Colorado Department of Public Health and Environment

RMNP 2012 NITROGEN DEPOSITION MILESTONE REPORT

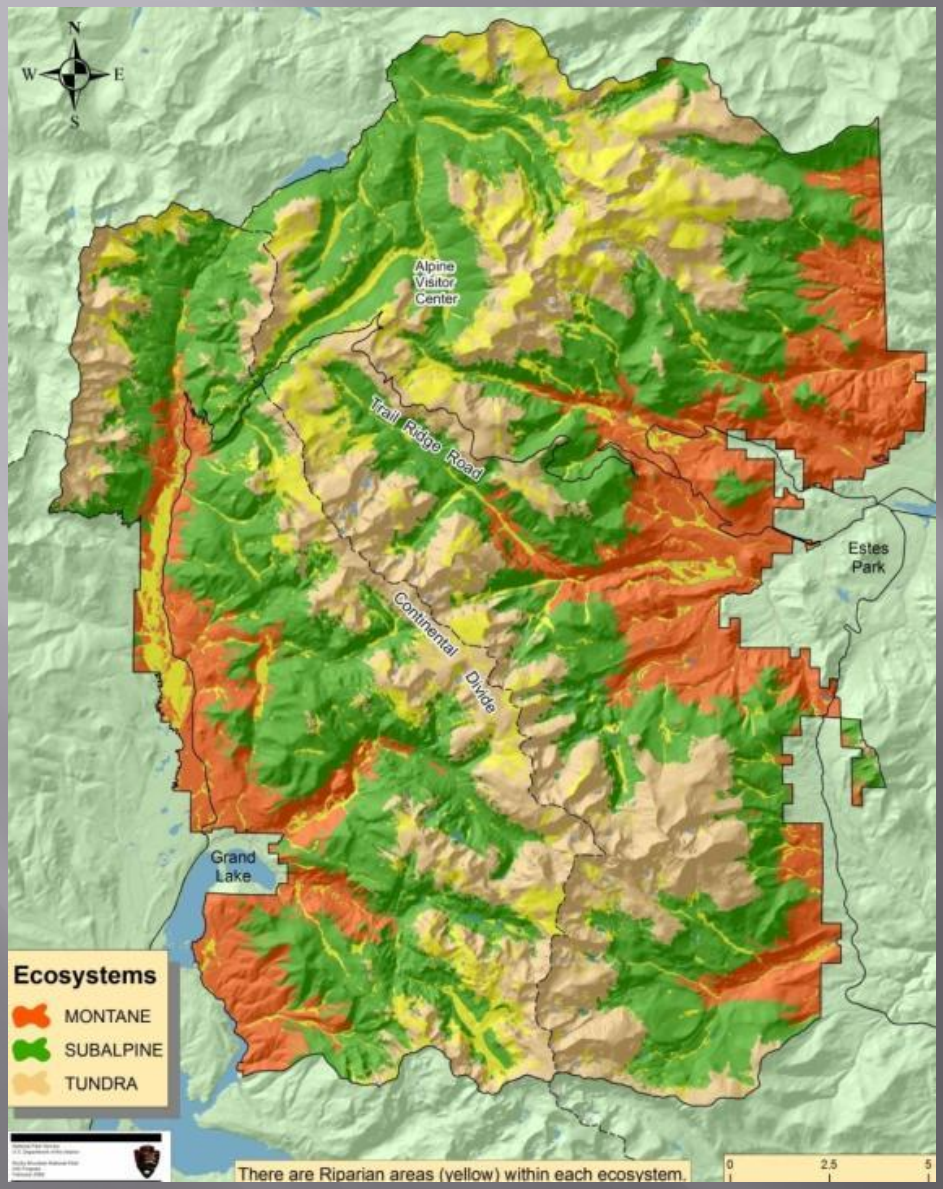
Stakeholder Meeting Presentation

February 12, 2014

Outline

- Background of RMNP Initiative
- Purpose & goals of 2012 Milestone Report
- Report details:
  - Critical load & glidepath
  - Weight of the evidence approach
  - Deposition trends
  - Source category & attribution analyses
  - Emission inventories, trends and studies
  - Current and future emission reduction activities
  - RMNP emissions and controls
  - Conclusions and next steps

Background



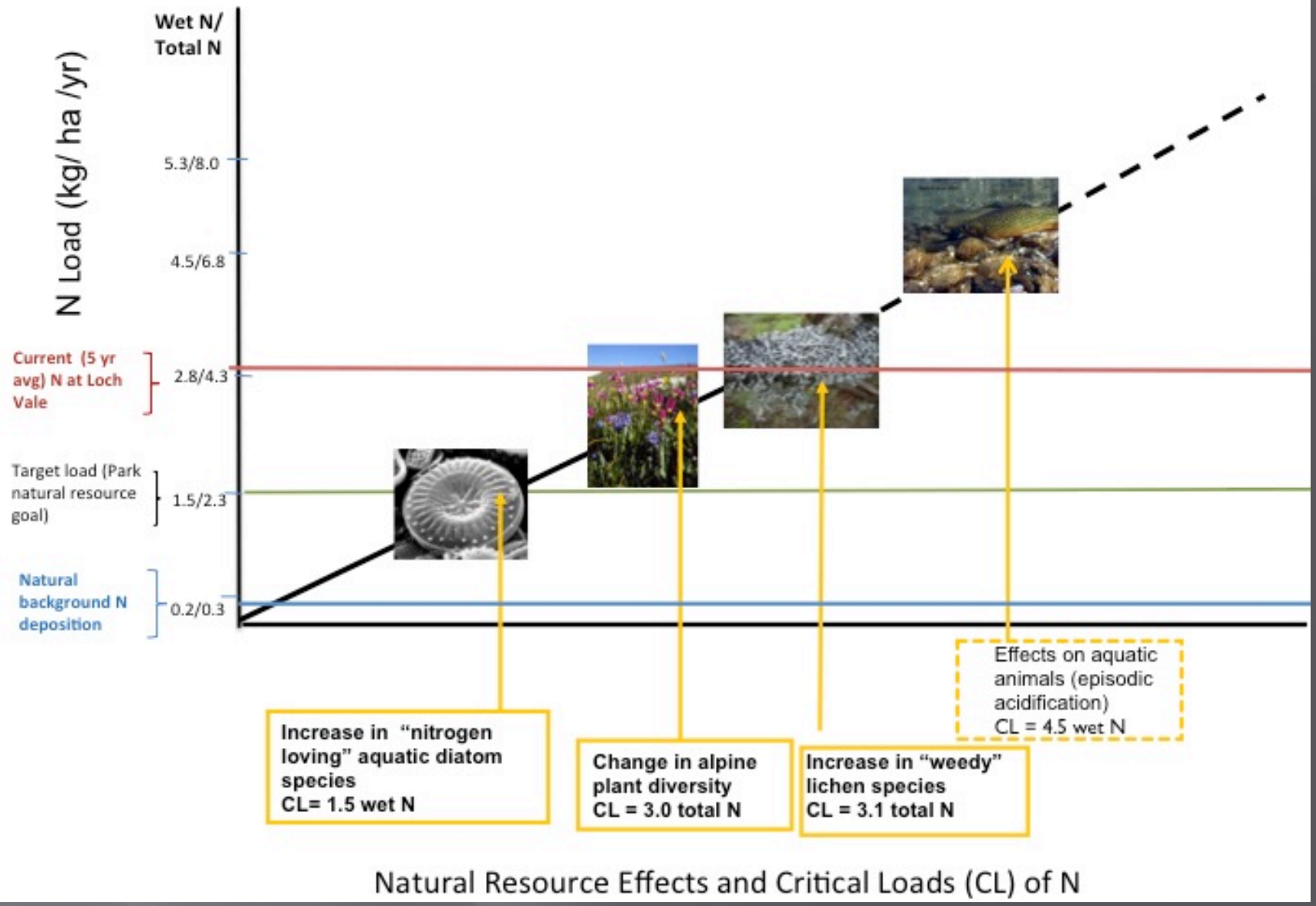
- Interagency effort addresses air pollution issues in RMNP
  - Focus on nitrogen deposition trends
  - CDPHE, EPA, NPS
- Nitrogen Deposition Reduction Plan – 2007
- Contingency Plan - 2010

