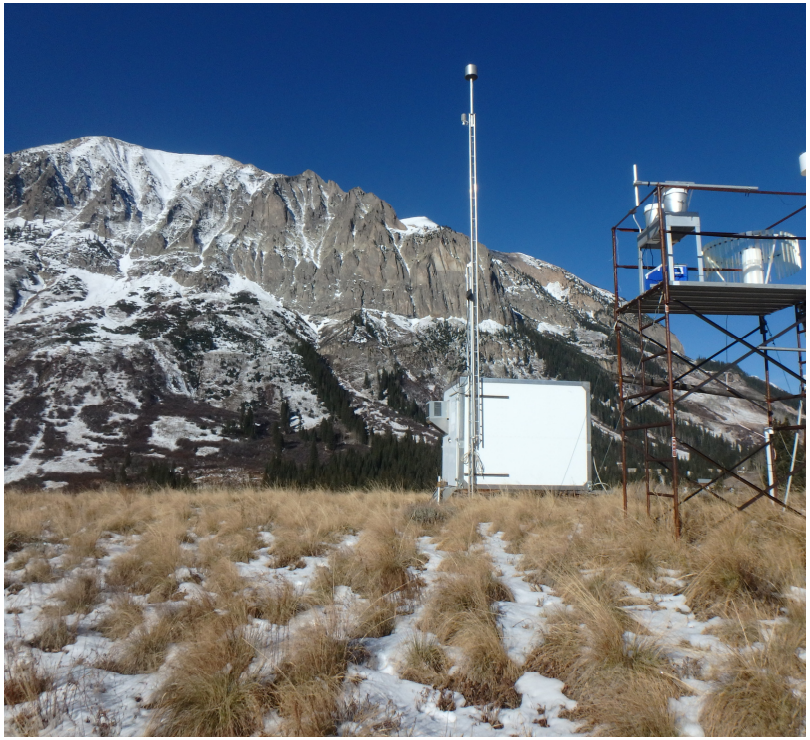
CASTNET Overview and Direction

EPA, NPS, BLM

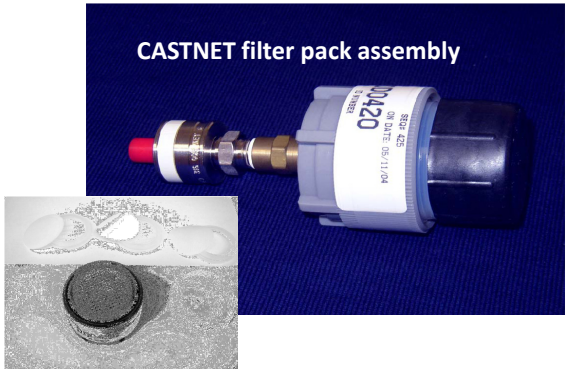
Wood, Air Resource Specialists



High elevation CASTNET + NADP wet deposition monitoring site Gothic, CO

CASTNET Overview

- Network provides data to assess long-term, regionally representative trends in O_3, sulfur, and nitrogen pollutants
  - Gas + particle concentrations in air are measured weekly on filters and used to estimate dry deposition
  - Continuous O_3 concentrations measured to support NAAQS determinations
- Sites are located away from known emissions sources (i.e. EGUs) and often in ecologically important locations including 28 National Parks
- Consistent measurements with a robust quality assurance program provides valuable data



