



# Rocky Mountain National Park Partnership to Reduce Nitrogen Impacts

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# Rocky Mountain National Park



## Partnership to Reduce Nitrogen Impacts

- Nitrogen Deposition Reduction Plan Background
- Ecological Impacts
- N Deposition Status and Trends
- Collaborative Efforts for NO<sub>x</sub> & NH<sub>4</sub> Reduction
- Park Strategy for Clean Air

*Jim Cheatham*

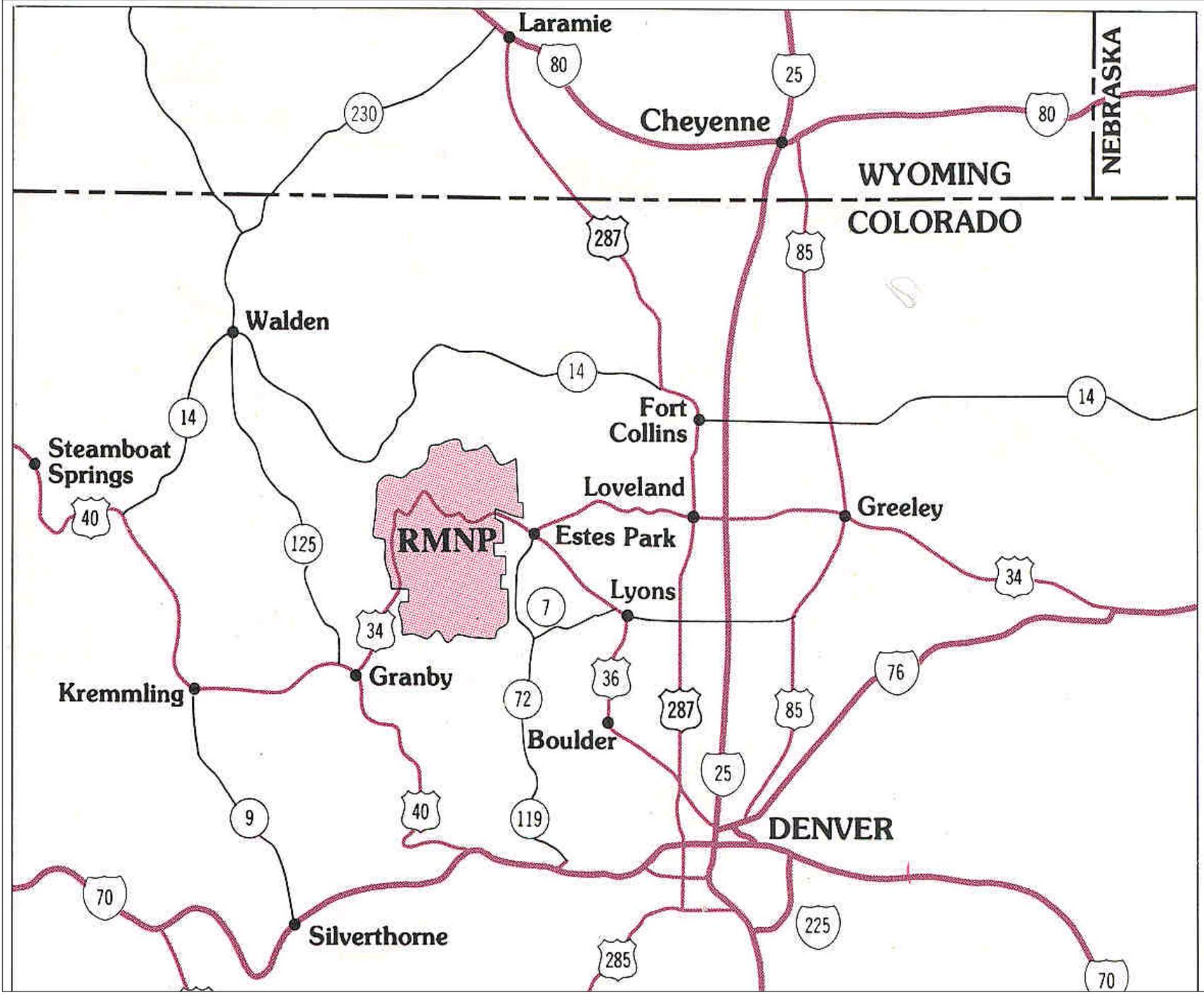
*National Park Service*

*Air Resources Division*

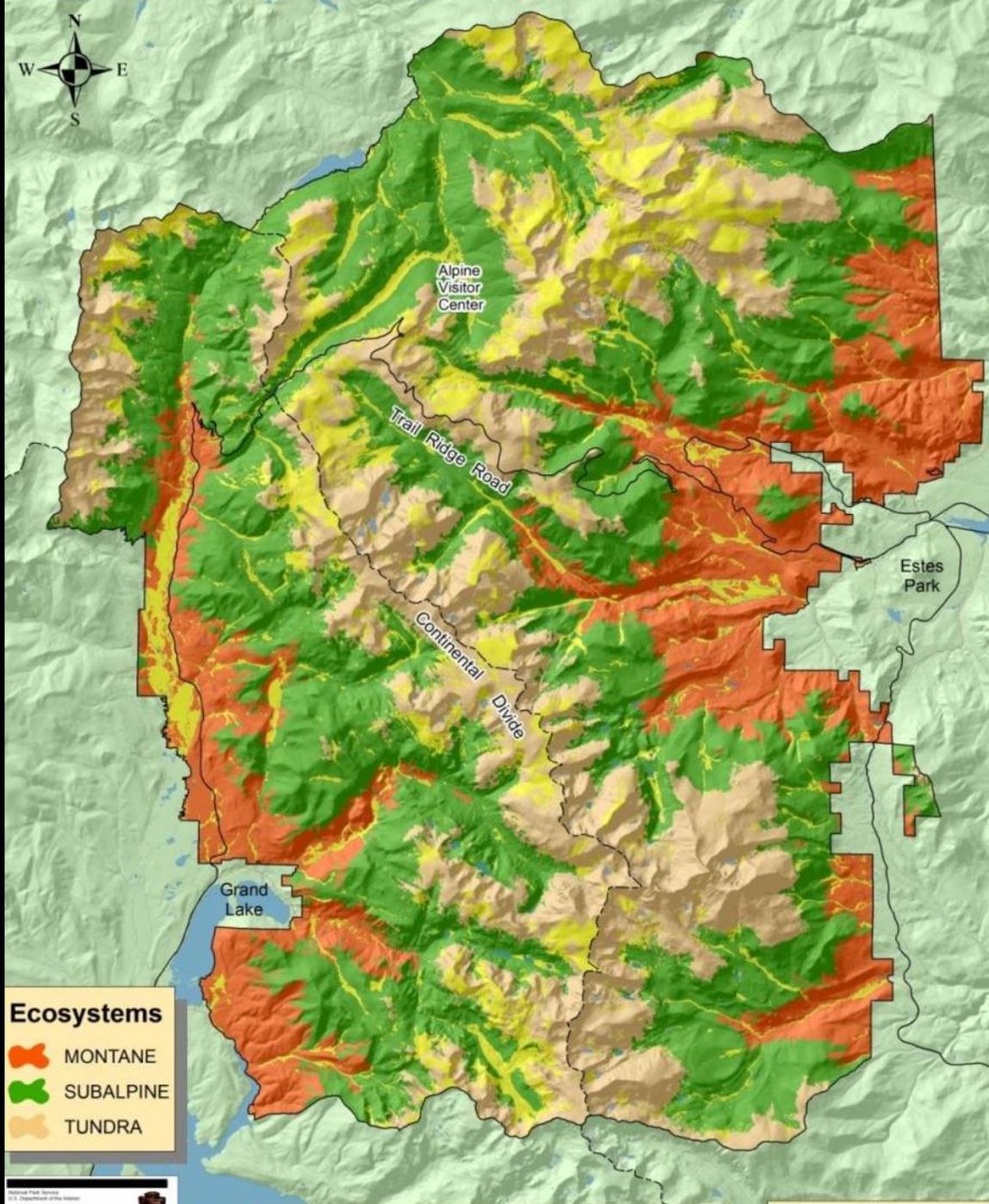
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# Rocky Mountain National Park



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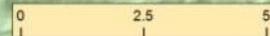