Critical Load

- **Large body of evidence indicates nitrogen deposition has affected and continues to affect ecosystems within the park.**
  - **Current wet deposition monitored at ~2.9 kg N/hectare/yr (rolling 5-year average)**
  - **Natural background estimated at 0.2 kg N/ha/yr**

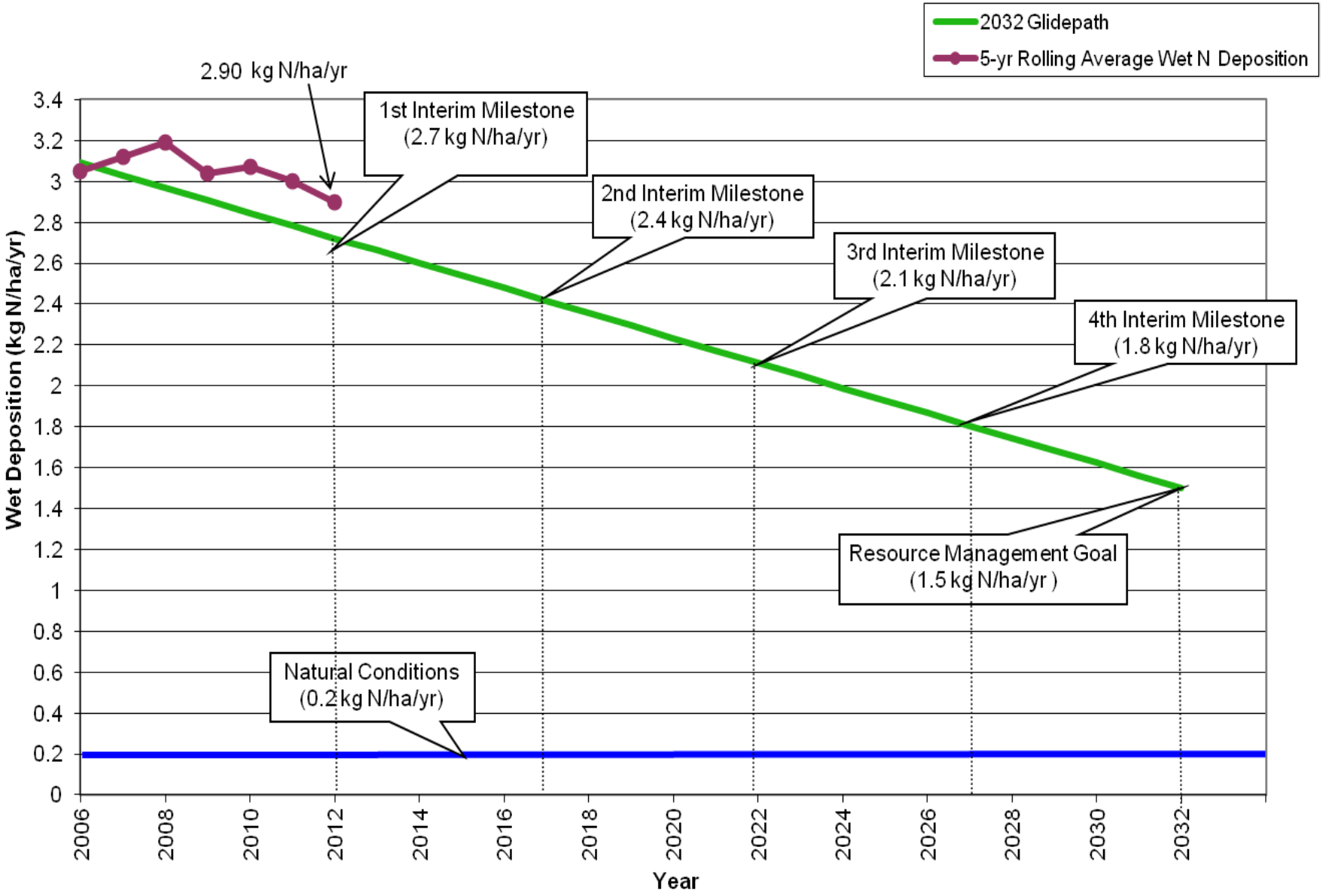
- **Specific, published (peer-reviewed) research has shown that wet deposition levels at the time the biological changes started to occur was ~1.5 kg N/ha/yr.**

Rocky Mountain NP: Continuum of Ecological Effects from Nitrogen Deposition



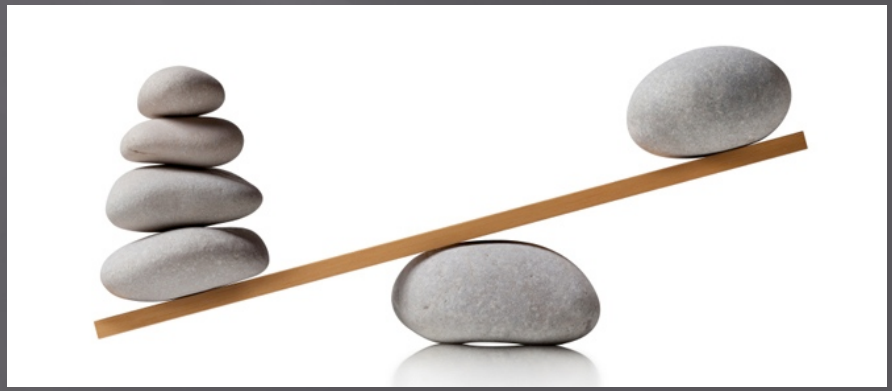
Natural Resource Effects and Critical Loads (CL) of N

Glidepath and Current Wet Nitrogen Deposition
Rocky Mountain National Park



Weight of the Evidence Approach

- Assessment of multiple evidence types
- Two main goals:
  - 2012 Nitrogen Deposition Interim Milestone met?
  - Will the RMNP Nitrogen Deposition Contingency Plan be triggered?
- Qualitative Process



