



# **Nitrogen Deposition Reduction Plan for Rocky Mountain National Park**

**Sustaining Colorado's  
Watersheds Conference:  
Making the Water Quality  
Connections**

**October 3, 2007**

# Participating Agencies

- Colorado Department of Public Health & Environment – Air Pollution Control Division
- National Park Service – Air Resources Division & RMNP Staff
- U.S. EPA Region VIII
- Colorado Air Quality Control Commission

# Air Quality Issues at RMNP

- **Air Quality Issues:**
  - **Visibility degradation**
  - **Increasing tropospheric ozone concentrations**
  - **Nitrogen deposition**

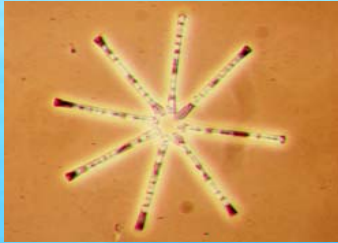
# Nitrogen Deposition at RMNP

- Current wet and dry nitrogen deposition averages 4.0 kilograms per hectare per year
- Wet nitrogen deposition averages 3.1 Kg/ha/yr
- Natural levels of nitrogen deposition estimated at 0.2 kg N/ha/yr
- Increased nitrogen loading is changing high elevation ecosystems at RMNP

# Nitrogen Deposition at RMNP

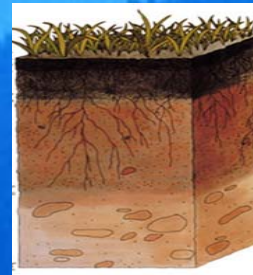
- RMNP Superintendent identified 1.5 kg/ha/yr for wet deposition as the critical load for eutrophication
- RMNP has adopted the critical load for wet nitrogen deposition as the resource management goal (1.5 kg N/ha/yr)
- CDPHE, the Colorado Air Quality Control Commission, and EPA have endorsed this goal

# Ecosystem Impacts



High elevation lakes have shifted from natural undisturbed systems to disturbed systems ; changes in aquatic plant species have occurred

Soils soak up nitrogen like a sponge; excess nitrogen is accumulating



Shift from alpine flowers to grasses likely occurring; nitrogen helps sedges and grasses outcompete flowering plants

Changes to tree and soil chemistry are beginning



# Addressing the Issues

- Collaborative agency effort 2004 - 2007
- Develop and review technical information and identify options to address the issues
- Visibility issues to be addressed through development of Regional Haze SIP element

# Addressing the Issues

- Increasing ambient ozone levels to be addressed through federal NAAQS program
- The science and policy issues were publicly discussed throughout this period
- This process led to the development of a nitrogen deposition reduction plan

# Collaborative Process to Address Air Quality Concerns

- **Agency MOU (2005)**
  - CDPHE, NPS, EPA
  - to develop air quality management policies and programs to address air quality and natural resource impacts occurring in Rocky Mountain National Park.
- **Colorado Air Quality Control Commission subcommittee**
  - 14 month public involvement process
- **Agriculture Community Involvement**
  - Stakeholder report on BMPs and areas for influence

# Collaborative Process to Address Air Quality Concerns

- Collaborative process considered:
  - Monitoring/trends
  - Attribution studies
  - Planned State & Federal emission reductions
  - Timeframe & milestones to achieve goal
  - Regulatory & Voluntary approaches
  - Contingency Planning
- Collaborative process led to plan Development