**Ecosystems**

-  MONTANE
-  SUBALPINE
-  TUNDRA



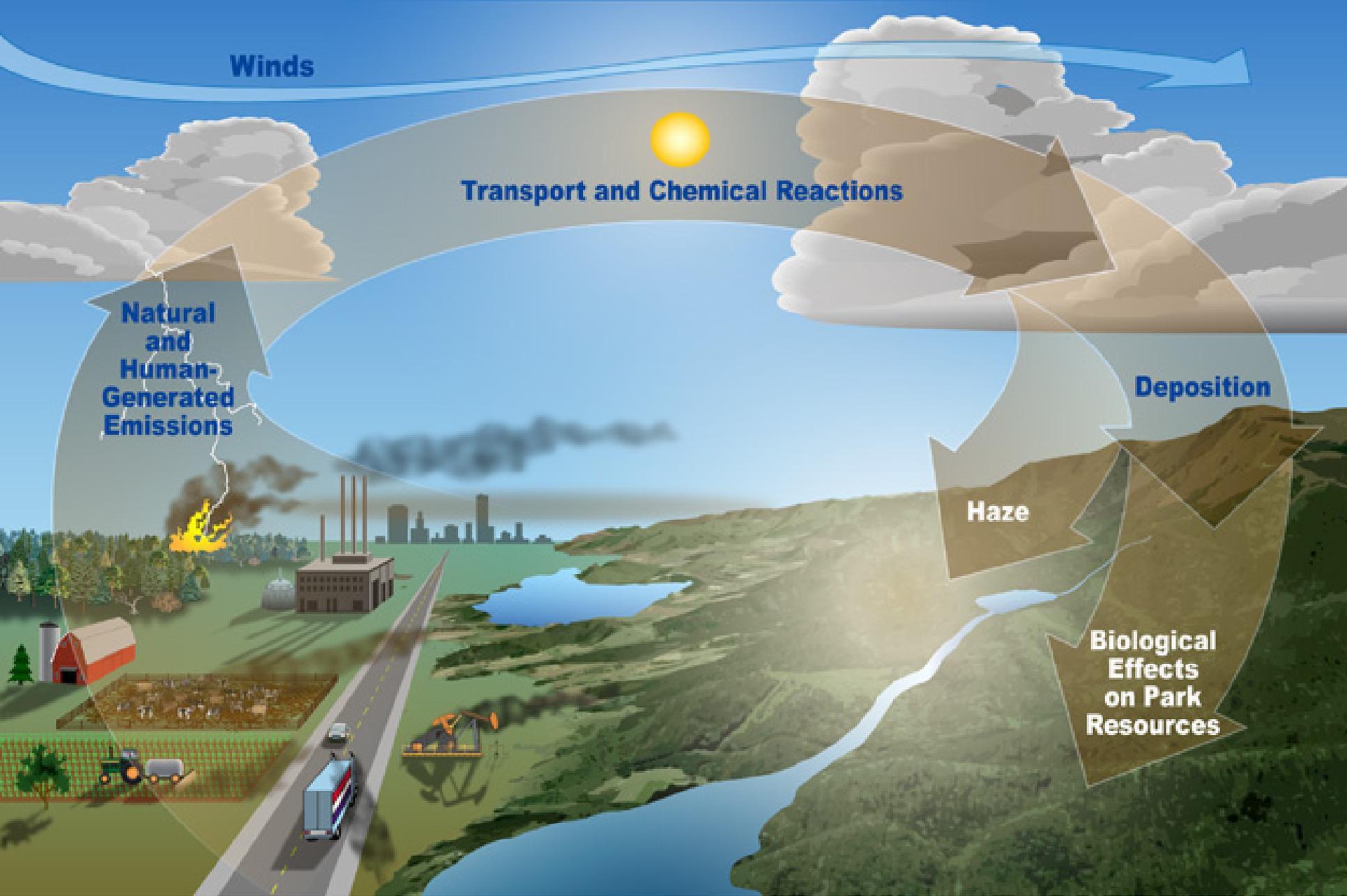
There are Riparian areas (yellow) within each ecosystem.