Types of Evidence

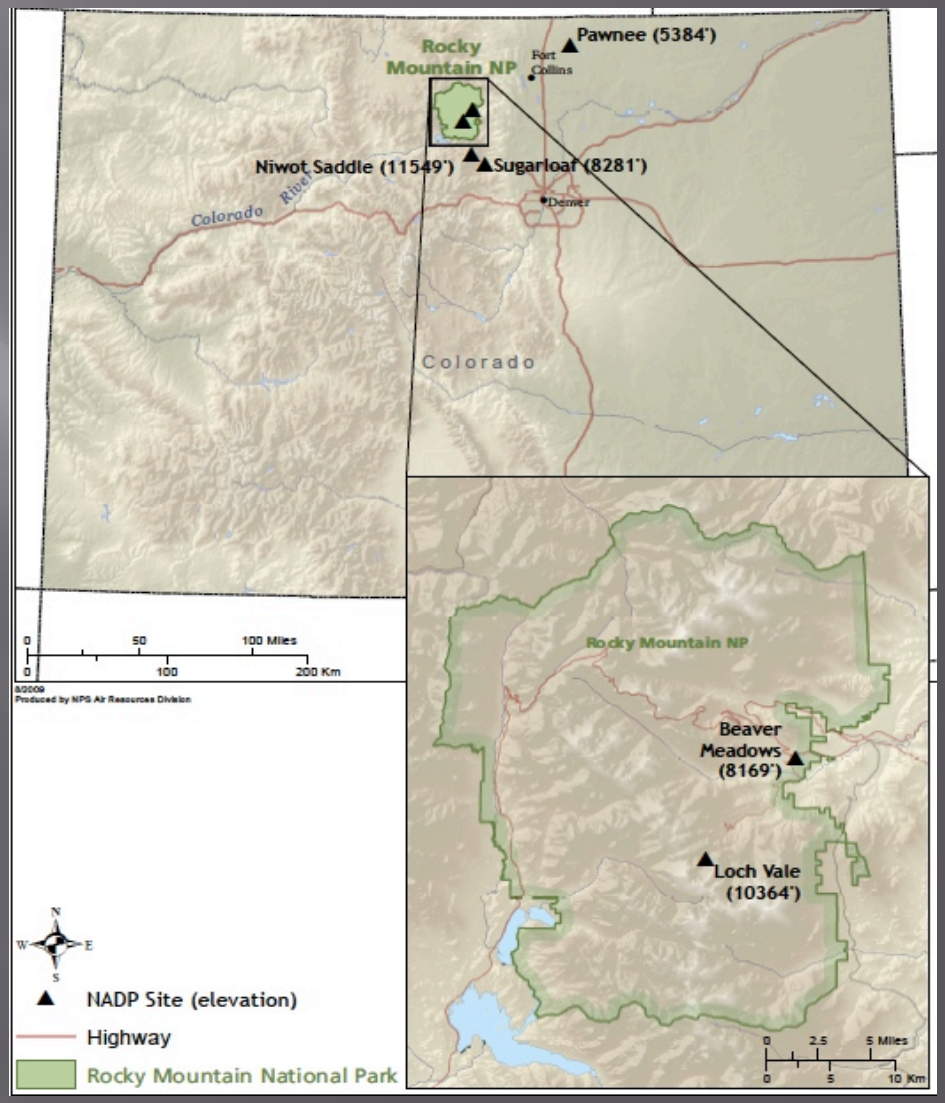
- Deposition patterns and trends on regional and national levels;
- Source category and attribution analyses and studies;
- Emission inventories, including significant source categories;
- Emission trends using several different techniques, including modeling, monitoring, and other scientific assessments;

Types of Evidence

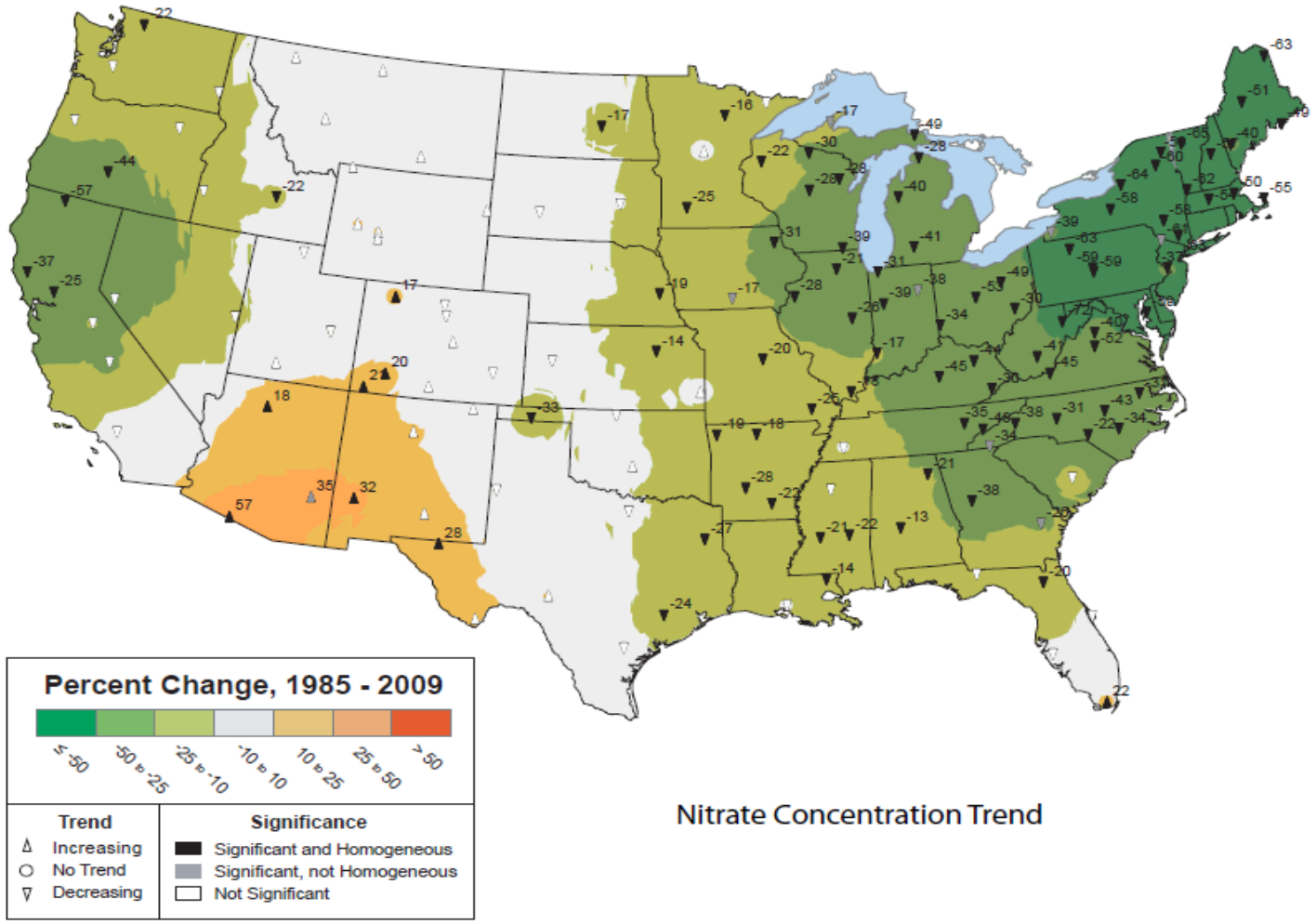
- Current and future emission inventory improvements;
- Demographic trends;
- Current and future emission reduction activities, including a discussion regarding regulatory vs. voluntary approaches;
- Ammonia-focused projects from both local and national perspectives; and
- In-park emissions and reduction activities.

Deposition Trends and Patterns

- Trend at Loch Vale shifted from increasing to stable
- Nitrate regional trend stable over long-term, decreasing in short-term
- Ammonia regional trend increasing over long-term, stable over short-term