Gases

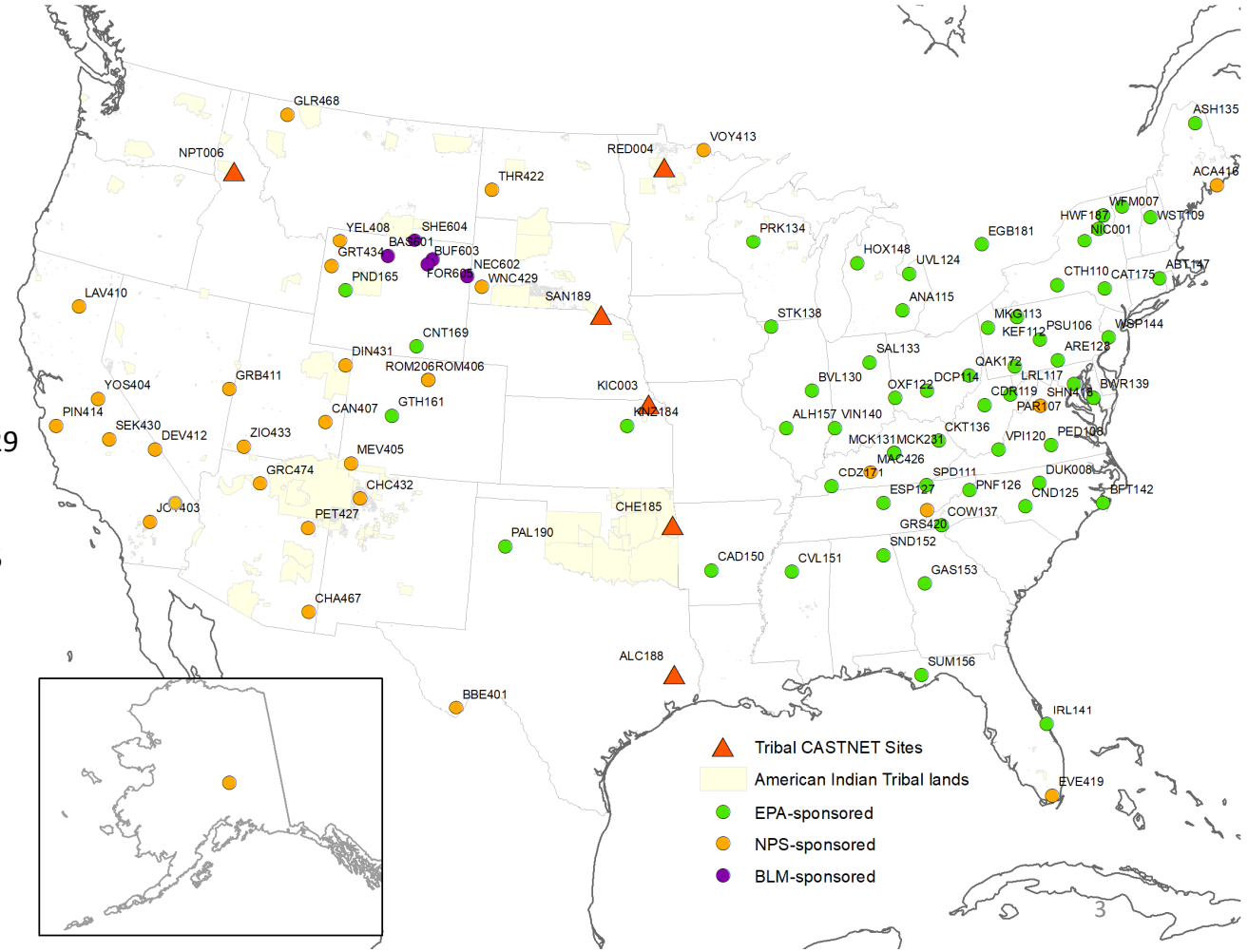
- O_3
- SO_2
- HNO_3
- NO/NO_y

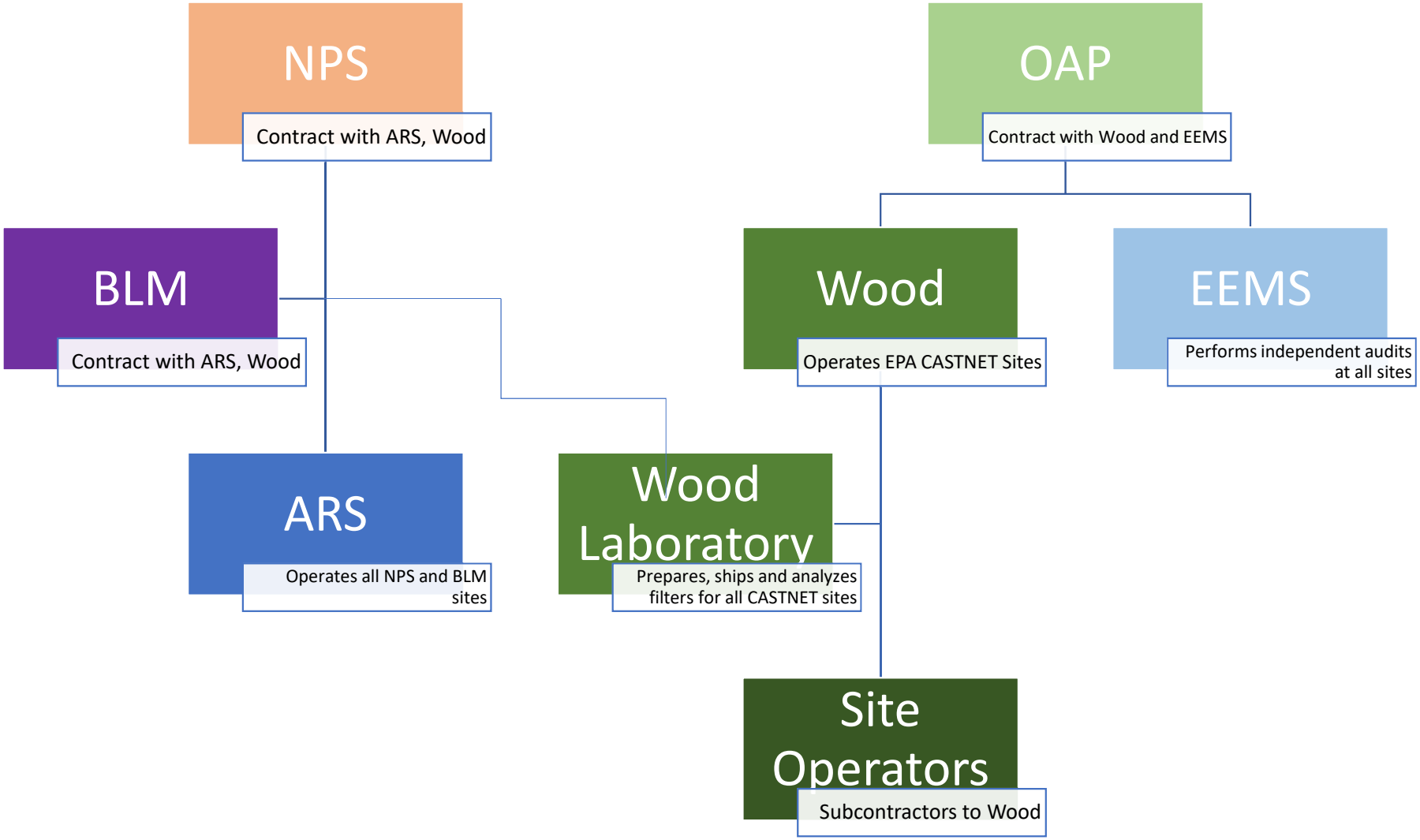
Particles

- NO_3
- NH_4^+
- SO_4^{2-}
- Base Cations
- Cl^-

CASTNET Monitoring Network

- Established in 1987 - **38 sites operating 30+ years** providing valuable data for long-term trends
  - **97 rural monitoring sites**
- OAP:
  - Funds and administers the network contract for 63 sites, contract for independent audits and performance evaluations
  - Manages the database to provide public data access
  - Analyzes the data to assess OAR programs
- NPS
  - Funds and administers network contract for 29 CASTNET sites (primarily in the West)
- BLM-WSO
  - Funds and administers network contract for 5 sites in WY
- Many partners participate in network:
  - 6 tribal sites
  - NY DEC supports two CASTNET sites
  - Region 10 supports O_3 monitoring at Nez Perce, ID
  - Environment & Climate Change Canada
  - Many sites provide in-kind support




NPS
Contract with ARS, Wood
OAP
Contract with Wood and EEMS
BLM
Contract with ARS, Wood
Wood
Operates EPA CASTNET Sites
EEMS
Performs independent audits at all sites
ARS
Operates all NPS and BLM sites