## RMNP Initiative Basis

- Petition from Environmental Defense Fund and Colorado Trout Unlimited , September 2004
  - ID's adverse impacts from air pollution
- CDPHE, NPS and EPA began a process for addressing these concerns: Beginning of “RMNP Initiative”
  - Nitrogen deposition is focus (monitor others: ozone, haze)
- Nitrogen Deposition Reduction Plan, August 2007
- NDRP Contingency Plan, June 2010
- 2012 Milestone Report, January 2014



**Winds**



**Transport and Chemical Reactions**

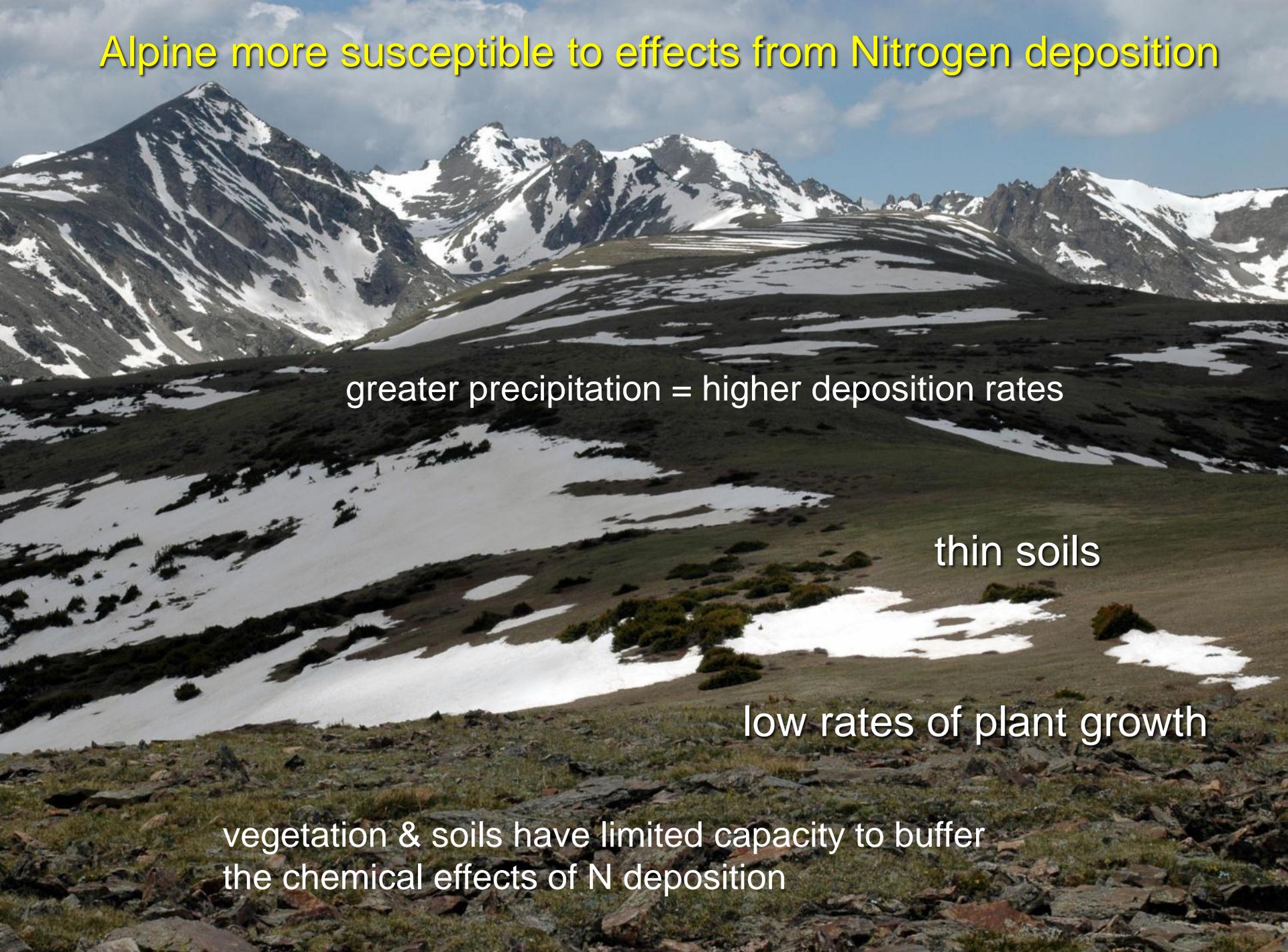
**Natural and Human-Generated Emissions**

**Deposition**

**Haze**

**Biological Effects on Park Resources**

# Alpine more susceptible to effects from Nitrogen deposition

A photograph of a high-altitude alpine landscape. In the background, several jagged mountain peaks are partially covered in snow. The middle ground shows a wide, open slope with patches of snow and low-lying vegetation. The foreground is a rocky, scree-covered slope with sparse green plants. The sky is blue with some light clouds.

