



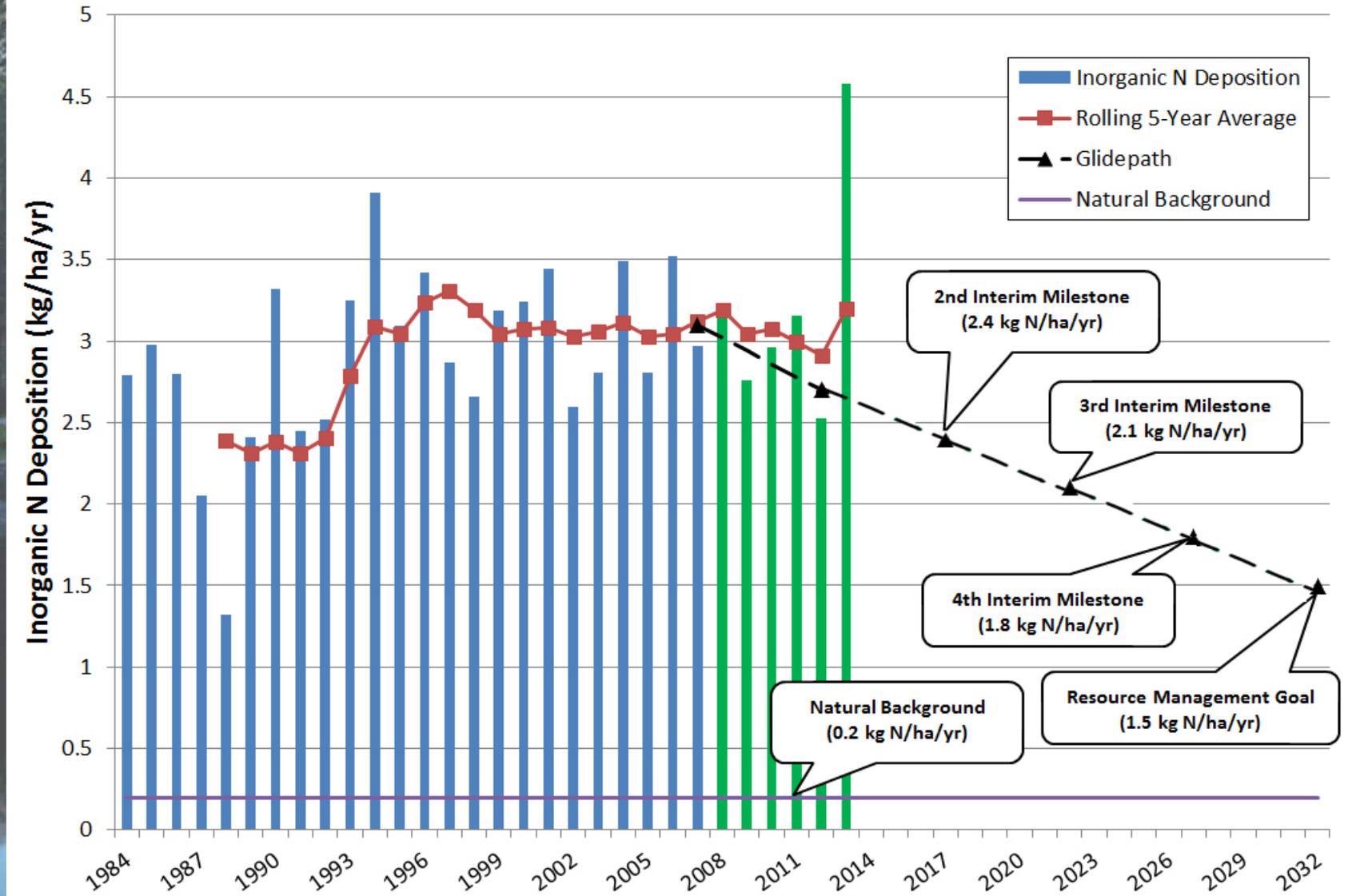
Nitrogen Deposition Early Warning System for Rocky Mountain National Park

USDA Agricultural Air Quality Task Force

December 2014

Nitrogen Deposition Reduction Plan

NADP Inorganic Nitrogen Deposition at Loch Vale



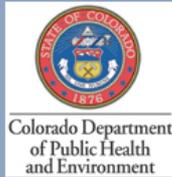
Early Warning System

www.rmwarningsystem.com

Rocky Mountain National Park Early Warning System

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Rocky Mountain National Park (RMNP) is a spectacular natural treasure encompassing 415 square miles of montane, subalpine, and alpine ecosystems. Air emissions of nitrogen from agricultural, industrial, and urban sources have contributed to increases in the amount of nitrogen deposited into the Park and are impacting the ecosystems.



