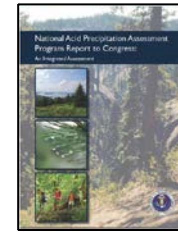
- Fifth NAPAP report(s) – previous in 2005
- Through peer review and review by Air Quality Research Subcommittee of Committee for Environ., Natural Resour. and Sustainability
- Currently with Office of Science and Technology Policy for final review
- Hopeful of late 2011 publishing date

Content



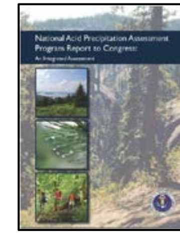
- Executive Summary and Introduction
- Chapter 1 – Overview of Acid Rain Program, costs and benefits
- Chapter 2 – Trends emissions and deposition, critical loads
- Chapter 3 – State-of-science, ecosystem effects of acid deposition
- Chapter 4 – Modeling future ecosystem effects, emissions/deposition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

Acid Rain Program (ARP)



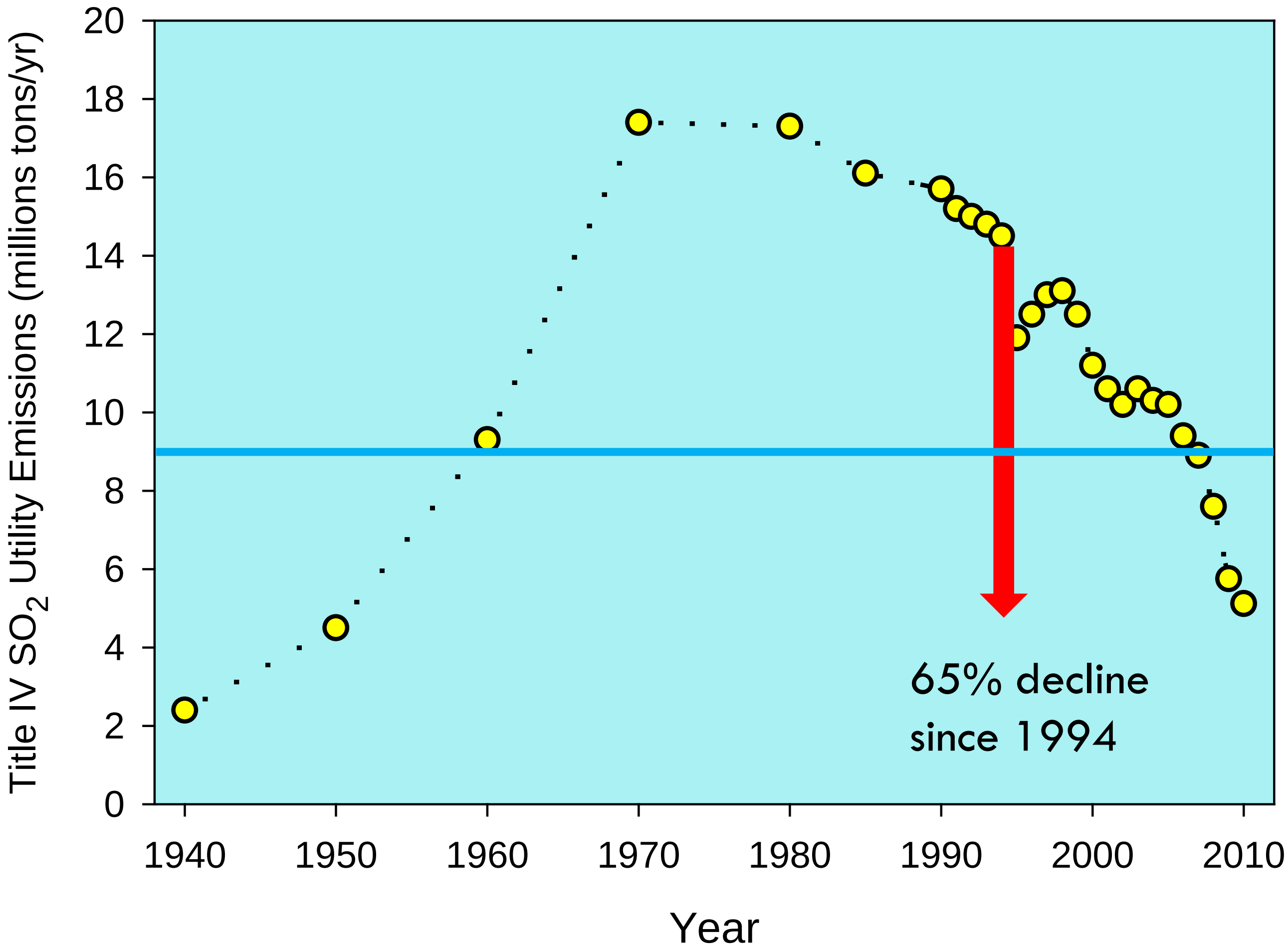
- EPA program that implements Title IV 1990 Clean Air Act Amendments
- SO_2 – Cap-and-trade, 8.95 Mt cap by 2010
- NO_X – Traditional emissions control, averaging
- Human health benefits – $174 to $427 billion/yr in 2010, primarily PM2.5 and secondarily O_3
- Costs – $1 to $3 billion/yr