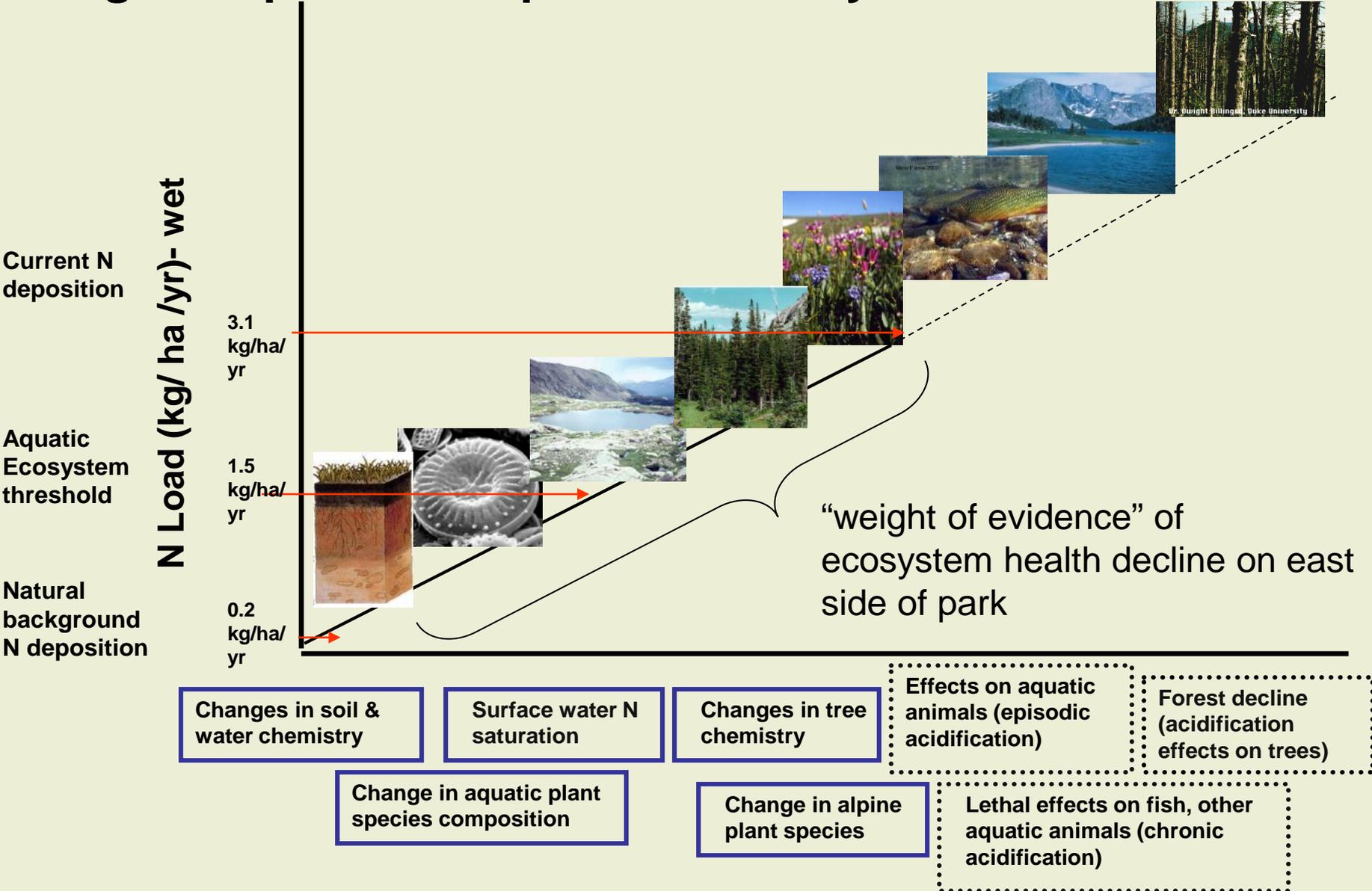
greater precipitation = higher deposition rates

thin soils

low rates of plant growth

vegetation & soils have limited capacity to buffer  
the chemical effects of N deposition