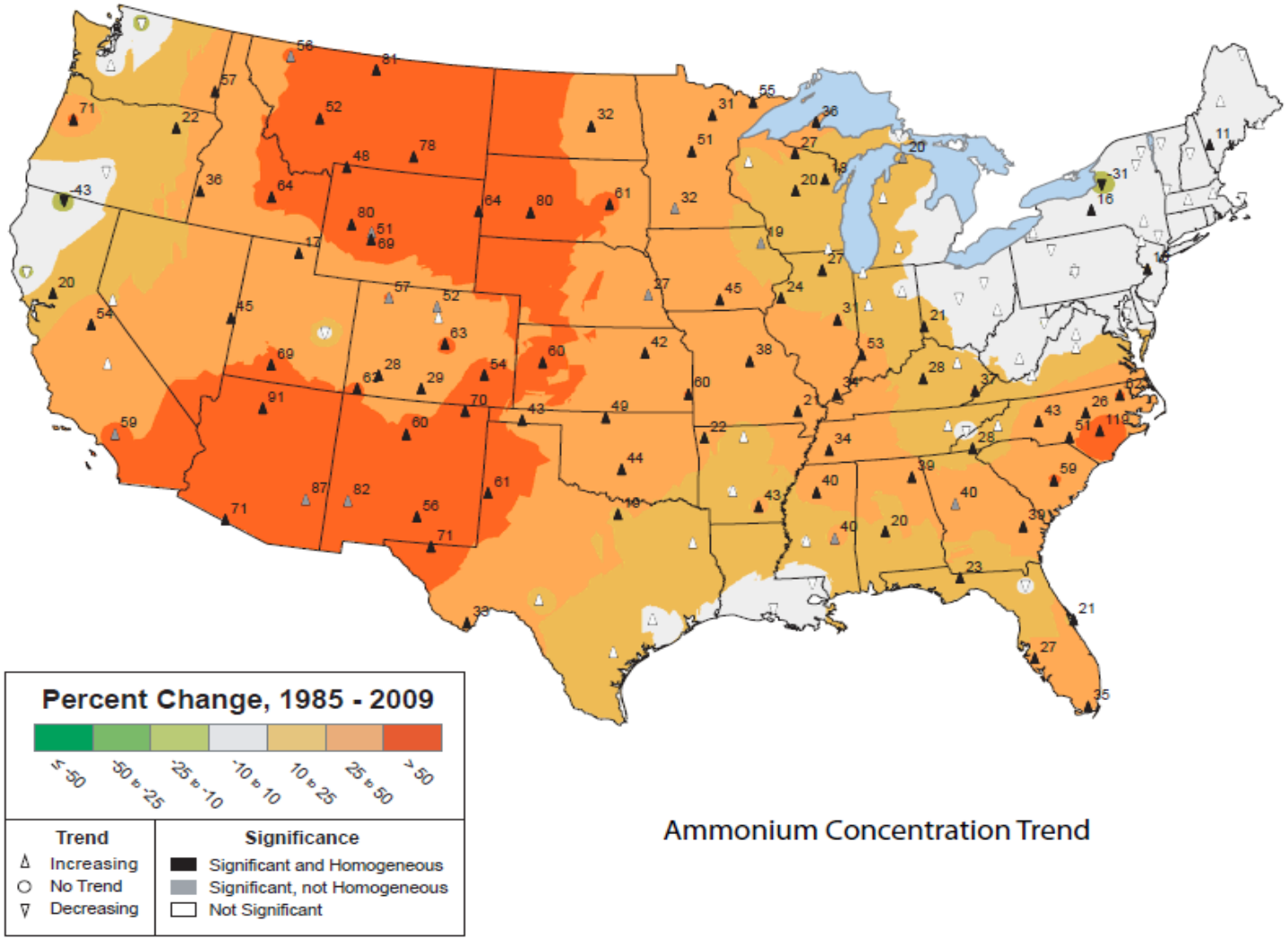


National Deposition Trends



updated from Lehmann et al, 2005

National Deposition Trends



updated from Lehmann et al, 2005

Source Category and Area Attribution Analyses

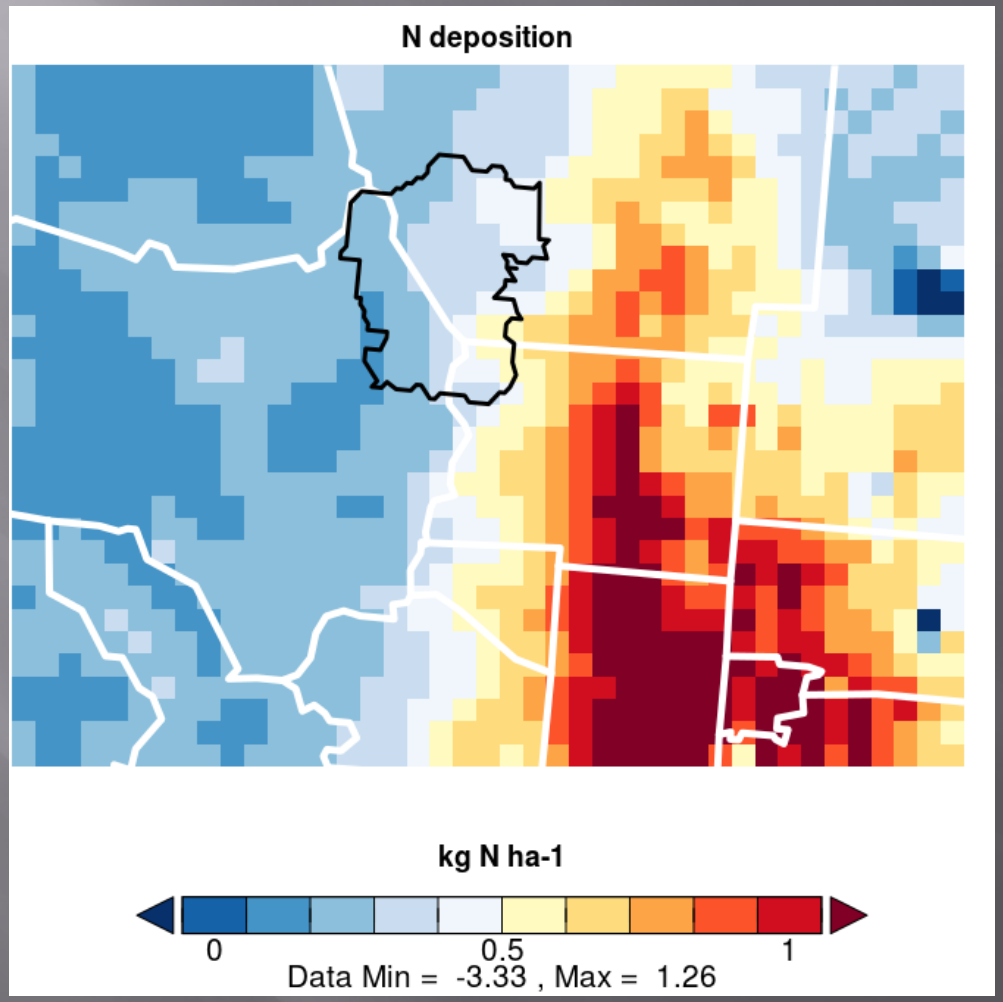
- Primary and secondary particulate contributions
- IMPROVE monitoring
- Flat over long-term
- Downward trend in recent years

- Modeling indicates that volatile organic compound (VOC) emissions are not significant contributor to deposition in RMNP
- Man-made NO_x emissions are significant for secondary particulate formation during spring and fall

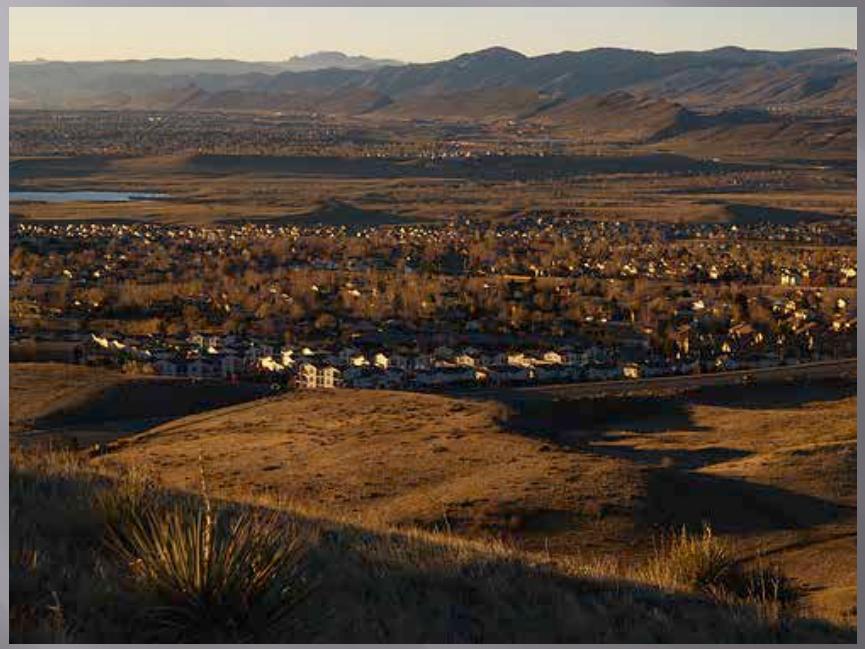
RoMANS I & II Conclusions

- Substantial portion of deposited nitrogen originates in Colorado
- Ammonia / ammonium sources
  - Greater than 50% from Colorado
- Nitrogen oxide (NO_x) sources
  - Less than 50% from Colorado
- During spring and fall events, high concentrations of both types of nitrogen move from eastern urban & agricultural areas of Front Range
- Local sources of ammonia not significant contributors to deposition in RMNP