Additional Benefits of ARP

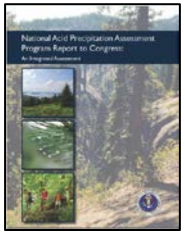


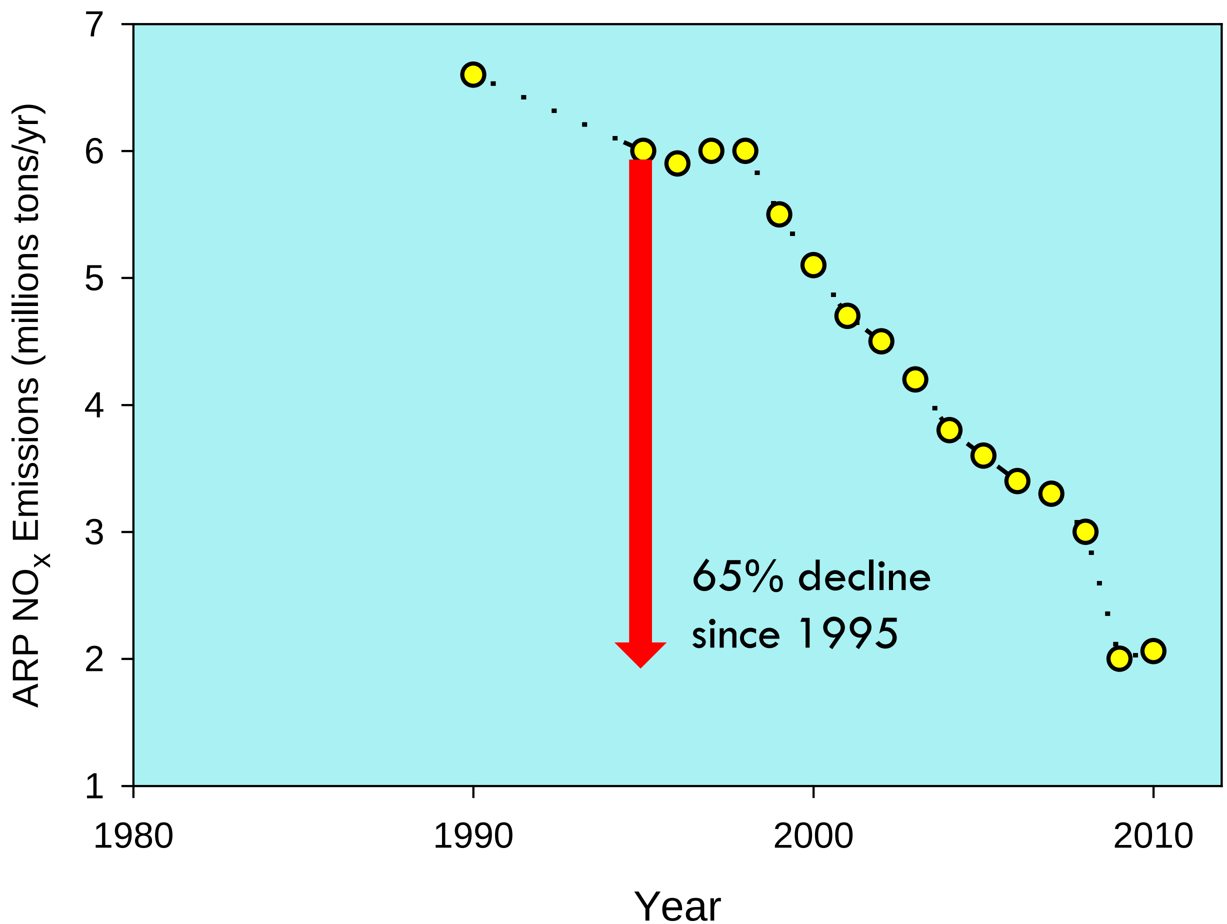
- Ecological and visibility improvement benefits not well quantified
- Adirondack case study - Banzhaf et al., 2006, ecological benefits of \$336 - \$749 million/yr
- Recent EPA study - visibility benefits \$40 billion/yr
- More research needed to better quantify complete set of benefits – ecosystem services