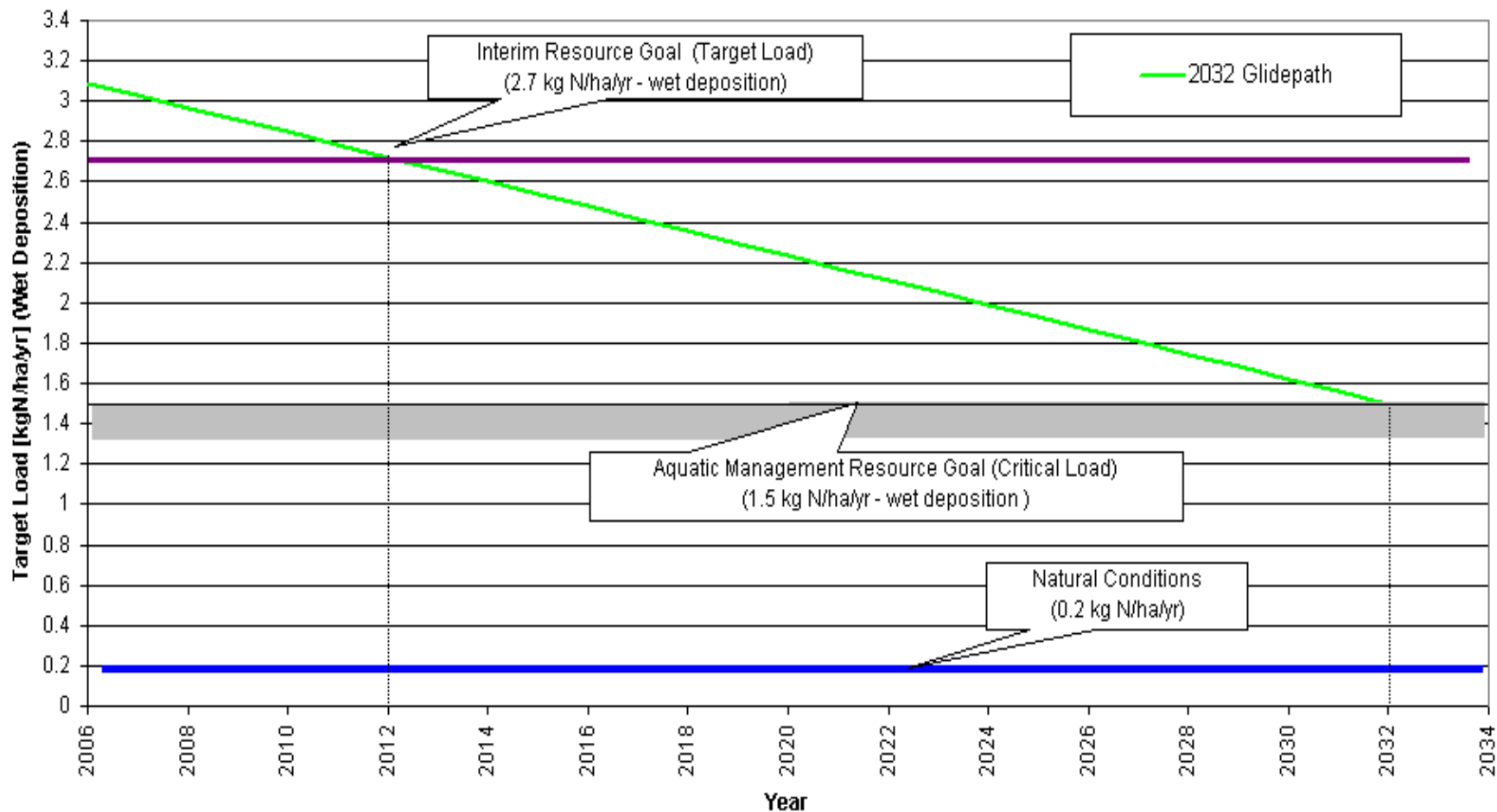
# **Rocky Mountain National Park**

## **Nitrogen Deposition Reduction Plan**

### **Highlights**

# Glidepath & Milestones

## Rocky Mountain National Park 2032 Glidepath for Nitrogen Deposition Reduction



# Deposition, Emissions, Transport and Attribution

- Deposition monitoring and trends data are presented
- Colorado emissions of N from NO<sub>x</sub> and ammonia are estimated
  - 34% mobile sources
  - 23% agriculture
  - 24% area sources
  - 19% point sources
  - Trends in activities and emissions are presented
- Anticipated NO<sub>x</sub> reductions may result in achieving the 2012 target load of 2.7 kg N/ha/yr *if* ammonia emissions remain constant

# Deposition, Emissions, Transport and Attribution

- Further research will better help determine source regions and emission reduction benefits
  - Regional Haze visibility modeling work
  - ROMANS study over the next 1-2 years
- Metro-area, in-Park, in-State and out-of-State culpability will be better defined
- Attribution of N deposition by source category will be possible
- The ozone/N deposition interplay will be examined

# NOx Emission Control Options

- A list of possible control options to reduce NOx emissions are provided for numerous source types
  - Stationary sources
  - Mobile sources
  - Area sources
- A general overview of each with emission reductions and cost estimates are provided