# Rocky Mountain National Park: Nitrogen Deposition Impacts on Ecosystem Health

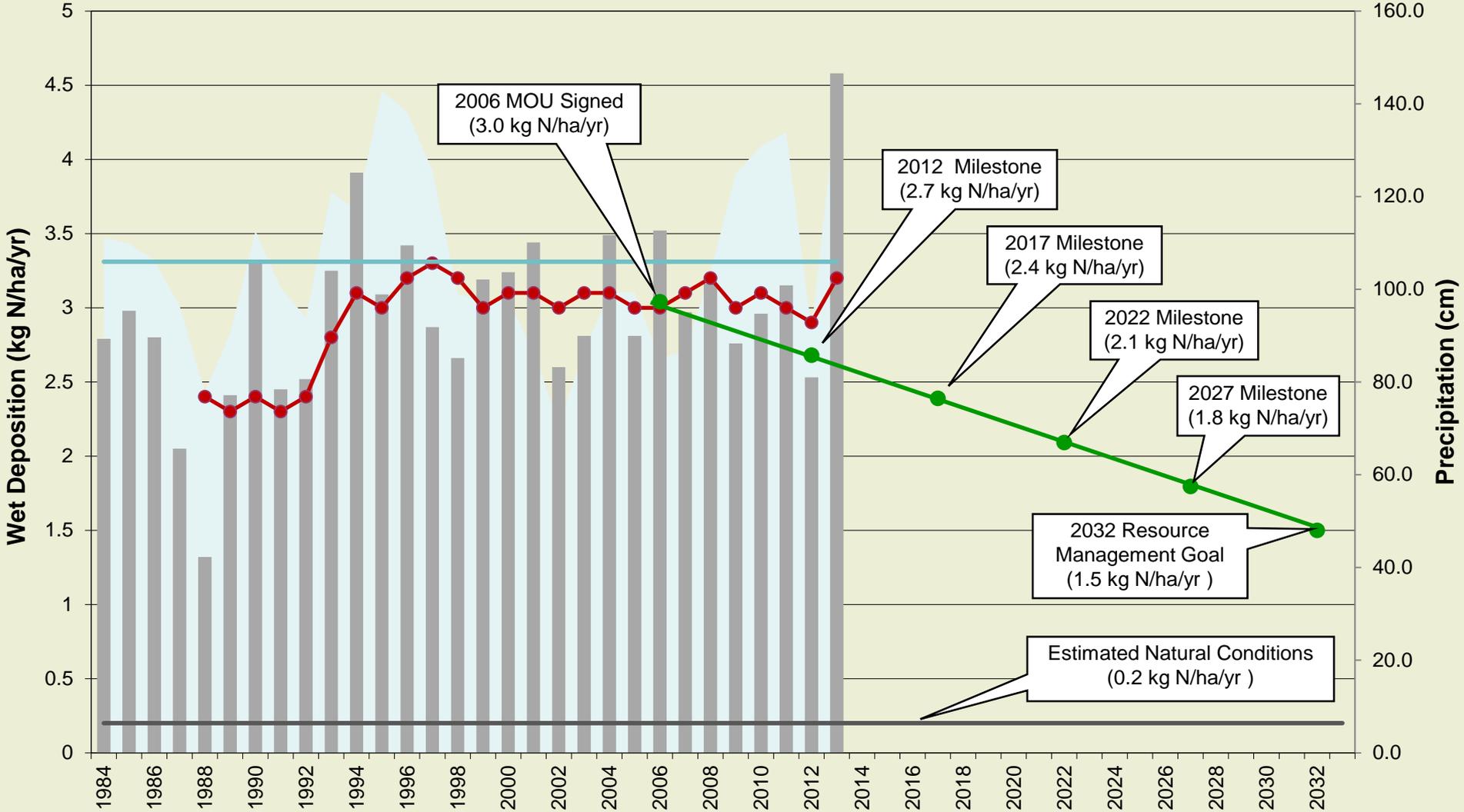
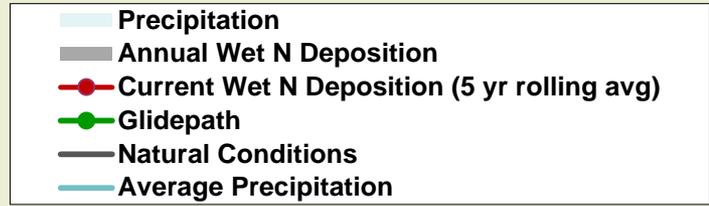