SO_2 Emissions

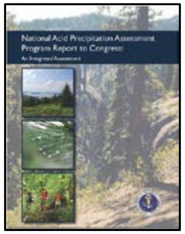


NO_x Emissions

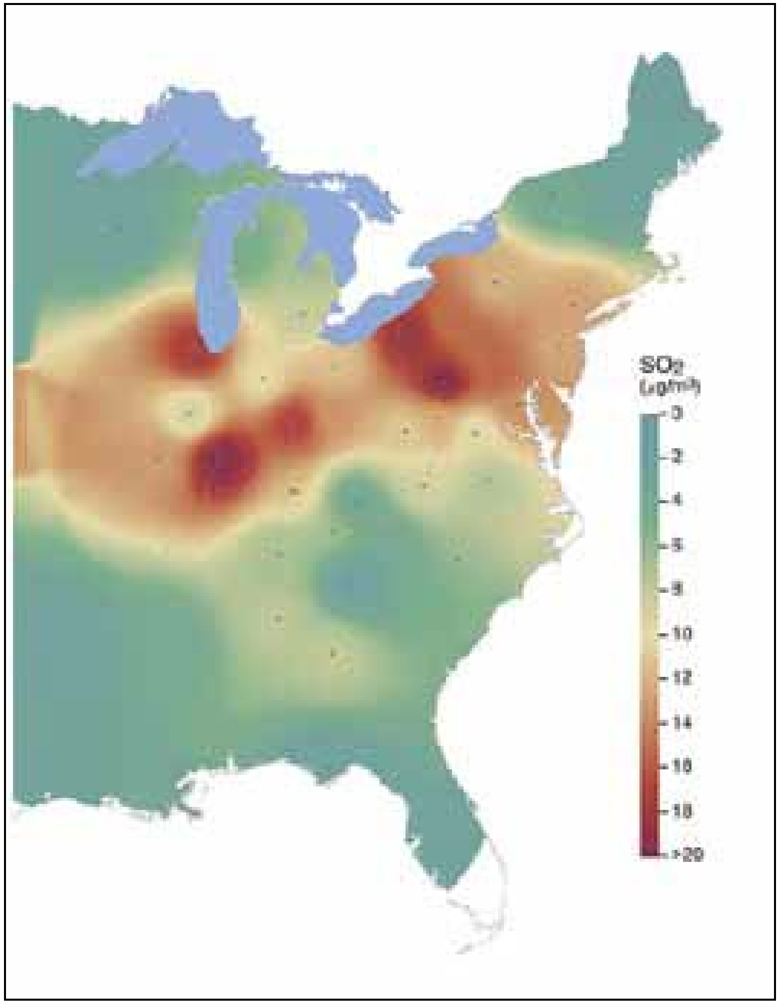




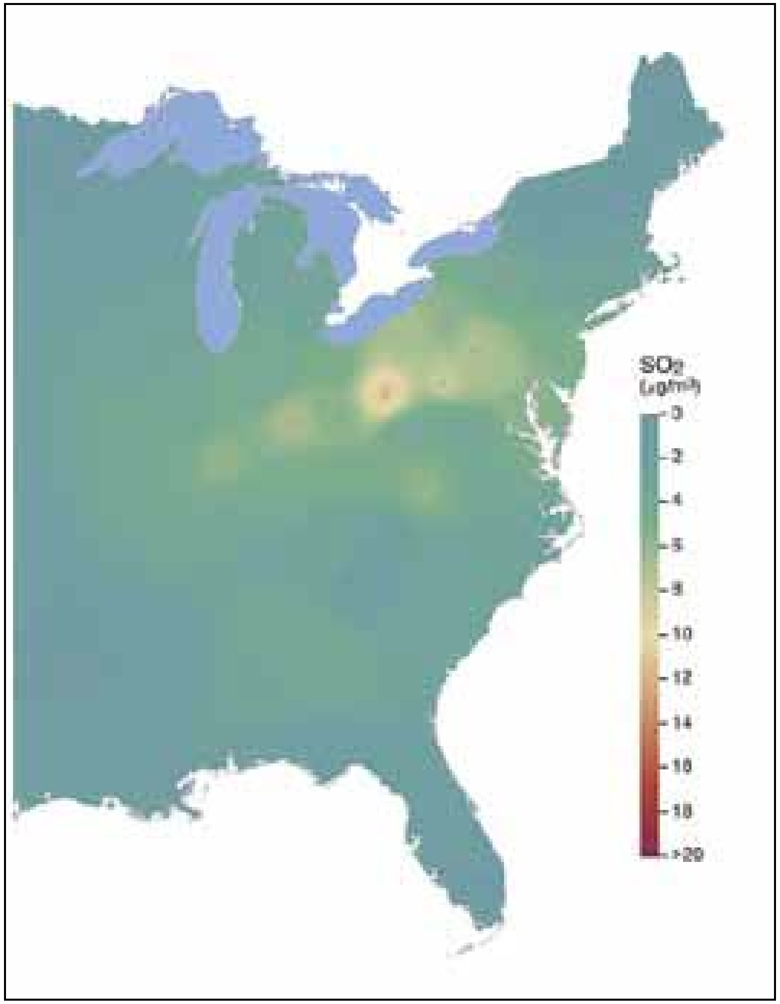
Air Quality – Ambient SO_2



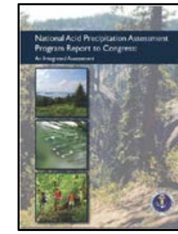
1989-91