Wood Laboratory
Prepares, ships and analyzes filters for all CASTNET sites
Site Operators
Subcontractors to Wood

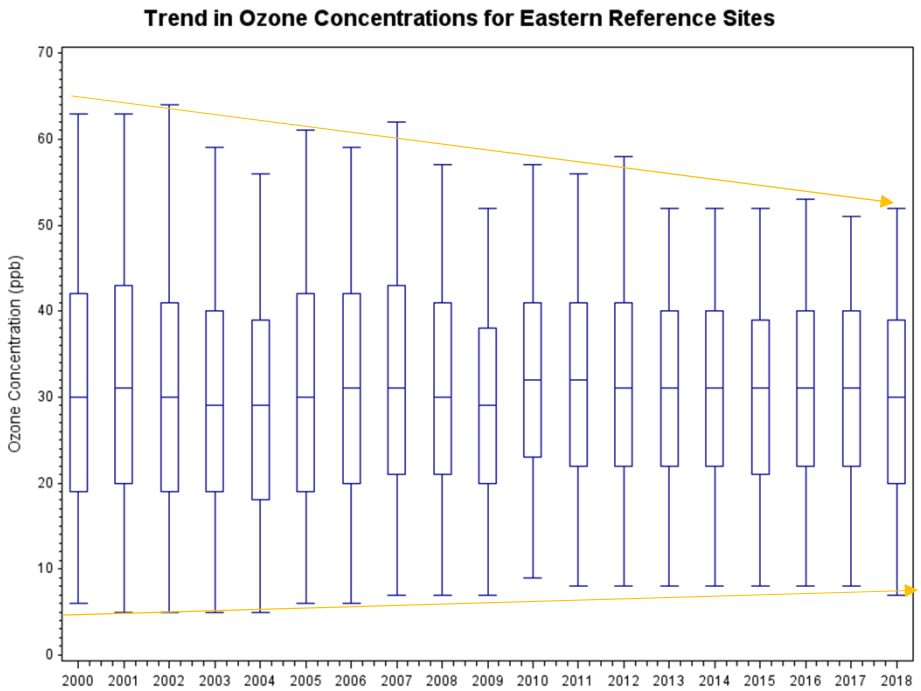
CASTNET Ambient Concentrations

- Large reductions in ambient concentrations of acidic gases and particles
- Data are used by OAR to assess emission reduction programs, Report on the Environment, NEPA/Environmental Impact Statements, NADP total deposition maps -> critical loads
- Focus on understanding the complete nitrogen budget

Worked with Wood, OAQPS and CAPMoN to select nylon filters that met acceptance criteria - MTL

CASTNET Ozone Concentrations

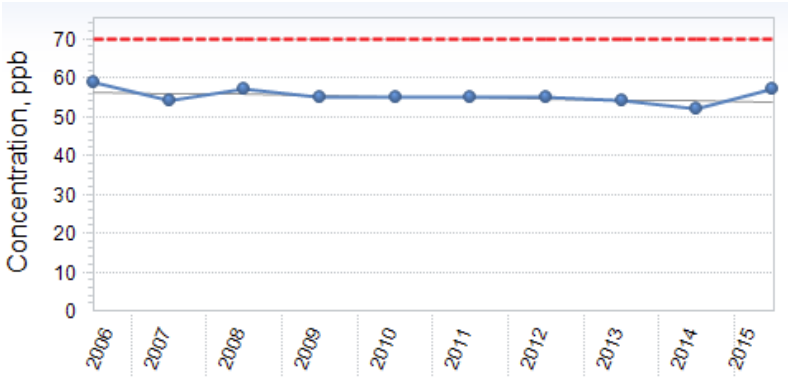
- EPA uses CASTNET O_3 data to assess NAAQS compliance in rural areas and National Parks and assess NOx EGU programs
- Useful for understanding background, stratospheric O_3 intrusions, and impacts from climate change
- Model evaluation on a local, regional and global scale



NPS: Why we monitor

Identify **sources** affecting park resources

Assess conditions and trends



Identify **risks** to park resources

Provide scientifically **robust data** to support mitigation and future protection of resources.