The **Rocky Mountain Atmospheric Nitrogen and Sulfur (RoMANS) study**, published in 2009,

demonstrated that a substantial portion of nitrogen deposition into RMNP occurs when large-scale, upslope weather events transport air from eastern Colorado and the surrounding region westward into the mountains. Rain or snow produced during these events captures the atmospheric nitrogen and deposits it in the Park. Most of these large weather events happen in the spring or fall.

In 2013, Colorado's livestock and crop producers and researchers at Colorado State University, with funding from the Colorado Department of Public Health and Environment and the National Park Service, began developing a weather-based "warning system" to inform crop and livestock producers of impending weather events that have a high likelihood of moving nitrogen emissions from eastern Colorado into RMNP. By identifying time periods when nitrogen emissions are most likely to have the greatest environmental impacts, producers may be able to temporarily avoid practices associated with nitrogen emissions, thereby reducing their environmental impacts.

A weather-based warning system will provide agricultural producers a valuable tool to reduce environmental impacts. The warning system gives producers the opportunity to voluntarily apply certain conservation management practices to reduce ammonia emissions -- practices which may not be feasible for year-round implementation -- during strategic times when they will be most beneficial. Implementation of the system will allow producers to be better neighbors and better stewards of our land and water resources while providing management flexibility.

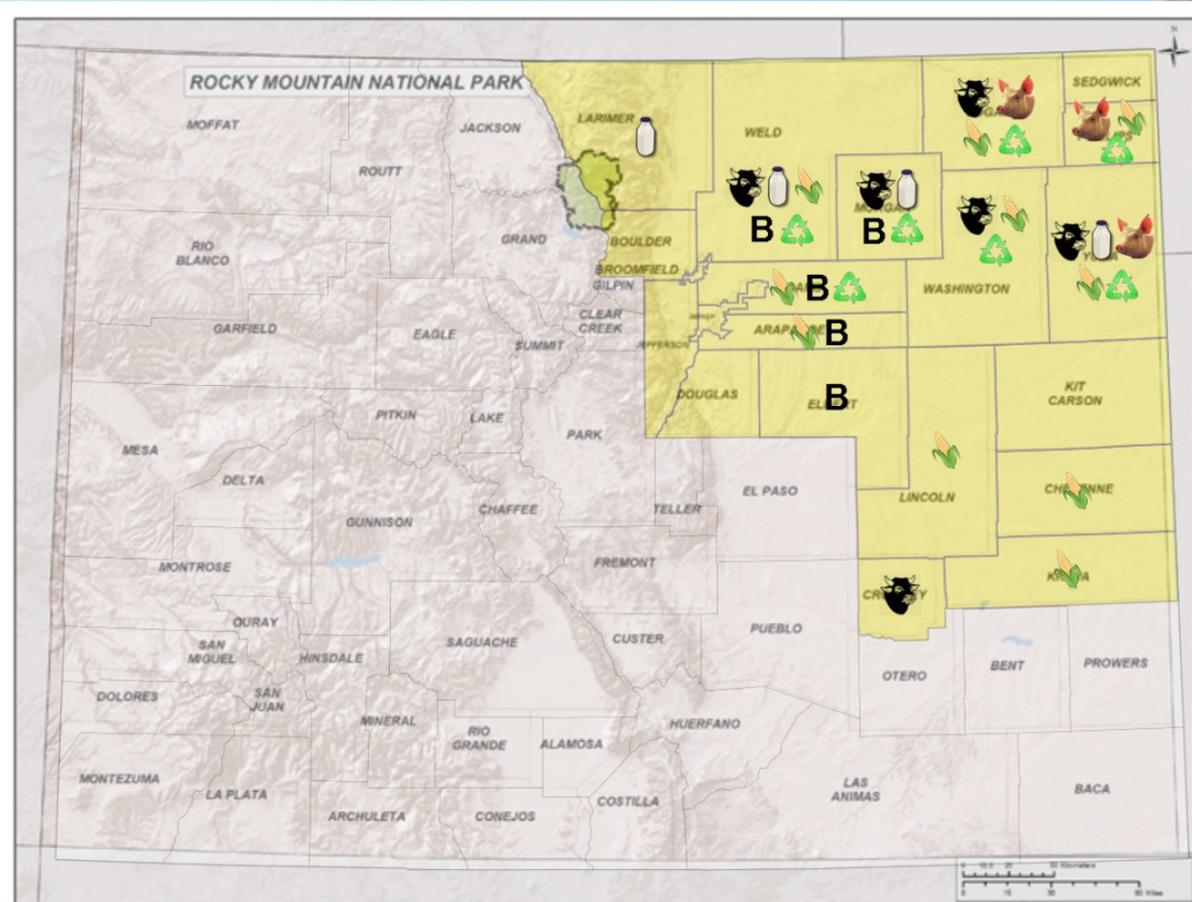
[Sign Me Up to Receive Warnings](#)