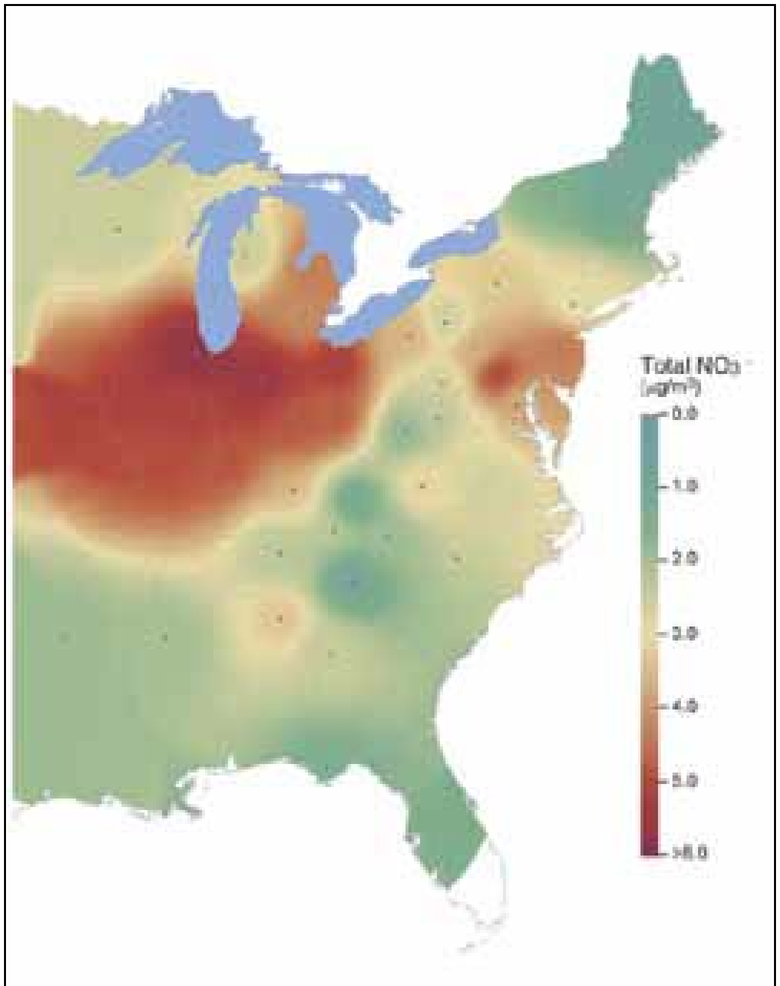
2007-09



Air Quality – Ambient NO_3



1989-91



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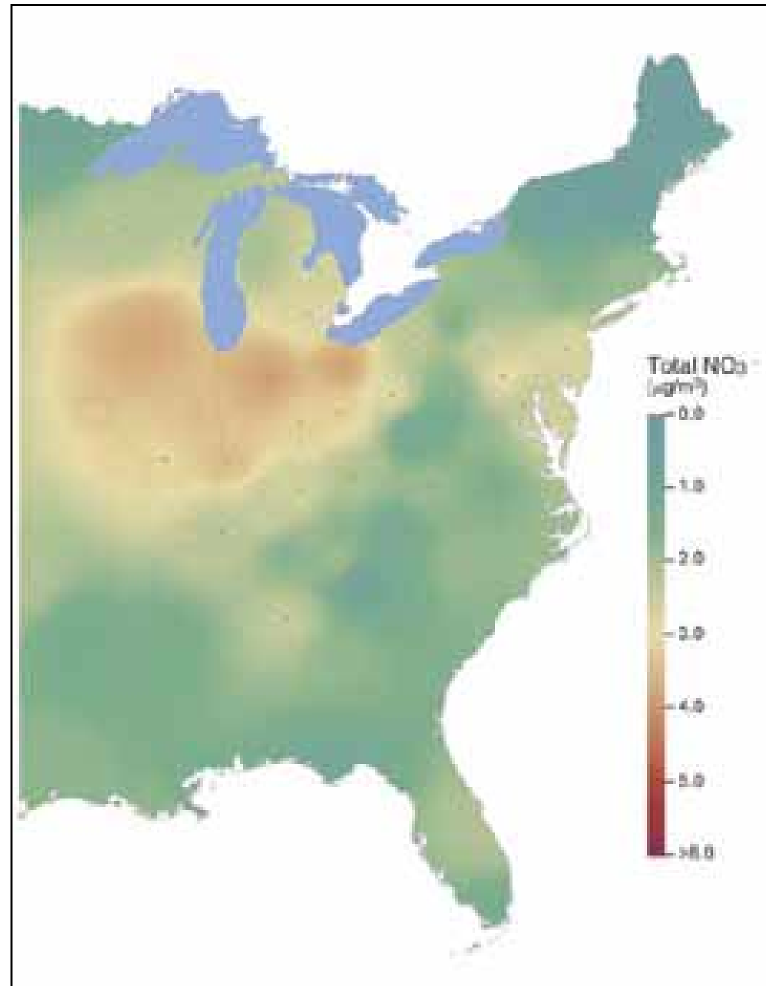
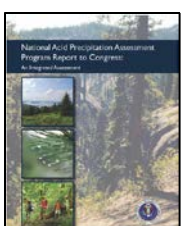
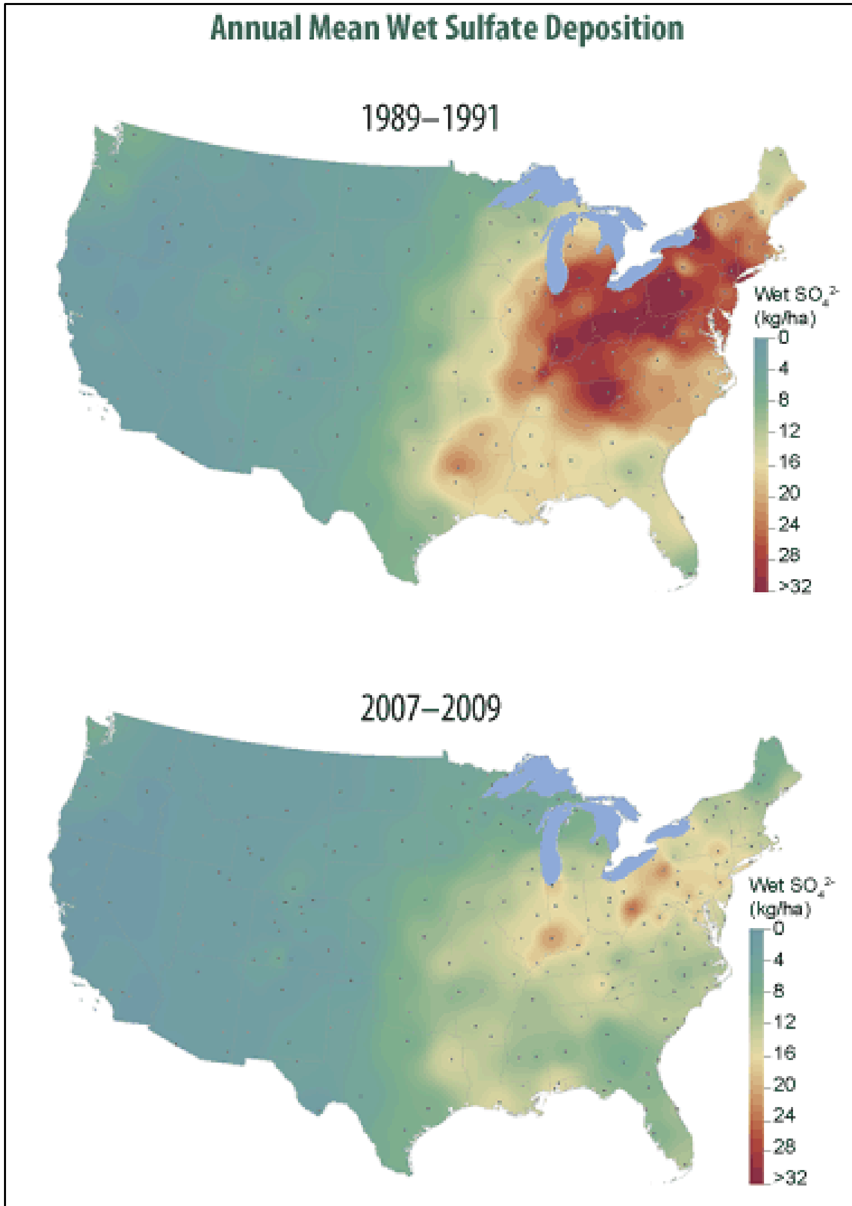