(3) The provisions of this subpart pertaining to implementation plans to address regional haze visibility impairment are applicable to all States as defined in section 302(d) of the Clean Air Act (CAA) except Guam, Puerto Rico, American Samoa, and the Northern Mariana Islands.

[45 FR 80089, Dec. 2, 1980, as amended at 64 FR 35763, July 1, 1999]

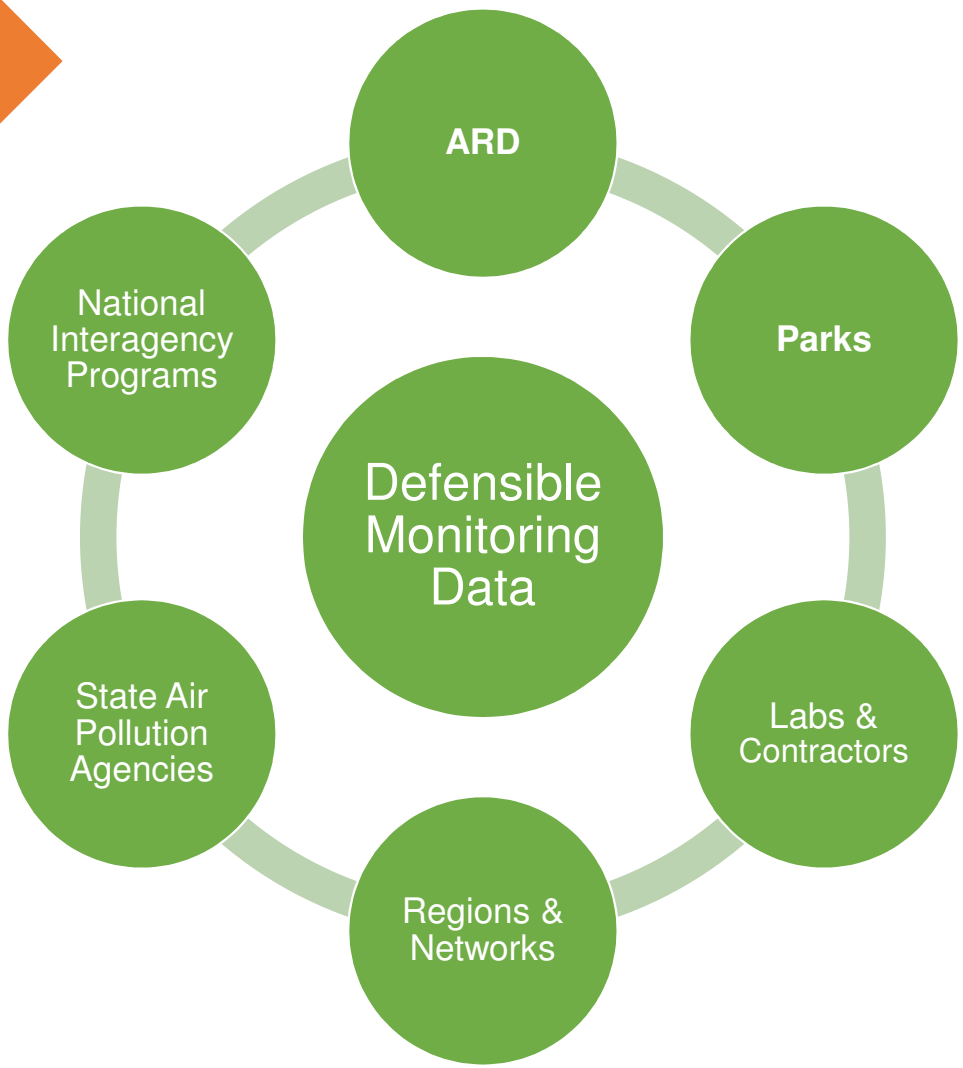
§ 51.301 Definitions.

For purposes of this subpart:

Adverse impact on visibility means, for purposes of section 307, visibility impairment which interferes with the management, protection, preservation, or enjoyment of the visitor's visual experience of the Federal Class I area. This determination must be made on a case-by-case basis taking into account contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Pollutant-emitting activities must be considered as part of the same industrial grouping if they belong to the same *Major Group* (i.e., which have the same two-digit code) as described in the *Standard Industrial Classification Manual, 1972* as amended by the 1977 Supplement (U.S. Government Printing Office stock numbers 4101–0066 and 003–005–00176–0 respectively).

Deciview means a measurement of visibility impairment. A deciview is a haze index derived from calculated light extinction, such that uniform changes in haziness correspond to uniform incremental changes in perception across the entire range of conditions, from pristine to highly impaired.