EWS Pilot Participants

Operation Type	Participants^[a]
Feedyards	17 (11)
Dairies	7 (6)
Swine producers	8 (5)
Poultry producers	2 (1)
Crop producers	9 (9)
Composters	2 (2)
Biosolids applicators	2 (1)
“Non-responding” recipients	23
Total People Receiving Warnings	70

[a] Number of individuals shown first; number of operations represented in parenthesis.

EWS Pilot Participants



Feedyard



Swine

B

Biosolids



Dairy



Crop



Compost

Step 1. Forecasting

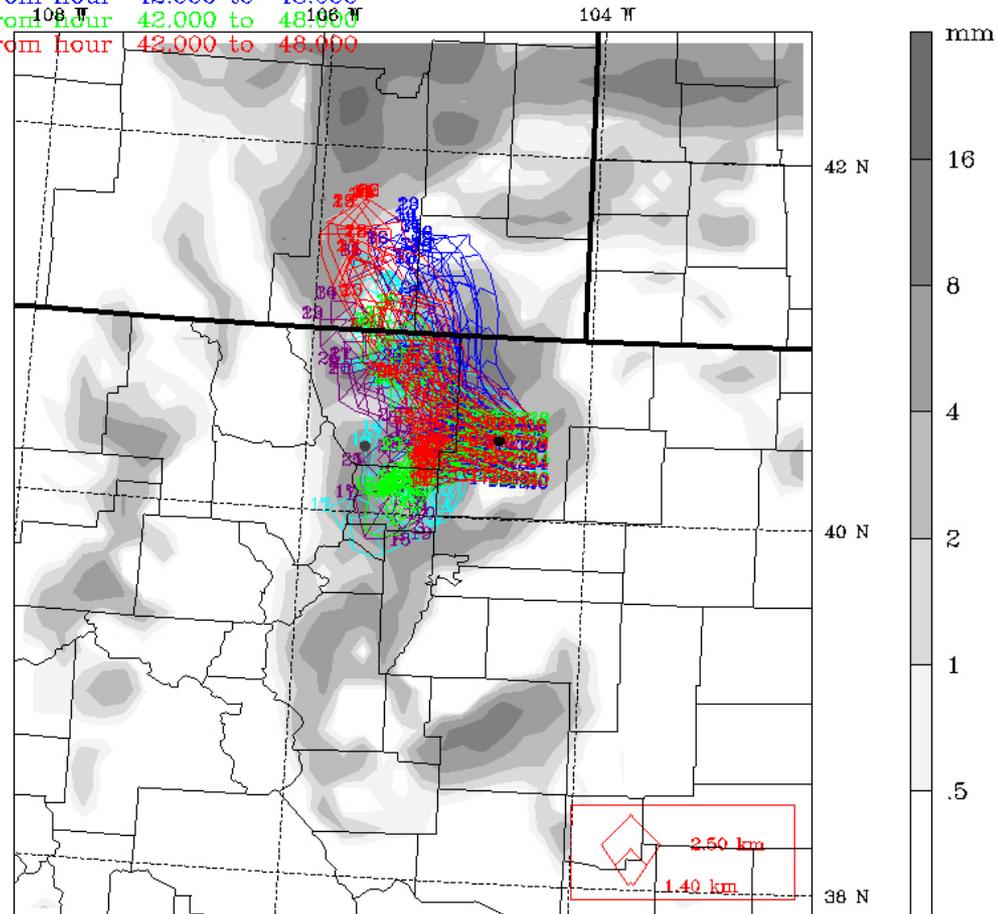
Init: 0000 UTC Tue 20 May 14

Fcst: 48.00 h

Valid: 0000 UTC Thu 22 May 14 (1800 MDT Wed 21 May 14)

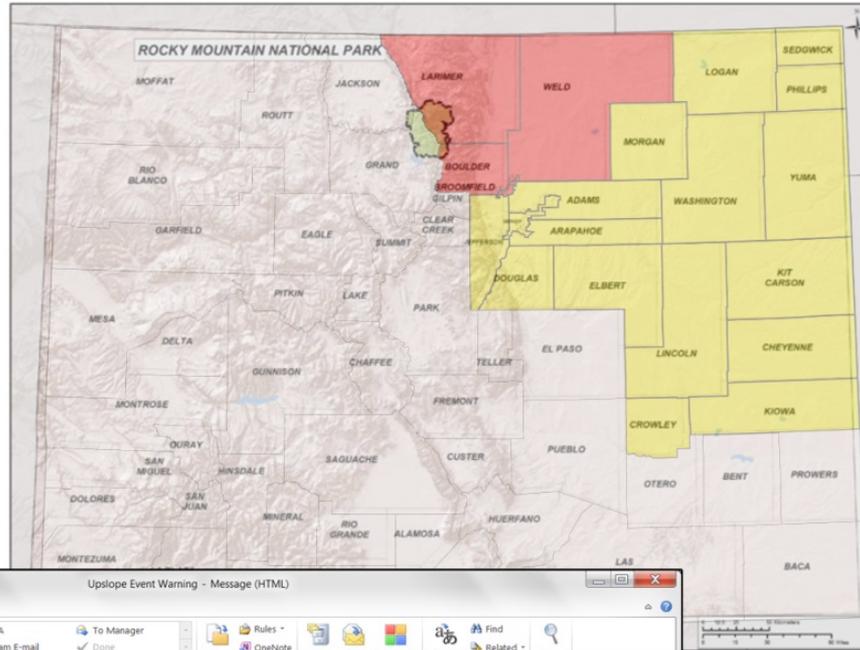
Total precip. in past 3 h

Trajectories from hour 42.000 to 48.000



Step 2. Issue Warnings

Warning System Website Map



Upslope Event Warning - Message (HTML)

From: info@rmwarningsystem.com
To: Brock Faulkner
Cc:
Subject: Upslope Event Warning

Sent: Tue 5/6/2014 2:13 PM

An upslope event is expected to move air from over Boulder, Broomfield, Larimer and Weld counties towards Rocky Mountain National Park from 05/07/2014 through 05/07/2014. During these days, please apply management practices that minimize emissions of nitrogen.

Archive: 5/6/2015

Email/Text Notification

Step 3. Collect Responses

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SUBMIT RESPONSE

Title
Upslope Warning (Dates)

Message
An upslope event is predicted for Eastern Colorado from XXXX to YYYY. Please avoid practices that may lead to unnecessary nitrogen emissions during this period. Respond to this warning by clicking here.

Response

I am changing practices based on the issued warning.

I am NOT changing practices based on the issued warning.

I intend to change practices for a portion of the warning period.

Reactive nitrogen emitted from eastern Colorado is contributing to elevated deposition in Rocky Mountain National Park (RMNP), leading to undesirable ecosystem changes. Nitrogen emitted east of the Park often moves into the mountains during synoptic-scale upslope events that can be predicted.

The goal of the early warning system is to inform agricultural producers of impending weather conditions that are likely to transport nitrogen from eastern Colorado into RMNP. These warnings will allow producers to strategically implement management practices that reduce nitrogen emissions but are not feasible for year-round implementation.

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Response

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I am NOT changing practices based on the issued warning.

I intend to change practices for a portion of the warning period.