Wet Deposition SO_4^{2-}

40%+ decline since early 1990s



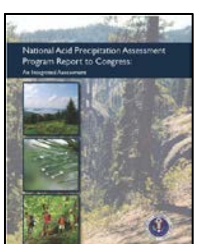


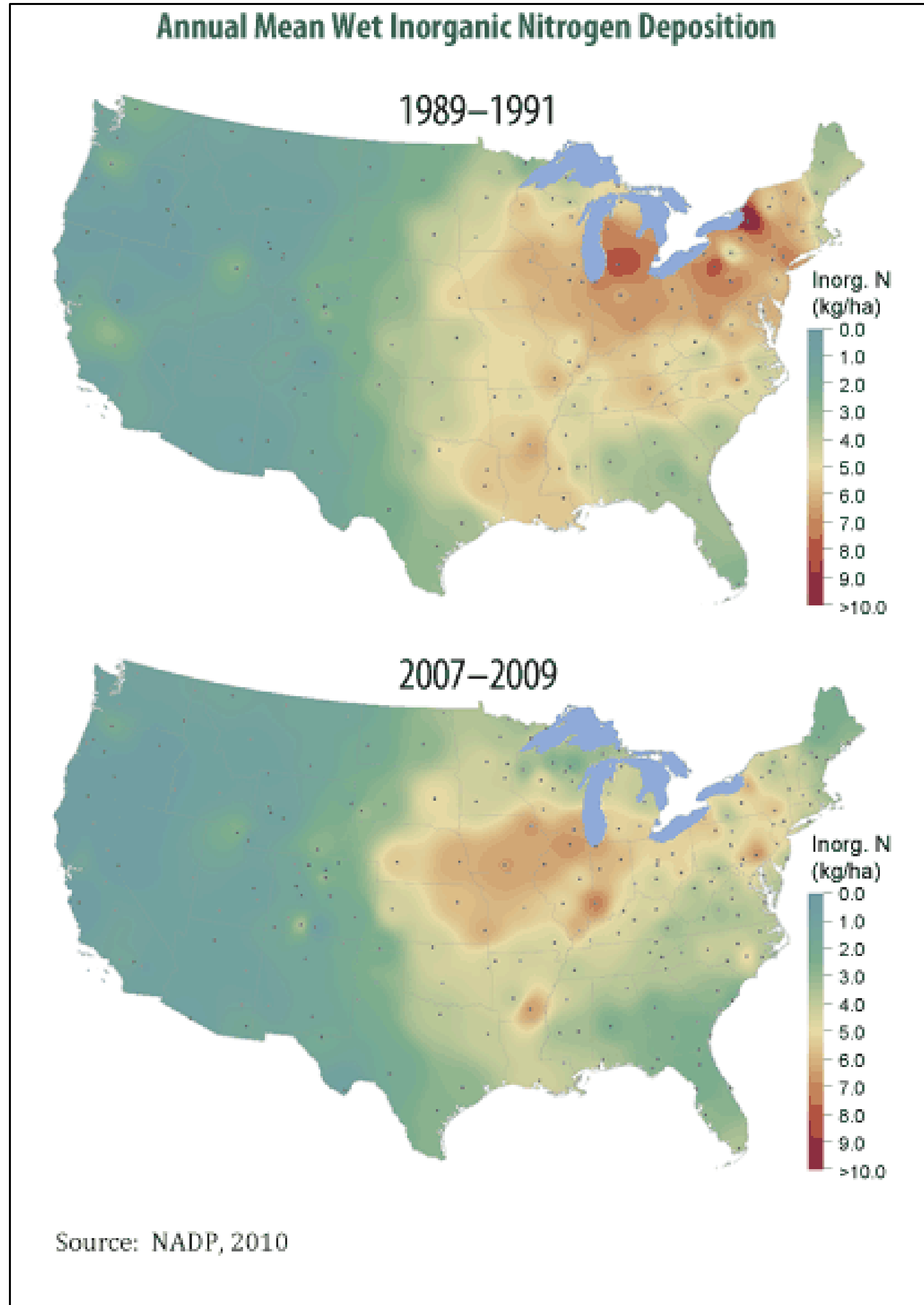
Source: NADP, 2010

Wet Deposition Inorganic N

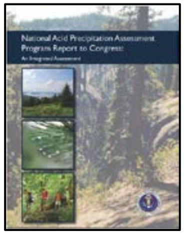
20% to 25% decline since early 1990s except mid-west