## RMNP Critical Load

- **Large body of evidence indicates nitrogen deposition has affected and continues to cause significant harmful effects on sensitive ecosystems within the park.**
  - **Current wet deposition monitored at ~3.0 kg N/hectare/yr (rolling 5-year average as of 2013)**
  - **Natural background estimated at 0.2 kg N/ha/yr**
- **Specific, published (peer-reviewed) research has shown that wet deposition levels at the time significant harmful effects started to occur was ~1.5 kg N/ha/yr.**

# RMNP Loch Vale Nitrogen Deposition & NDRP Glidepath



2006 MOU Signed  
(3.0 kg N/ha/yr)

2012 Milestone  
(2.7 kg N/ha/yr)

2017 Milestone  
(2.4 kg N/ha/yr)

2022 Milestone  
(2.1 kg N/ha/yr)

2027 Milestone  
(1.8 kg N/ha/yr)

2032 Resource Management Goal  
(1.5 kg N/ha/yr)

Estimated Natural Conditions  
(0.2 kg N/ha/yr)

# Agricultural Best Management Practices:

*Helping to Reduce Nitrogen Impacts at Rocky Mountain National Park*



Rocky Mountain NP, Colorado



Colorado Department  
of Public Health  
and Environment



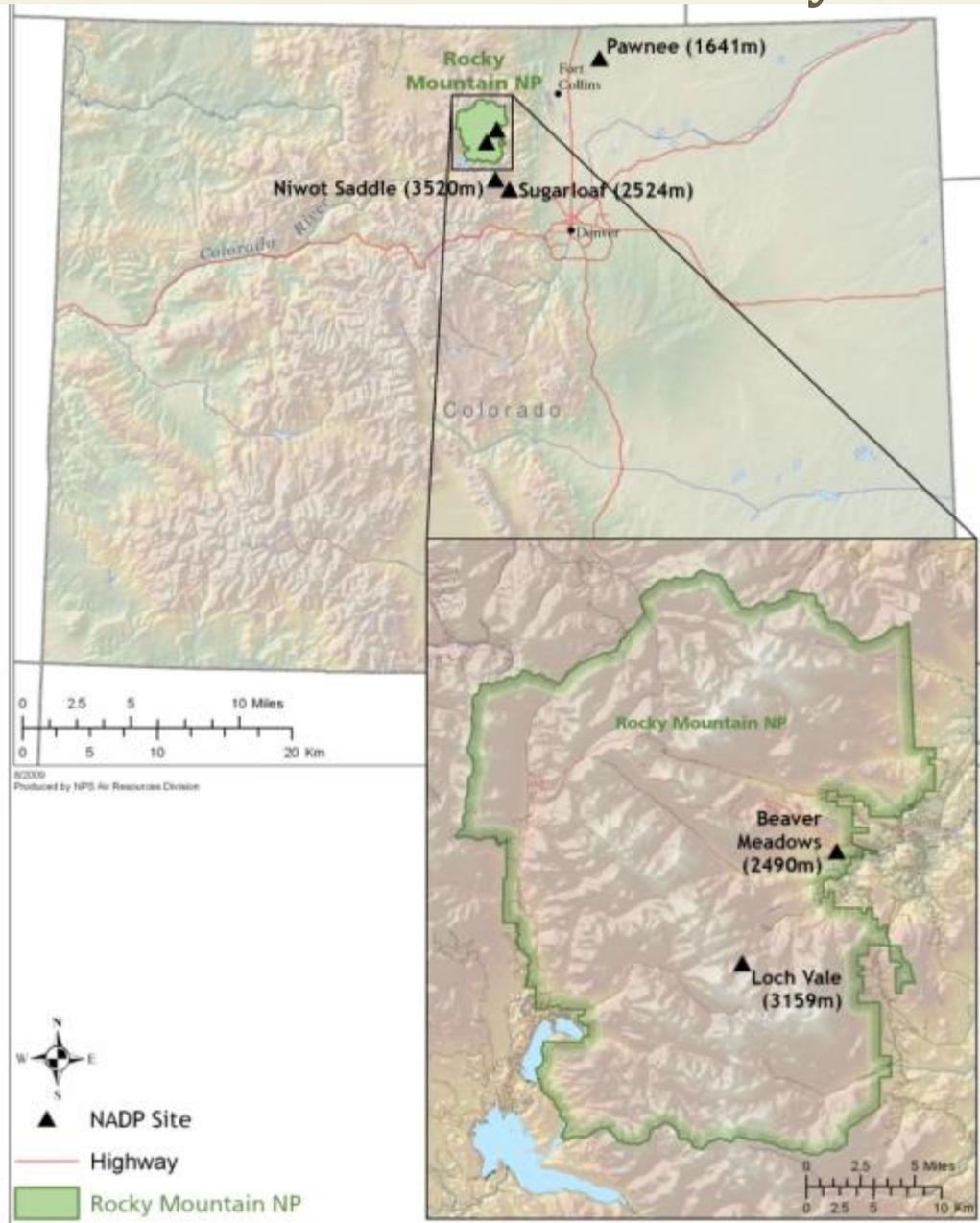
West Greeley  
Conservation District



Colorado  
Dairy  
Farmers



# Regional NADP Sites for Trend Analyses



# Regional NADP Sites for Trend Analyses



<b>Site Name</b>	<b>Site ID</b>	<b>Start Date</b>	<b>Elevation (feet)</b>
Rocky Mountain National Park- Loch Vale	CO98	8/16/1983	10,364
Rocky Mountain National Park- Beaver Meadows	CO19	5/29/1980	8,169
Niwot Saddle	CO02	6/5/1984	11,549
Sugarloaf	CO94	11/4/1986	8,281
Pawnee	CO22	5/22/1979	5,384

# Rocky Mountain National Park Loch Vale NADP Monitoring Station





# Tracking Wet Nitrogen Deposition Summary

Wet nitrogen deposition was above the glidepath in 2013.

## Long-term trend analyses for RMNP and other regional sites.

- Since 2010, wet nitrogen deposition long term trend has stabilized, but not decreased, at RMNP and other sites in the region.
- Significant increases were found in
  - Wet nitrogen deposition and precipitation at Beaver Meadows,