Partnership



BLM-Wyoming Air Resource Monitoring System (WARMS)

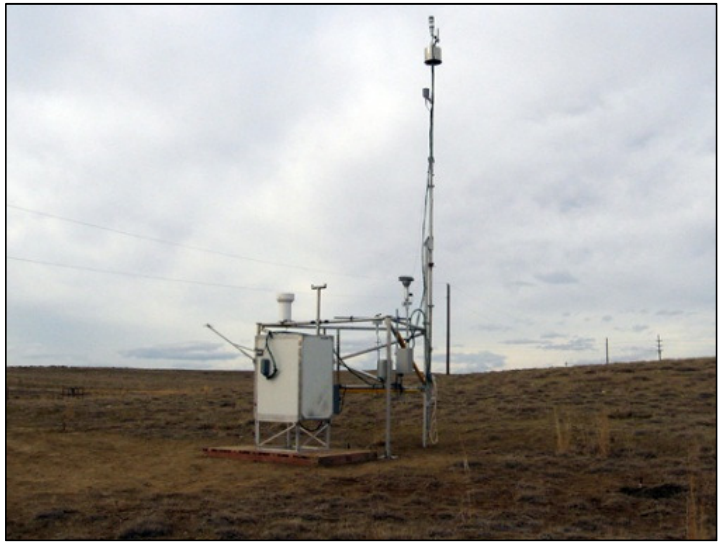
To establish a cost-effective network of air quality monitoring sites to:

- Meet the needs of BLM land managers and decision makers by providing useful air quality data for identifying concerns and evaluating air strategy effectiveness;

- Fulfill air monitoring commitments in Resource Management Plans (RMPs) and other Records of Decisions (RODs); and

- Provide adequate data to assess existing conditions, impacts of federal actions, and long term trends.