Role of NH_3/NH_4^+



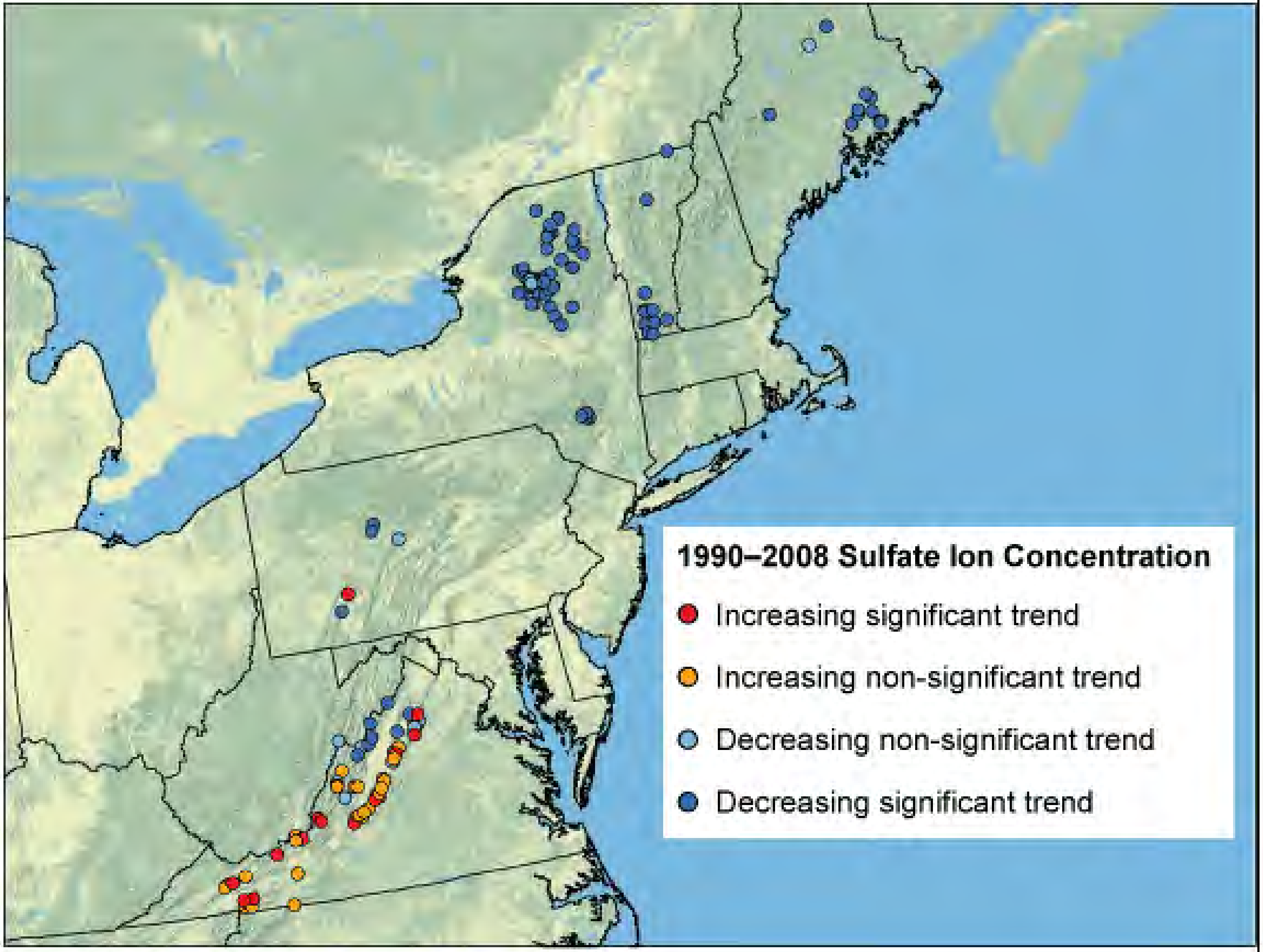


Ecosystem Recovery



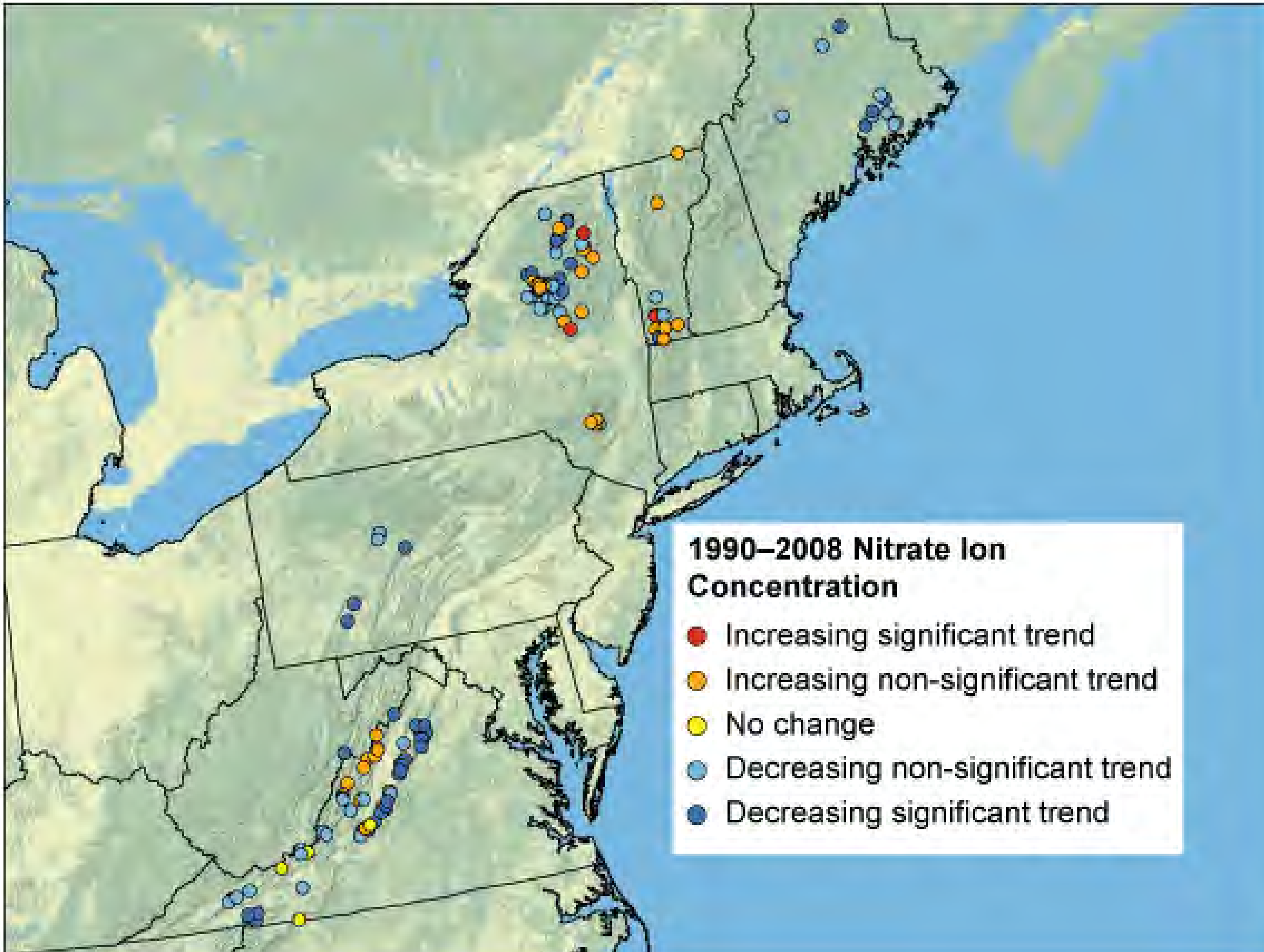
- More complex and nuanced story
- Aquatic ecosystems
  1. SO_4^{2-} decreasing everywhere except SE
  2. NO_3^- decreases at many sites, but less than SO_4^{2-} and no decreases at some sites
  3. ANC – increasing in NE, but not in SE
- Terrestrial ecosystems – most studies show no recovery, continued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