Effects of Planned NO_x Emission Reductions



Demographic Trends

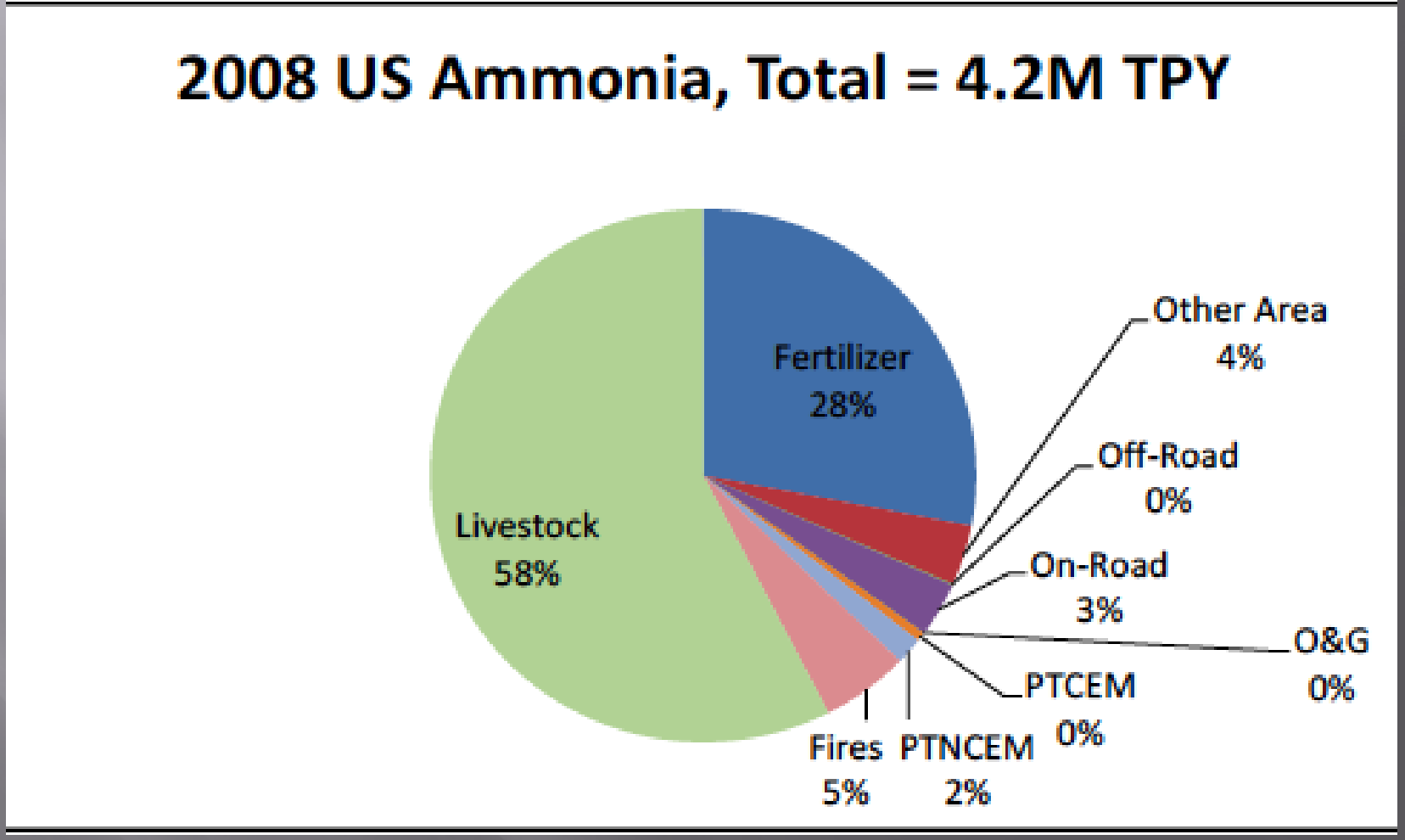


- Small steady increase in Denver Metro population
- Future vehicle miles traveled slightly greater than population increase
- Almost half of population settled in areas not previously urbanized
- Total cattle, farms, and swine remain steady in recent years