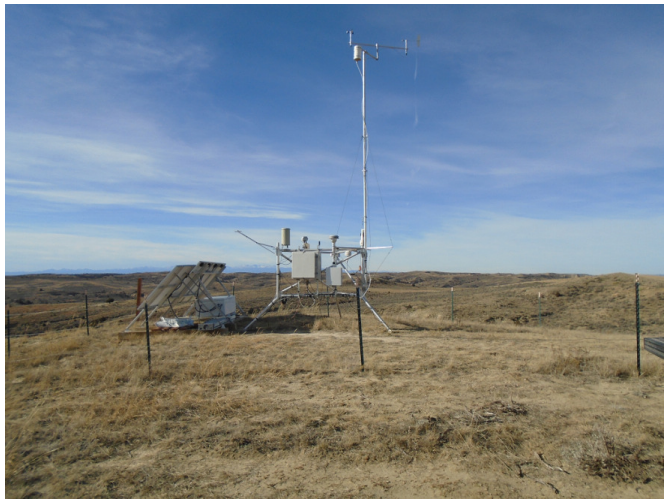
BLM-Wyoming WARMS Sites



Basin

Buffalo

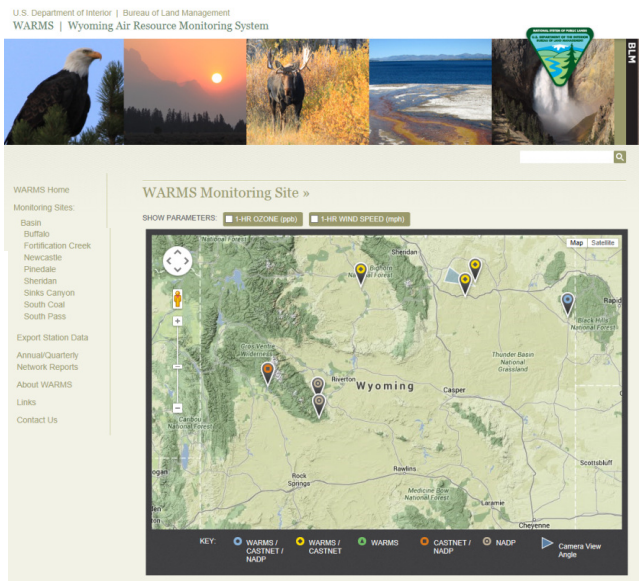
Sheridan

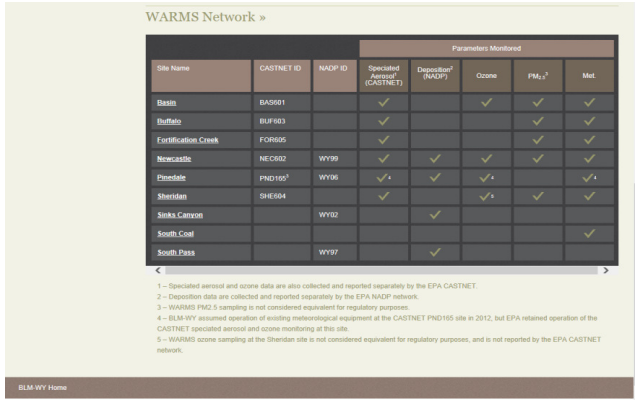


Fortification Creek

Newcastle

WARMS Website



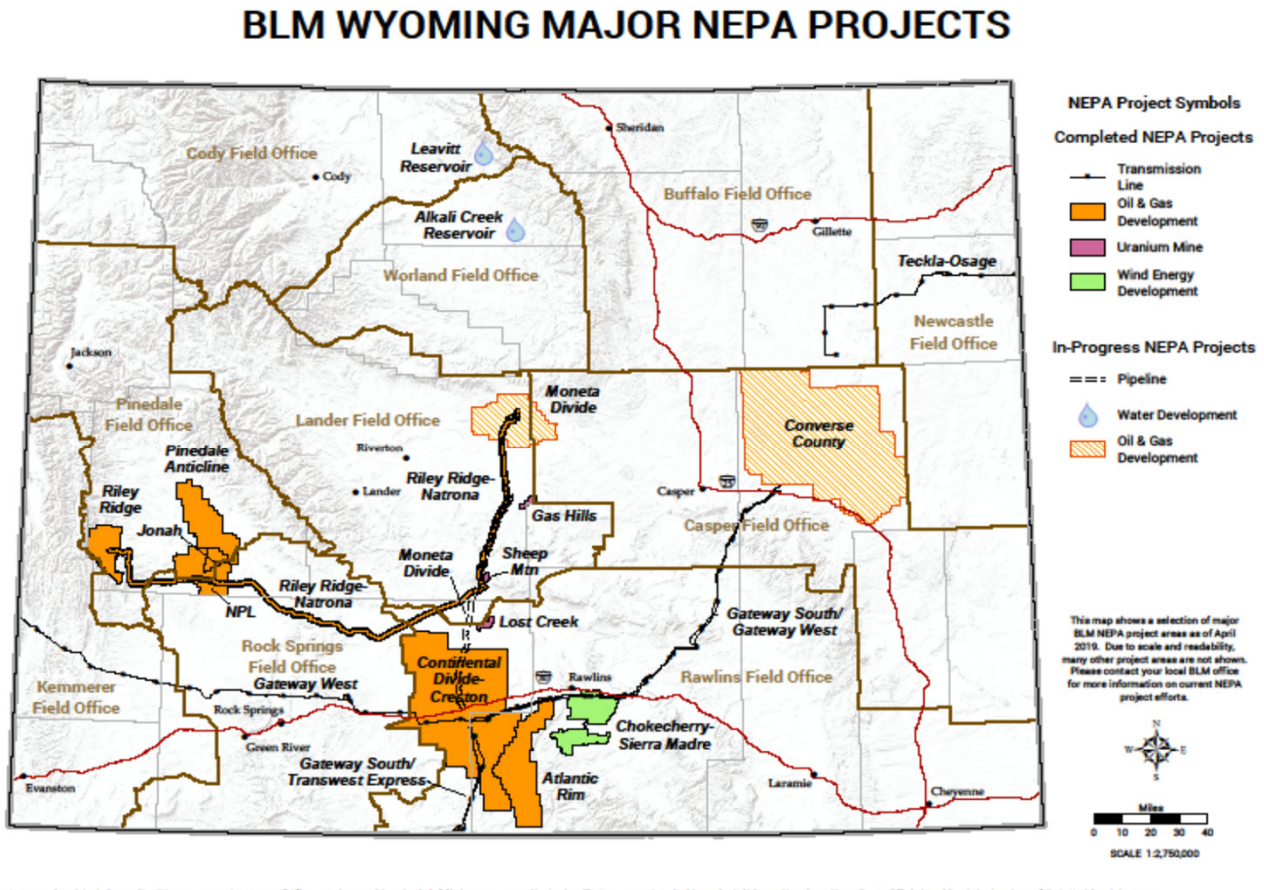


http://www.blmwarms.net/

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

- Guides the Federal decision making process
- Requires Federal agencies to consider environmental impacts alongside technical and economic consideration
- Calls for the evaluation of reasonable alternatives to a proposed action and the unbiased presentation of direct, indirect, and cumulative environmental impacts: Environmental Impact Statement (EIS)
- Encourages solicitation of input from organizations and individuals that could potentially be affected

CURRENT NEPA PROJECTS AS OF APRIL 23, 2019



U.S. Department of the Interior
Bureau of Land Management

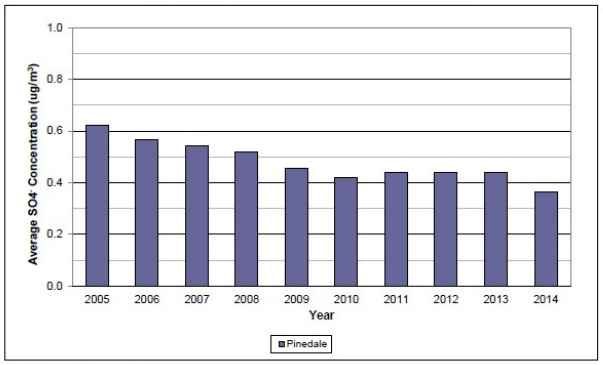
Normally Pressured Lance Natural Gas Development Project

Wyoming - Pinedale Field Office
May 2018

Final Environmental Impact Statement
Volume I (Chapters 1-3)

Pinedale, Wyoming CASTNET Site

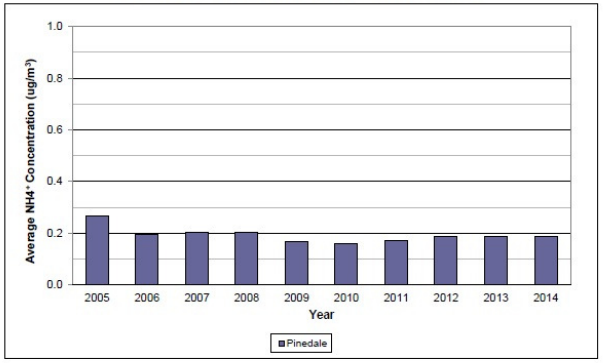
Figure 3-13b. Annual Average Concentration (µg/m³) for the CASTNet Monitoring Site at Pinedale: Sulfate Ion Concentration



Source: VIEWS 2014.