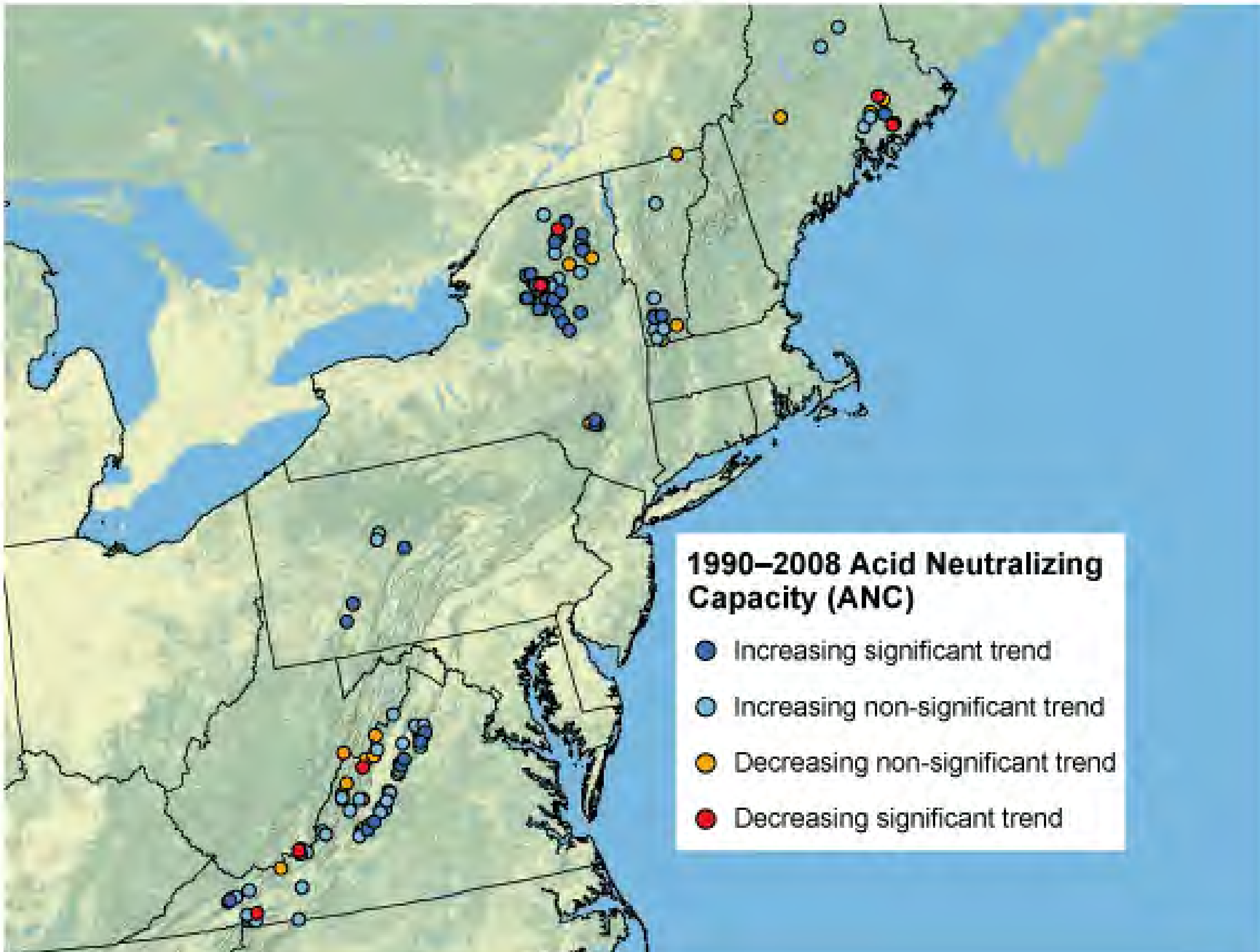
Source: EPA, 2010

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



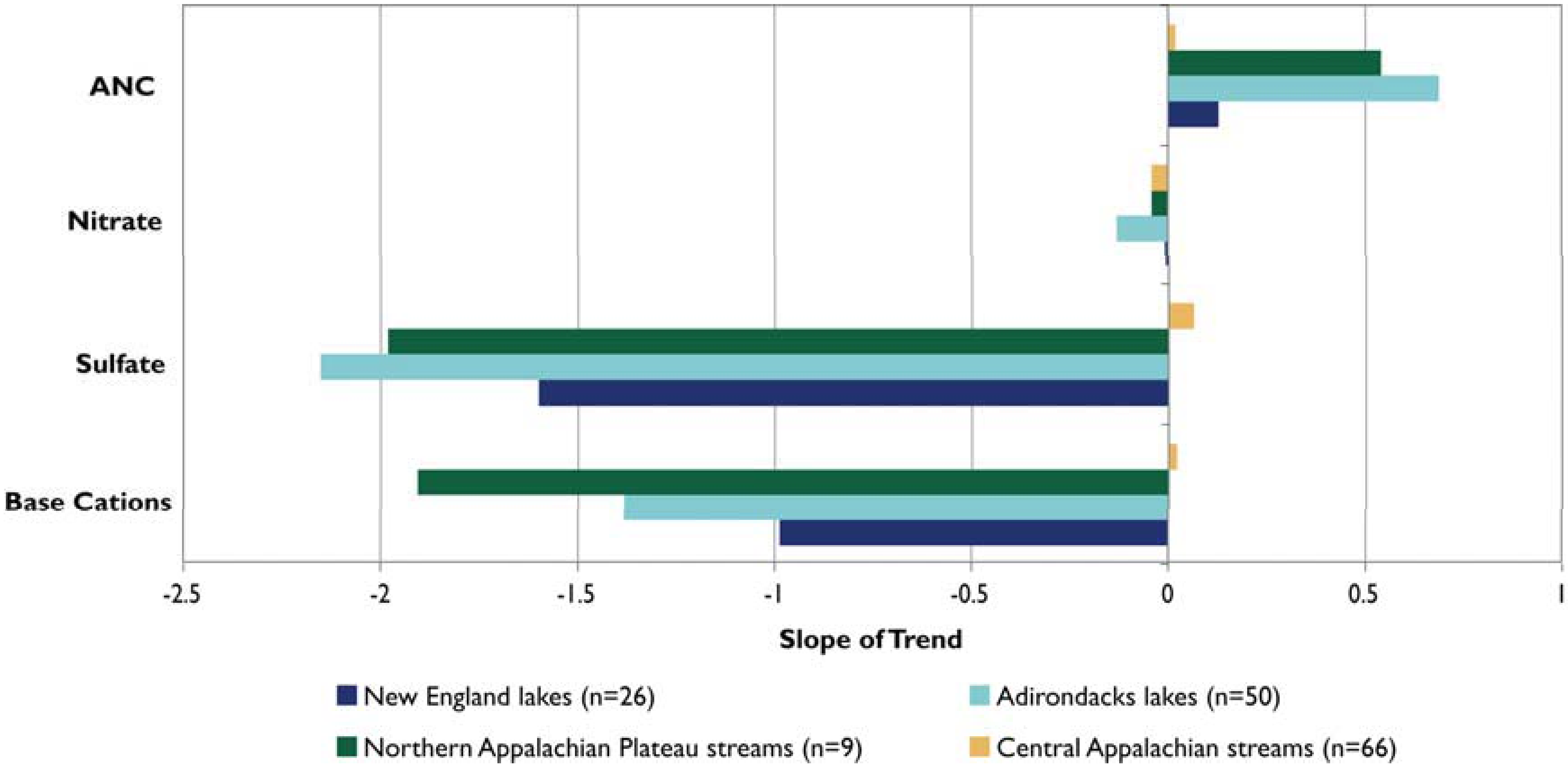
Source: EPA, 2010

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

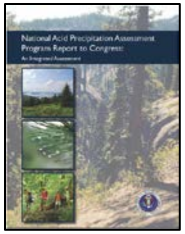


Source: EPA, 2010

Trend Magnitude by Region

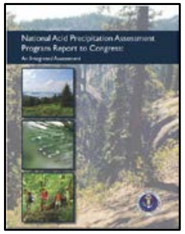


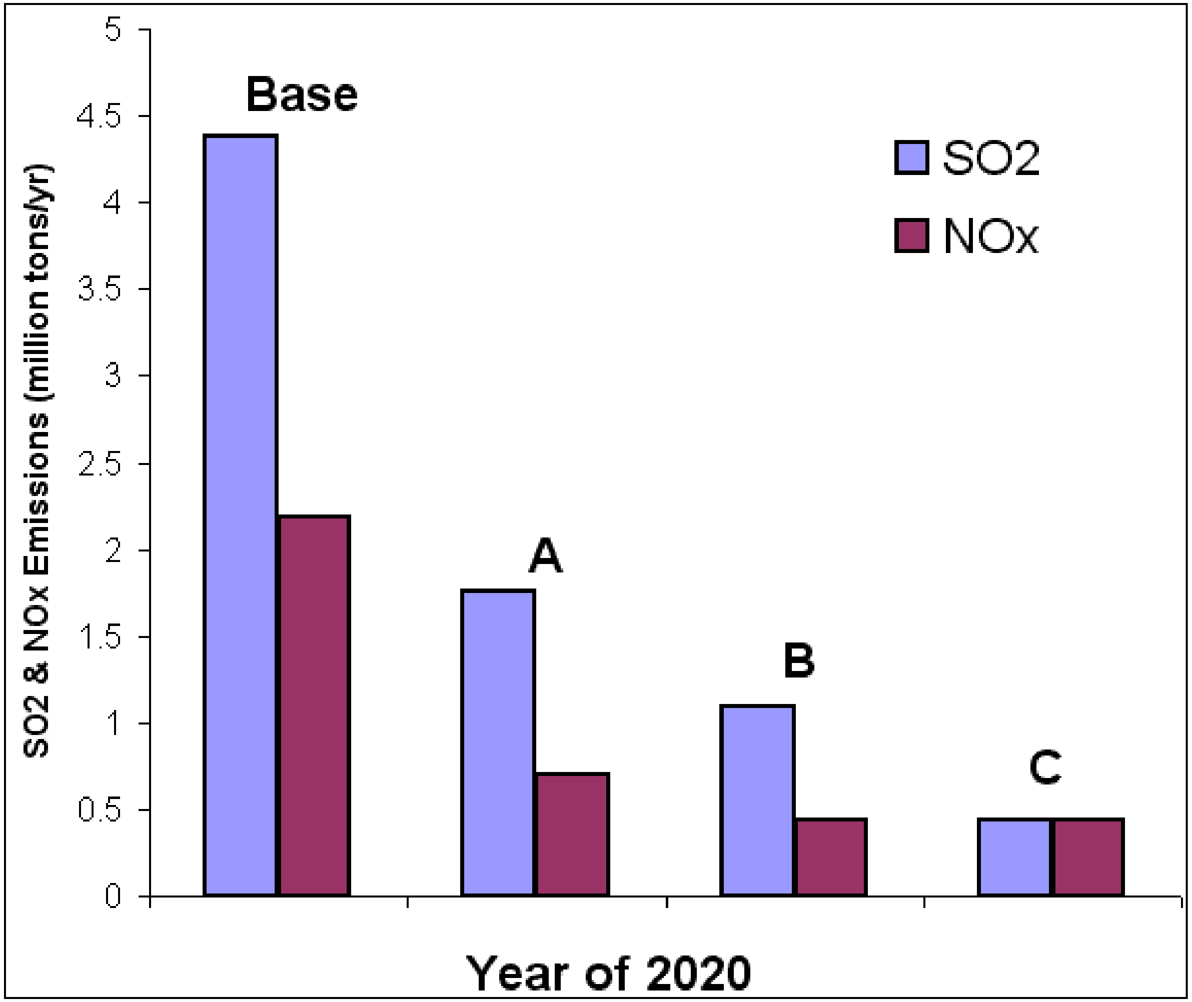
Critical Loads



- 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
- Report emphasizes value of critical loads as policy-informing tool