Reason:

No manure management activities were planned

Other weather concerns

Animal health concerns

Labor availability

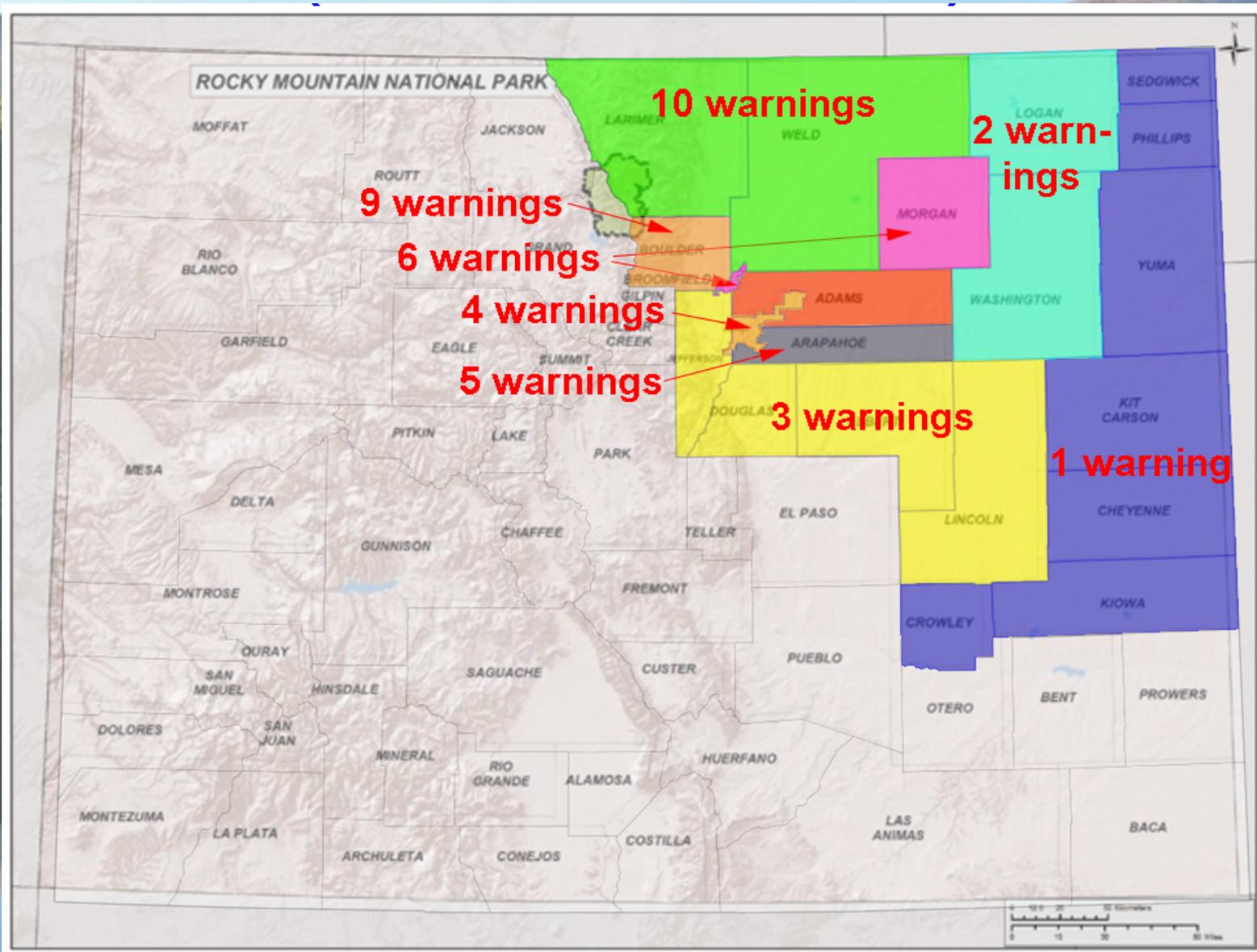
Credibility of warning is questionable

Other (please specify)

Reactive nitrogen emitted from eastern Colorado is contributing to elevated deposition in Rocky Mountain National Park (RMNP), leading to undesirable ecosystem changes. Nitrogen emitted east of the Park often moves into the mountains during synoptic-scale upslope events that can be predicted.