µg/m³ micrograms per cubic meter
CASTNet Clean Air Status and Trends Network

Figure 3-13c. Annual Average Concentration (µg/m³) for the CASTNet Monitoring Site at Pinedale: Ammonium Ion Concentration



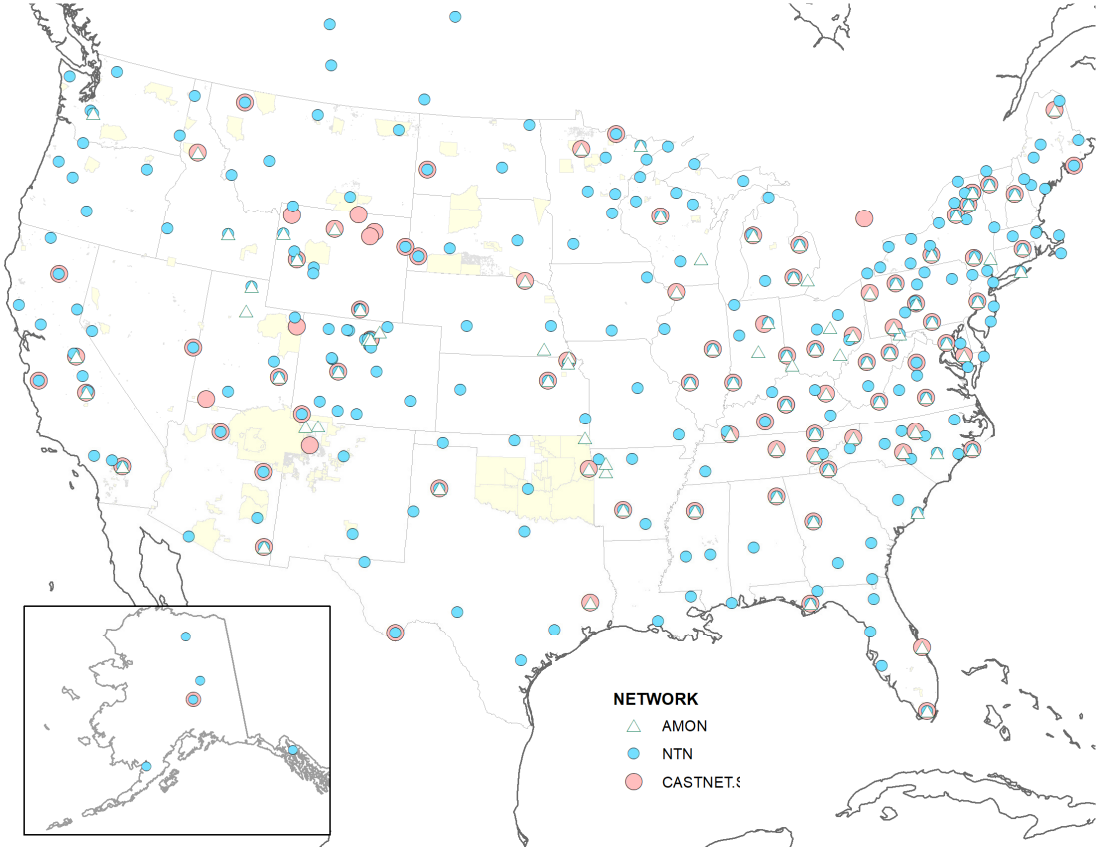
Source: VIEWS 2014.

µg/m³ micrograms per cubic meter
CASTNet Clean Air Status and Trends Network

National Atmospheric Deposition Network (NADP)