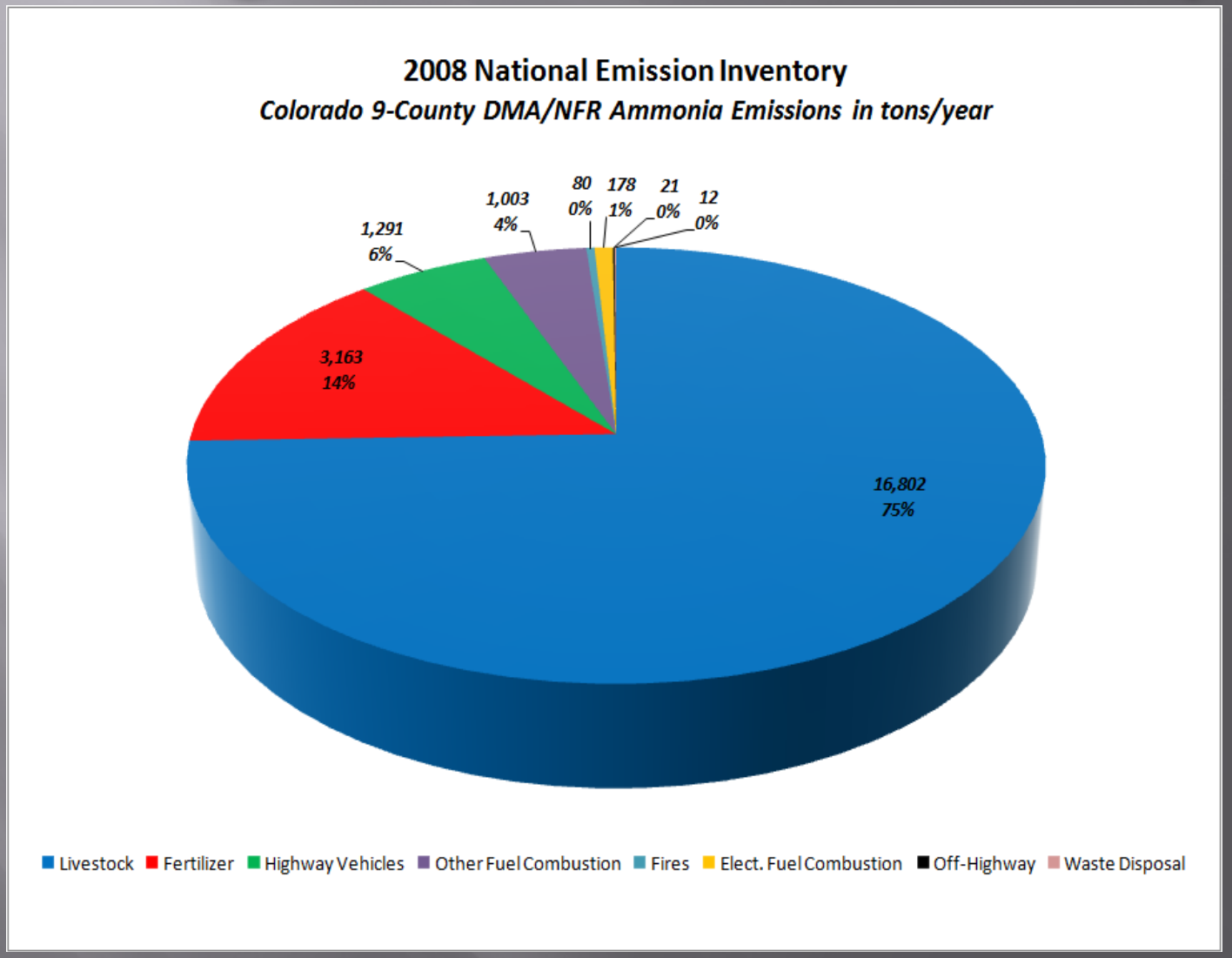
National Emission/Monitoring Trends

- NO_2 monitoring:
  - Nationally, 52% decrease in last 20 years
  - Locally, 34% decrease in last 20 years
- Ammonia:
  - Monitoring not available
  - National Emissions Inventory estimates fairly stable emissions since 2002

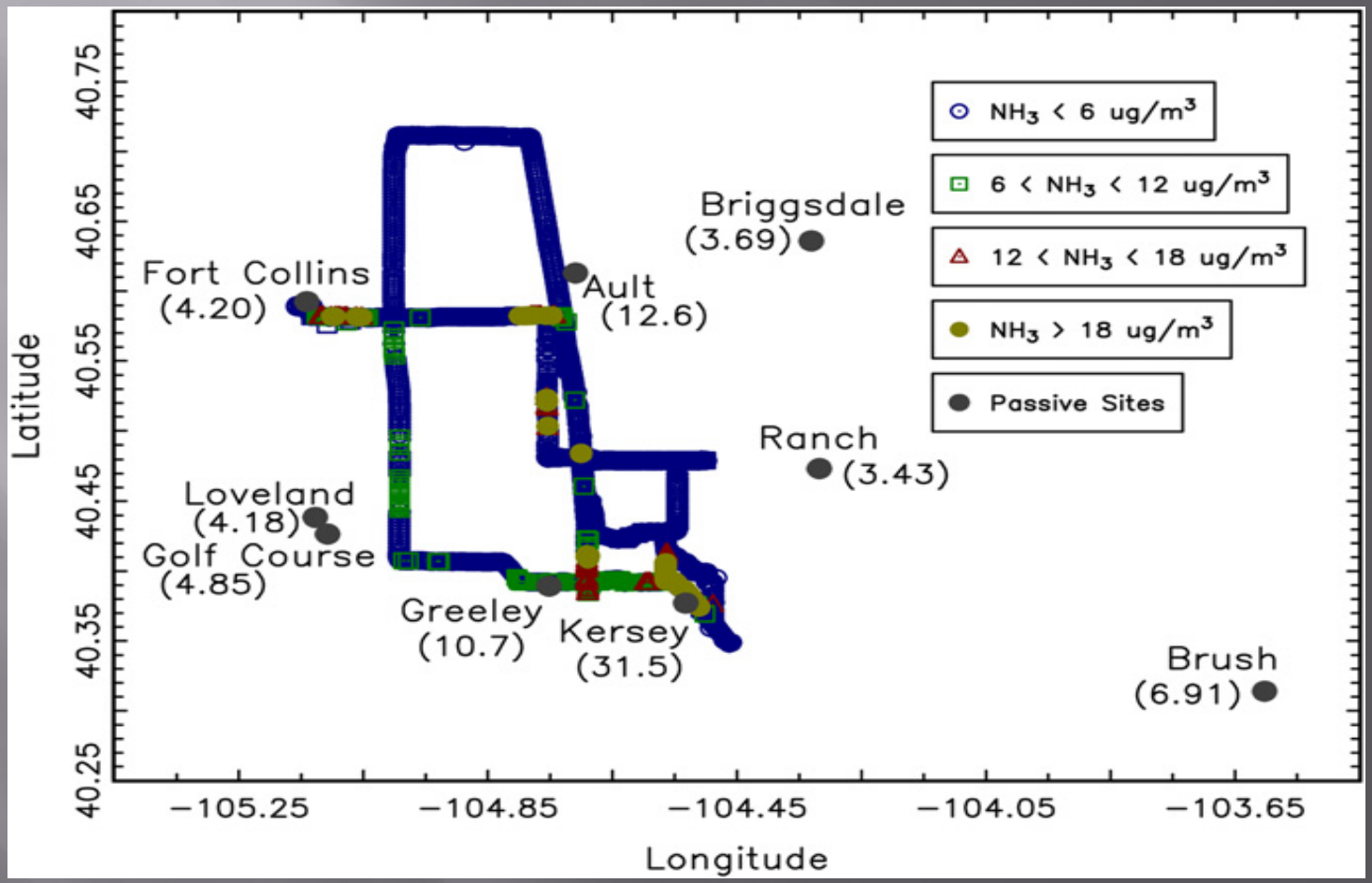
National Ammonia Inventory



Denver Metro Area/North Front Range Ammonia Inventory



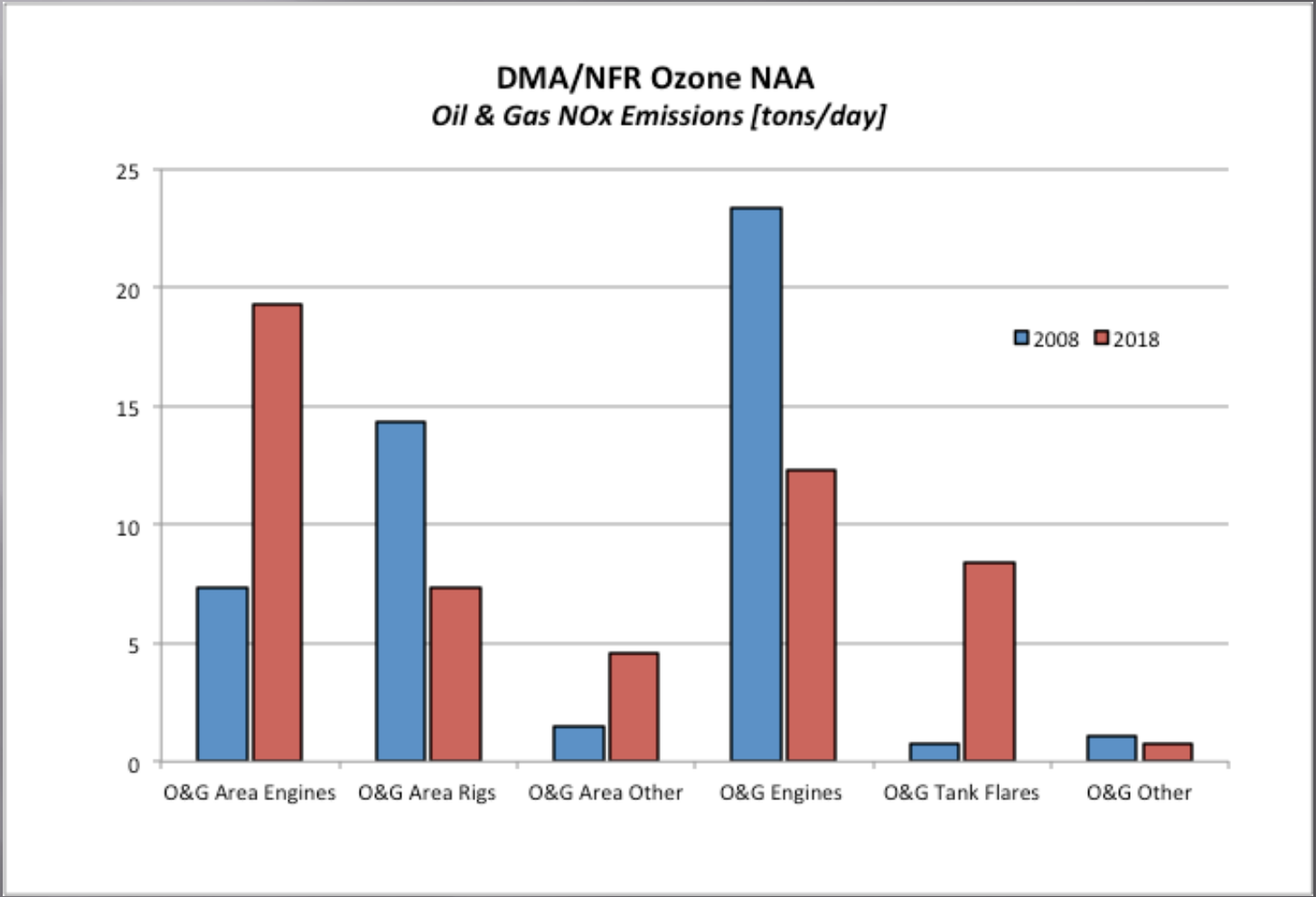
Passive Ammonia Sampling in Northeast Colorado