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Step 4. System Evaluation

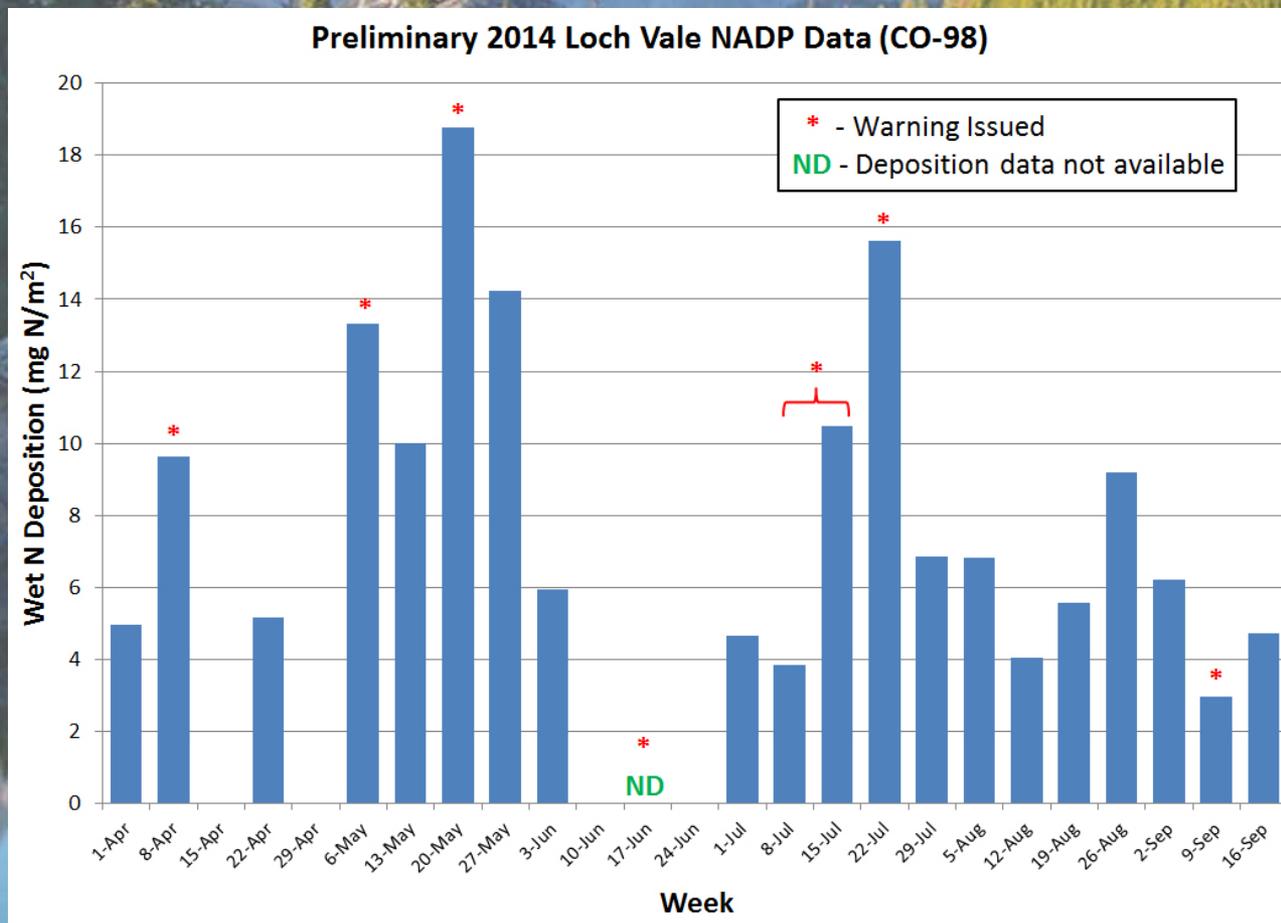


From April 1 to October 15...