# Ammonia Emission Control Options

- A list of possible best management practices to reduce ammonia emissions are discussed
  - BMPs for crop production
    - Tillage and fertilizer management
  - BMPs for livestock production
    - Feed, livestock, facility, wastewater, manure management
- A general overview of each with emission reduction potential and implementation issues are provided
- Research needs and plans are also presented
- BMPs for domestic fertilizer and controls for stationary sources will be investigated

# Achieving Emission Reductions

- **2012 milestone**
  - Currently Planned State & Federal Programs
  - Best Management Practices
  - Voluntary Reduction Programs
- **Future milestones anticipate regulatory efforts**
- **Contingency Plan to be Developed**
  - Implemented if not monitoring improvement
  - To contain regulatory measures

# Implementation Strategy and Continuing Evaluation

- **Near term:**
  - Existing and planned NO<sub>x</sub> reduction measures will be implemented
  - NO<sub>x</sub> strategies will be developed
  - Agricultural BMPs accepted by the industry will be broadly implemented in Colorado
  - Ammonia emissions will be better characterized
  - Modeling and assessment activities will proceed

# Implementation Strategy and Continuing Evaluation

- Longer term:
  - Ammonia-reducing agricultural BMPs will be researched, field tested
    - MOU agencies will work with producers to implement BMPs that are shown to be cost-effective
  - Ammonia-reducing BMPs and emission reduction programs for urban sources and water treatment facilities will be researched and implemented
    - Urban fertilizer usage research began this Spring
  - Education/outreach to the agricultural sector, industrial groups and the public will occur
  - Additional NOx strategies, voluntary and regulatory, will be considered



# Agency Endorsements MOU Agencies

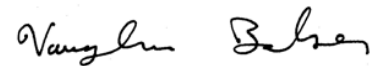
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## Rocky Mountain National Park

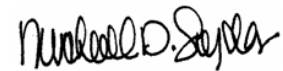
## Nitrogen Deposition Reduction Plan

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### Memorandum of Understanding Agencies



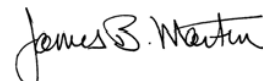
Vaughn Baker, Superintendent, Rocky Mountain National Park



Michael Snyder, Acting Director, National Park Service, Intermountain Region



Robert E. Roberts, Regional Administrator, Environmental Protection Agency, Region 8



James B. Martin, Executive Director, Colorado Department of Public Health & Environment

**August 16, 2007**

# Agency Endorsements

# Air Quality Control Commission

## STATE OF COLORADO

Bill Ritter, Jr., Governor  
Janice D. Martin, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department  
of Public Health  
and Environment

### COLORADO AIR QUALITY CONTROL COMMISSION POLICY RESOLUTION

#### *ROCKY MOUNTAIN NATIONAL PARK NITROGEN DEPOSITION REDUCTION PLAN*

#### BACKGROUND

1. Rocky Mountain National Park ("Park") is a nationally and internationally recognized scenic, recreational and historic public treasure located within the State of Colorado.
2. Data collected over the past 20 years and findings published in over 80 peer reviewed research articles document changes to this fragile ecosystem resulting from nitrogen deposition on the east side of the Continental Divide. These include:
  - a) Changes in the type and abundance of aquatic plant species;
  - b) Elevated levels of nitrate in surface waters;
  - c) Elevated levels of nitrogen in spruce tree chemistry;
  - d) Long-term accumulation of nitrogen in forest soils; and
  - e) A shift in alpine tundra plant communities favoring sedges and grasses of the natural wildflower flora.
3. The Colorado Air Pollution Control Act declares that it is state policy to "...achieve the maximum practical degree of air purity in every portion of the state...." The Park's enabling legislation and other federal statutes mandate that natural resources at the Park are to remain unimpaired for future generations.
4. In 2006, the Park's Superintendent established a resource management goal for wet nitrogen deposition at the high alpine monitoring site of Loch Vale of 1.5kg N/ha/yr. The National Park Service indicates that this is the rate of nitrogen deposition below which ecosystem changes are unlikely to occur.

<http://www.cdphe.state.co.us/ap/rmnp.html>

**The Website for this presentation, the Nitrogen Deposition Reduction Plan, the Options and Technical Papers, and additional information about the RMNP Initiative**