Efforts to Improve Colorado Emission Inventories: Studies

- WestJump Air Quality Modeling Study
  - Identify source categories with potential for updates and/or improvements
    - Ammonia: Livestock, fertilizer
    - NO_x: Oil and gas
    - NO_x: Highway vehicles
    - NO_x and Ammonia: Fires
- Three-State Study
  - Updating modeling profiles for livestock ammonia emission sources

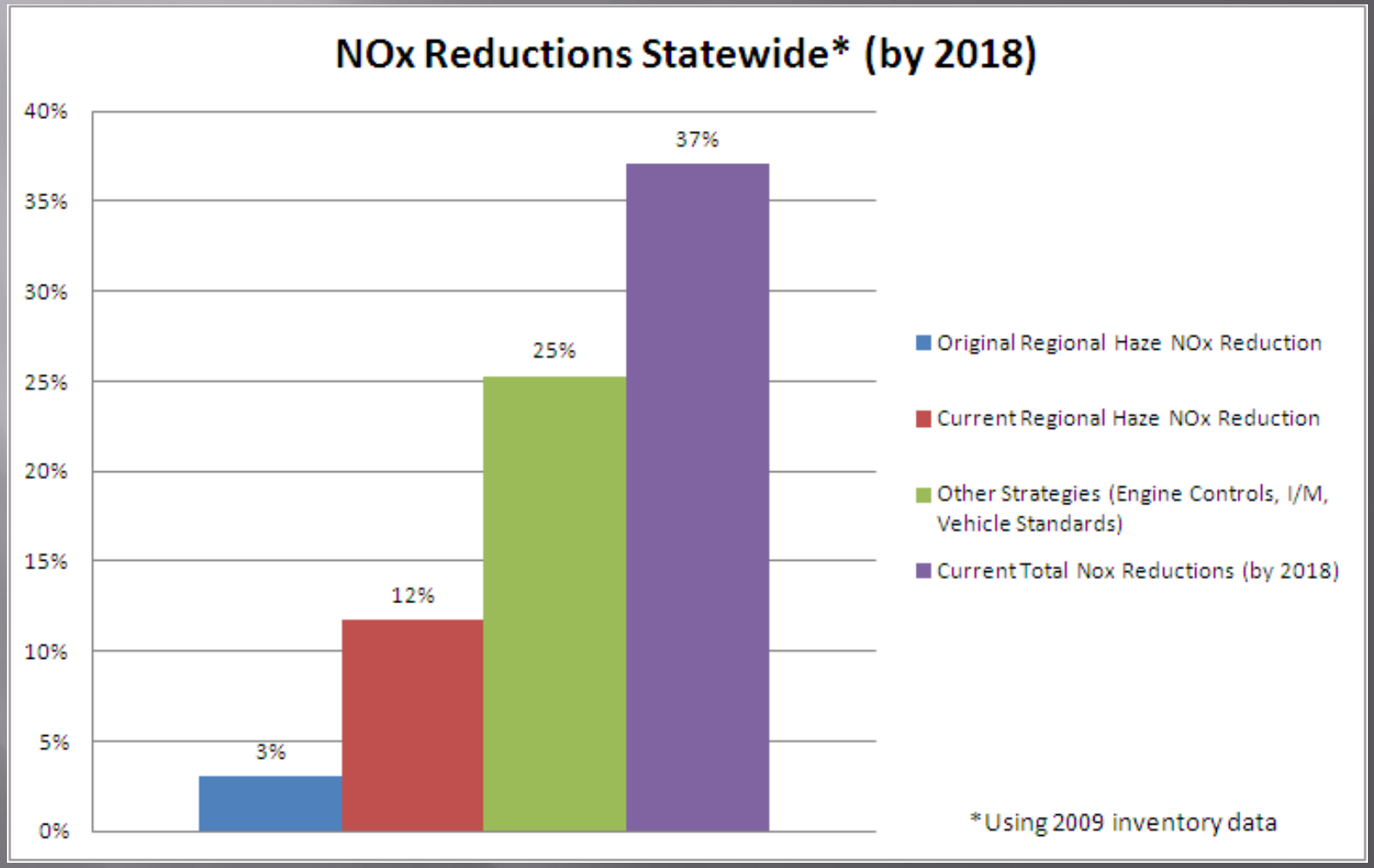
Efforts to Improve Colorado Emission Inventories: Modeling



Efforts to Improve Colorado Emission Inventories

- Ammonia not regulated as criteria or hazardous pollutant under Clean Air Act
  - Emission inventories remain uncertain
- MOU agencies continually address stakeholder concerns about unknown source categories
- Revisit ammonia and NO_x inventories when 2011 NEI becomes available
- Upcoming initiatives:
  - North Front Range Oil and Gas Air Pollutant Emissions and Dispersion Study (2014 – 2017)
  - Front Range Air Pollution and Photochemistry Experiment (FRAPPE) (summer 2014)

Current and Future Emission Reduction Activities: NO_x



Current and Future Emission Reduction Activities: Ammonia

- Animal feeding operation research
  - EPA National Air Emissions Monitoring Study (NAEMS)
  - CSU ambient ammonia feedlot monitoring
- Report from EPA's Integrated Nitrogen Committee
  - Recommend livestock ammonia emissions be reduced 30% and nitrogenous fertilizer 20%

Current and Future Emission Reduction Activities: Ammonia

- Ag Subcommittee
  - Follows progress of deposition trends in RMNP;
  - Help quantify ammonia emissions in Colorado;
  - Investigate ways to mitigate ammonia emissions from agriculture and other sources;
  - Develop plans for outreach activities to increase industry mitigation efforts;
  - Dialogue with MOU agencies to improve understanding of nitrogen deposition effects in RMNP and challenges and opportunities associated with reducing ammonia emissions

Current and Future Emission Reduction Activities: Ammonia

- Ag Subcommittee
  - CSU Research:
    - Best Management Practice surveys
    - Livestock facility BMP effectiveness
    - Improving ammonia emissions measurements
    - Soil cores to improve diurnal and seasonal trends in local ammonia emissions
    - Examine dietary trends and feed additives that may reduce ammonia emissions
  - Natural Resource Conservation Service (NRCS) 2013 Air Quality Initiative