Future Deposition Scenario Modeling to 2020 - MAGIC

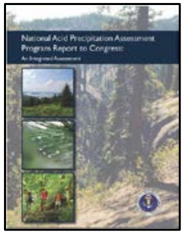


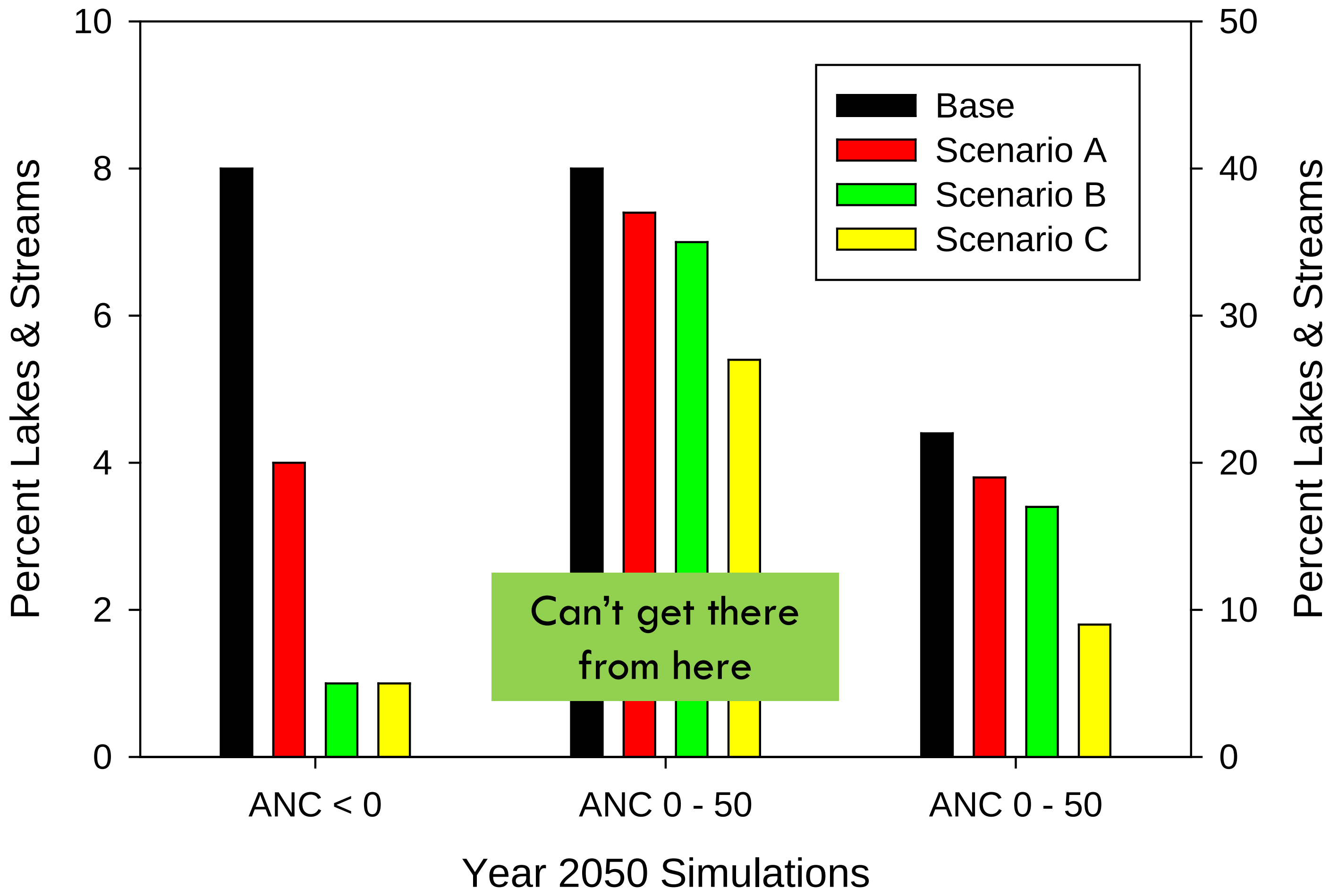


NAPAP

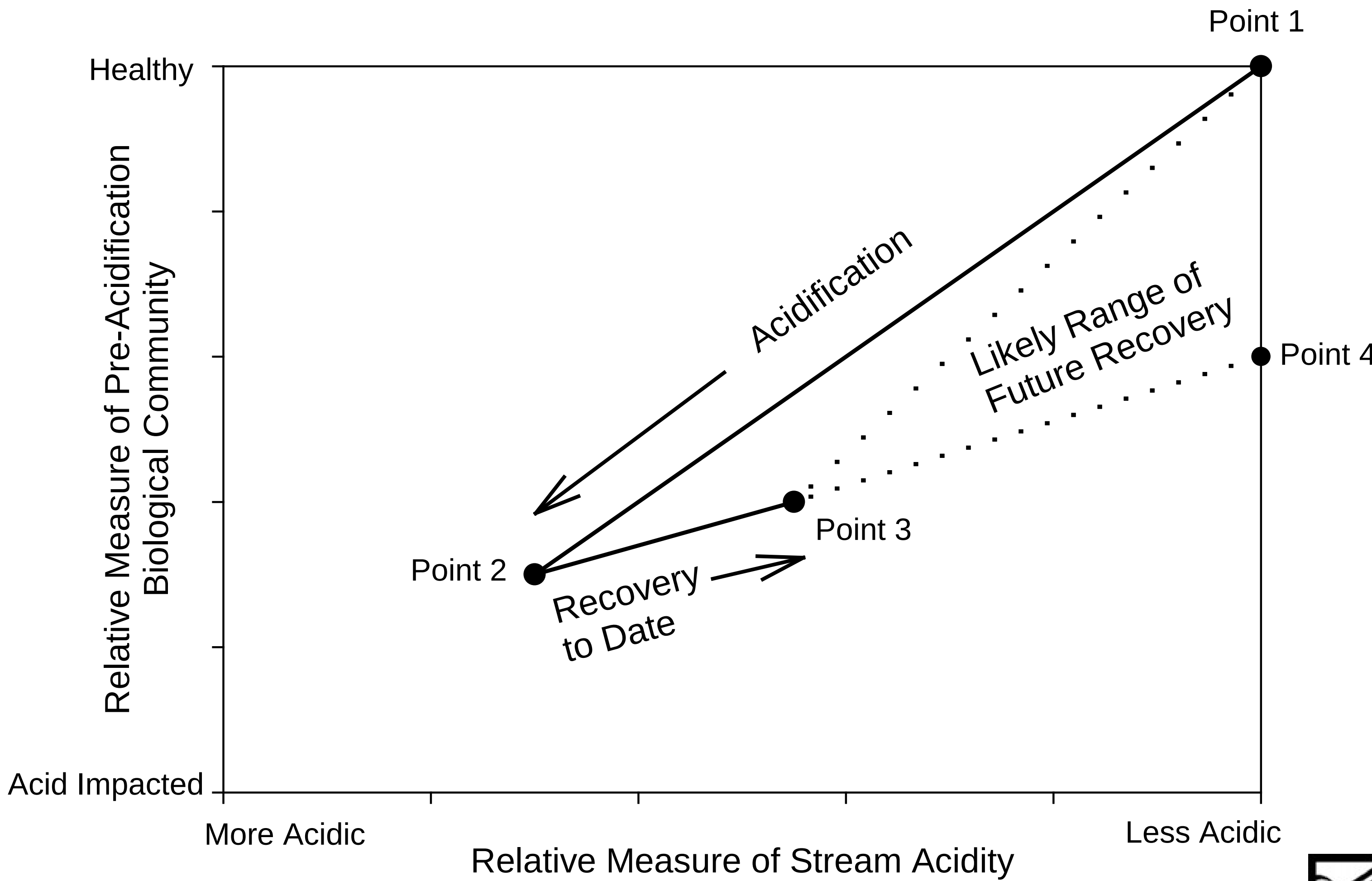
USGS
science for a changing world

Model Results – Year 2050





Ecosystem Recovery - Hysteresis



Acid Deposition & 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 another **source of ecosystem stress**
- Global change should be considered in future forecasts of S and N deposition effects

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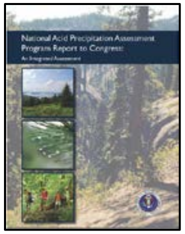
Take Home Messages



- Title IV of CAA a huge success – goals have been exceeded
- Ecosystems – not there yet
  - Aquatic – chemistry recovering
  - Terrestrial – no evidence of recovery, little data available

- A more in-depth discussion of recovery would be helpful – expectations, restoration needed?, climate change

Cross-State Air Pollution Rule

- Rule finalized by EPA July 6, 2011
- Implementation would begin Jan. 1, 2012 – fully implemented by 2014
- Affects SO_2 and NO_x emissions in 27 states
- SO_2 emissions reduced by 73% (2005)
- NO_x emissions reduced by 54% (2005)
- Most similar to Scenario A from NAPAP report – emissions reductions less, but faster