  - Ammonium concentrations at 4 of the 5 regional sites, and
- Significant decrease in nitrate concentrations at 1 of the 5 regional sites.

## Short-term trends analyses for RMNP and other regional sites.

- Nitrogen deposition is stable at RMNP over the short-term.
- Significant increases were found in
  - Wet nitrogen deposition at 1 site over the last 5-years,
  - Ammonium concentrations at 3 sites over the last 5-years,
- Nitrate concentrations that were decreasing last year at 3 sites over the last 7-years are now stable .



# RMNP Ground-level Ozone

- Human Health Ozone Advisories

**UNHEALTHY FOR  
SENSITIVE GROUPS**

Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.

- Damage to seven ozone sensitive plant species including aspen, willow, and coneflower





# RMNP Actions to Improve Air Quality

- Collaboration (external mitigation)
  - EPA & State of CO
    - Nitrogen Deposition Reduction Plan
    - Regional Haze & Ozone Regulations
  - CO Agriculture ammonia emissions
  - CSU - Monitoring & Research
- Park Greening (internal mitigation, environmental leadership)
  - NPS Climate Friendly Park & Green Team
  - Environmental Management System
- Communicating the park air quality story





# RMNP Actions to Improve Air Quality

## Green Team

### *Sustainability for our Climate Friendly Park*

#### Energy & Waste Reduction Guidelines for Park Employees and Volunteers

*Contribute to the park's green culture, reduce costs and impacts to park resources*



#### Environmental Management System

Greenhouse Gas

Water Use

Green Purchasing

Sustainable Buildings

Regulatory Compliance

Solid Waste

Energy

Transportation

Communication



## Shuttle System

*expansion reduced the vehicle miles travelled in the park*

Bear Lake Route

Moraine Park Route

Hiker Shuttle

Town of Estes Park Shuttles

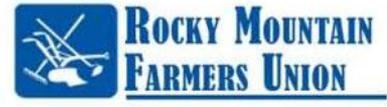


# Agricultural Best Management Practices:

*Helping to Reduce Nitrogen Impacts at Rocky Mountain National Park*



Rocky Mountain NP, Colorado





End

December 2014