Current and Future Emission Reduction Activities: Ammonia

- "Early Warning System"
  - Advises agriculture producers to avoid high nitrogen-emitting activities (e.g. manure handling) during specific periods of time when weather conditions could readily transport nitrogen into the park (CSU)
- 2 year Development Pilot
  - Approx. $189K committed
    - $44k+ Colorado Agriculture Industry
    - $10k Rocky Mountain National Park
    - $40k NPS Air Resource Division
    - $20k CDPHE APCD
    - $21k+ from CDPHE DEHS
    - Texas A&M($20k), CSU($25k) in-kind support

Current and Future Emission Reduction Activities: Ammonia

- Ag Subcommittee Outreach Efforts & Future Plans
  - Quarterly meetings since 2007
  - Several fact sheets and web resources
  - Four Agricultural Air Quality Symposia
    - More planned for 2015
  - Development of adaptive 5-year plan
  - Additional CSU research
  - Researching additional monitoring options

RMNP Emissions & Controls

- Mobile Sources
  - Approx. 3 million visitors annually
  - Visitor transportation systems
    - Bear Lake
    - Moraine Park
    - Estes Park Fairgrounds
  - Increasing fleet efficiency
    - Shuttles
    - National Park Service fleet
      - 19 hybrid vehicles in 2012 (increased from 4 in 2007)

RMNP Emissions & Controls

- Stationary Sources
  - Replacement of two diesel powered generators in 2005
- Climate Friendly Parks Program
- Environmental Management System
  - 30% energy use reduction for RMNP by 2015 (2003 as baseline year)

Weight of the Evidence Summary

- Monitoring indicates current wet nitrogen deposition is above milestone, but trends have shifted from increasing to flat
- Measurements and modeling analyses indicate NO_x and ammonia sources significant contributors during spring and fall
- Demographic trends show Front Range population and vehicle miles increasing while agricultural counts steady
- NO_x emissions decreasing nationally and locally while ammonia emissions remain stable
- Efforts continue to improve Colorado's nitrogen emission inventories

Weight of the Evidence Summary

- Significant NO_x reductions on the horizon expected to contribute to reduced nitrogen deposition in RMNP
- Ag Subcommittee and multiple ammonia-related research efforts promising
  - 5-year adaptive plan
    - Early Warning System
- In-Park emission strategies in place
  - Vehicle transportation systems
  - Increases in fleet efficiency
  - Environmental Management System

Conclusions

- Two identified goals:
  - 2012 interim milestone determination
  - RMNP Nitrogen Deposition Contingency Plan triggering
- *Therefore, the MOU agencies conclude that the 2012 interim milestone has not been achieved. However, the RMNP Nitrogen Deposition Contingency Plan shall not be triggered at this time.*

Next Steps

- Review and update 2010 Contingency Plan;
- Continued tracking of nitrogen deposition reduction;
- Continued collaboration with Ag Subcommittee;
- Continued work with additional CDPHE programs and state agencies, and other relevant agencies and stakeholders particularly on inventory improvements;
- Continued collaboration with stakeholders, researchers, and other agencies;
- Coordination with other states and initializing discussions regarding nitrogen deposition changes in the West;
- Additional monitoring research and modeling (as funding permits); and
- Education and outreach to interested stakeholders.

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Liz Sapio (DEHS)
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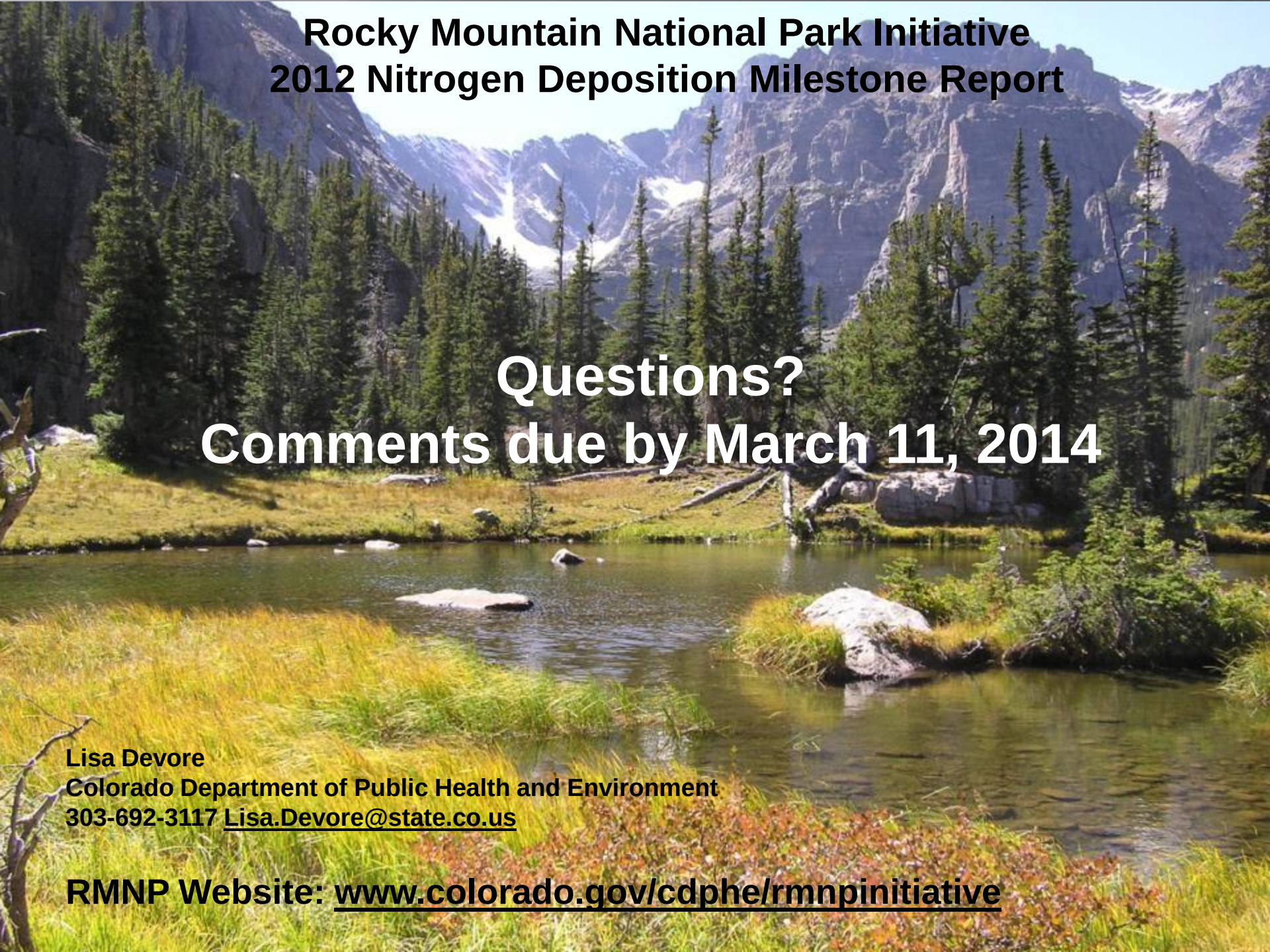
Daniel Bon (APCD)
Garry Kaufman (APCD)

EPA
Steven Pratt (current)
Rebecca Perrin (current)
Monica Morales
Laurel Dygowski

Rocky Mountain National Park Initiative
2012 Nitrogen Deposition Milestone Report



Questions?
Comments due by March 11, 2014

Lisa Devore
Colorado Department of Public Health and Environment
303-692-3117 Lisa.Devore@state.co.us

RMNP Website: www.colorado.gov/cdphe/rmnpinitiative