- 10 warnings issued
- Participating producers affected ranged from 15 to 27
- Response rates ranged from 33 to 69 percent of affected producers
- 60 to 90 percent of respondents changed practices based on warnings*

EWS Next Steps/Goals

- Evaluate forecasting reliability

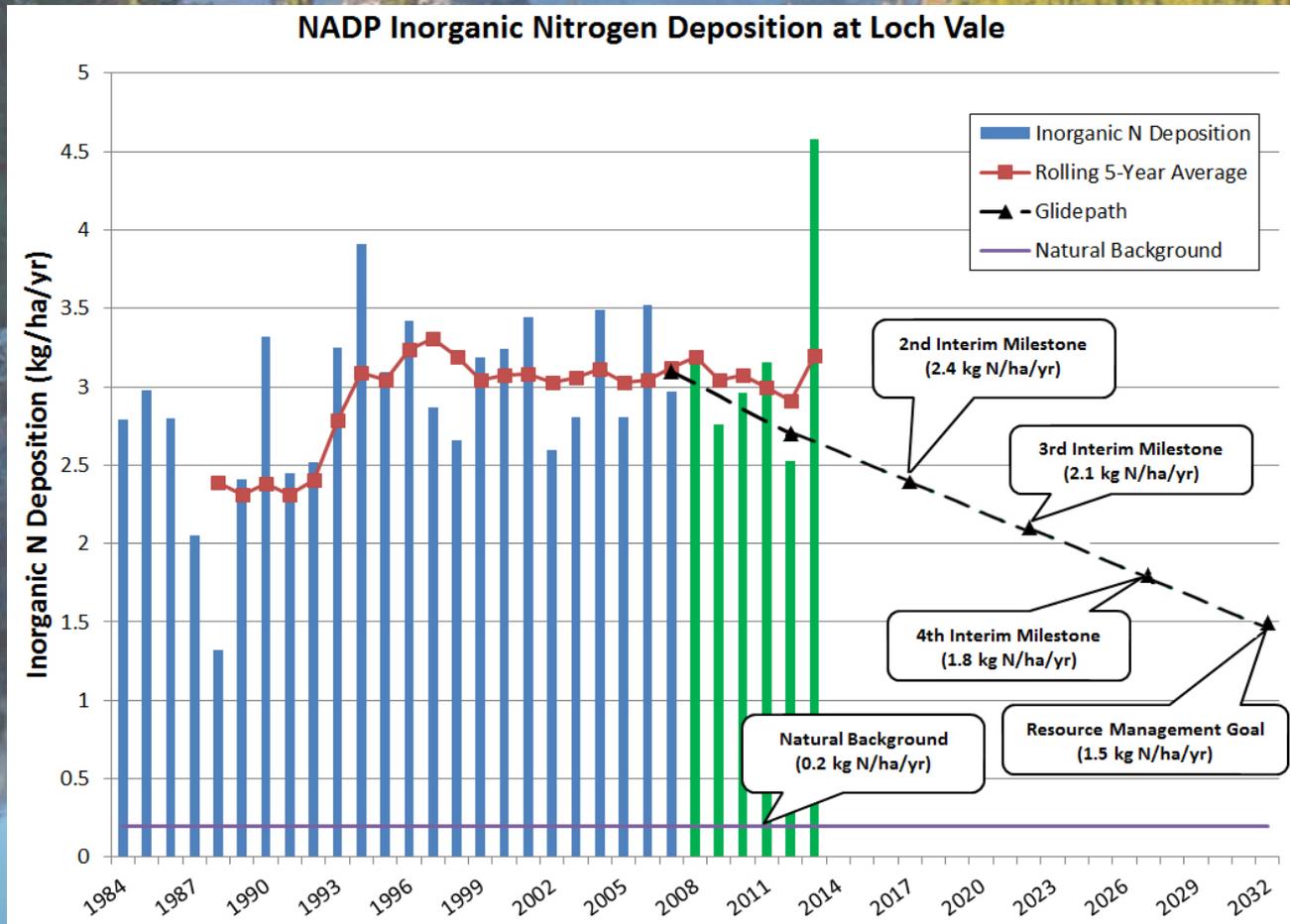


EWS Next Steps/Goals

- Evaluate forecasting reliability
- Increase participant response rates
- Outreach to / recruitment of additional participants in Front Range counties

N-Deposition Reduction Plan

- 2012 milestone was not reached



N-Deposition Reduction Plan

- 2012 milestone was not reached
- Additional monitoring activities
- Communication Plan
 - MOU Agency outreach efforts
 - Push for outreach to out-of-state sources