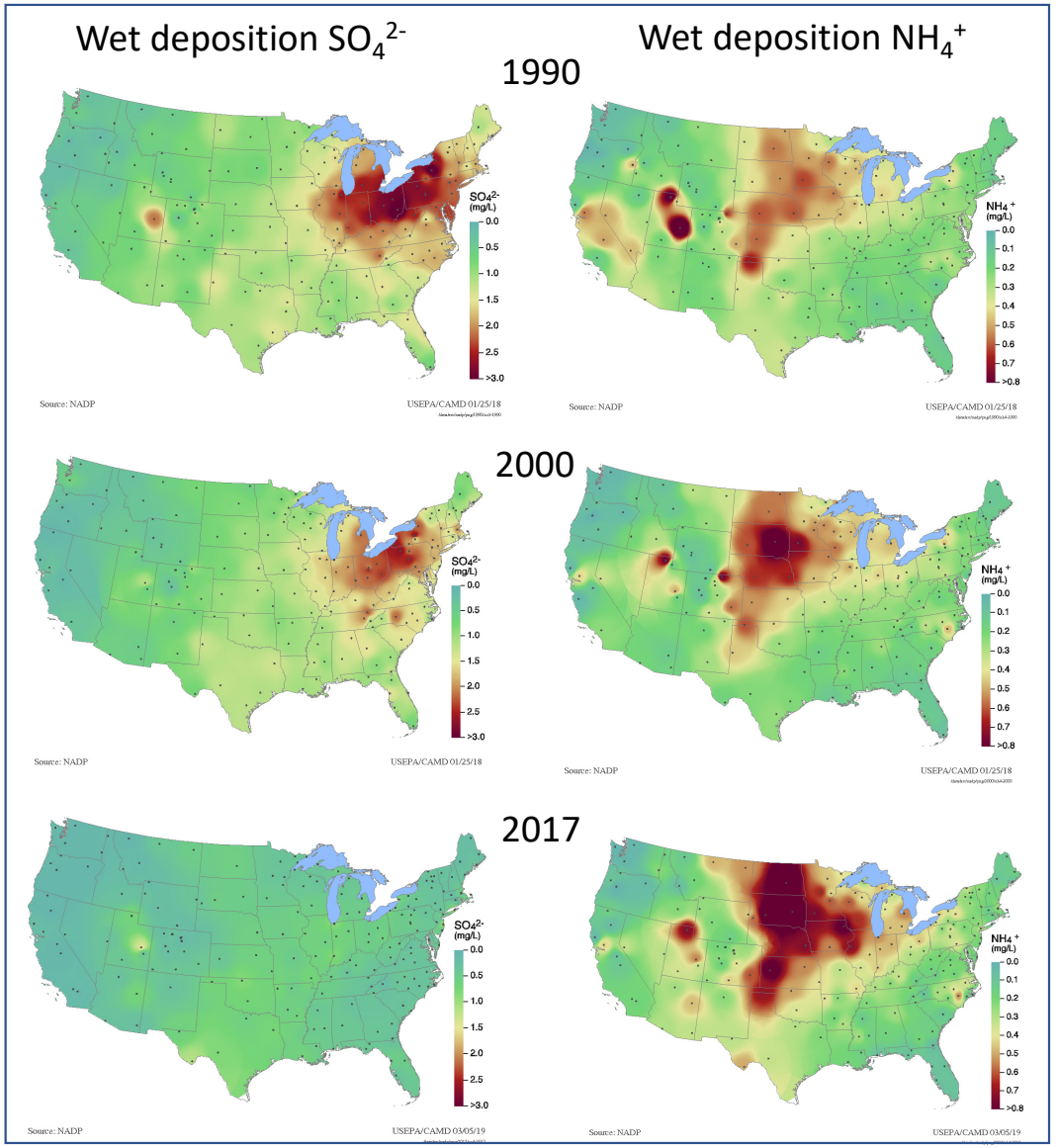
- Program established in 1978 to measure pollutants in precipitation (acid rain)
  - **National Trends Network (NTN)** measures weekly wet deposition of SO_4^{2-}, NO_3^-, NH_4^+, pH, cations, Cl^- at more than 200 sites
  - Nearly all CASTNET sites are co-located or near an NTN site
  - NTN provides long-term record of consistent measurements from regionally representative sites
- Mercury Monitoring
  - **Mercury Deposition Network (MDN)** provides weekly wet deposition of Hg
  - **Atmospheric Mercury Network (AMNet)** provides concentrations of speciated gaseous Hg
- Ammonia Monitoring
  - **Ammonia Monitoring Network (AMoN)** provides bi-weekly concentrations of ambient NH_3
  - Network was established in 2007 and has grown to more than 100 sites
  - Over 60 AMoN sites co-located with CASTNET

Deposition results from CASTNET + NADP provide accountability for OAR's emission reduction programs

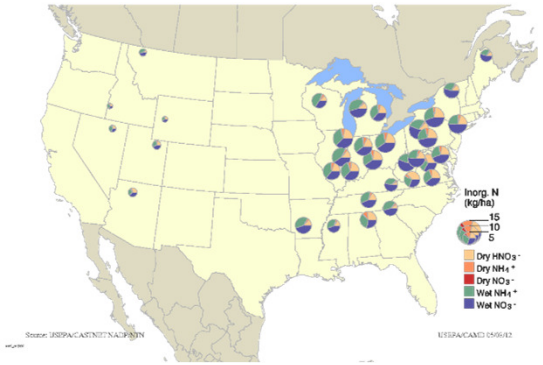


NADP

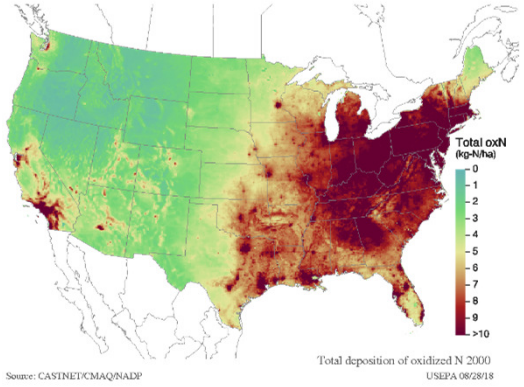
- Program is supported by 7 federal agencies and 87 subscribers that include universities, state agencies, tribes, cities, and industry
  - CASTNET budget supports:
    - NADP's **quality assurance** program
    - Independent **field audits**
    - Over **100 sites**
- CASTNET and NADP have advanced the science of **total atmospheric deposition**
  - Data fusion mapping method combines measurement data from CASTNET + NTN and modeled estimates from CMAQ to expand coverage
  - Maps are used to assess critical loads and ecosystem effects in areas where monitoring is sparse



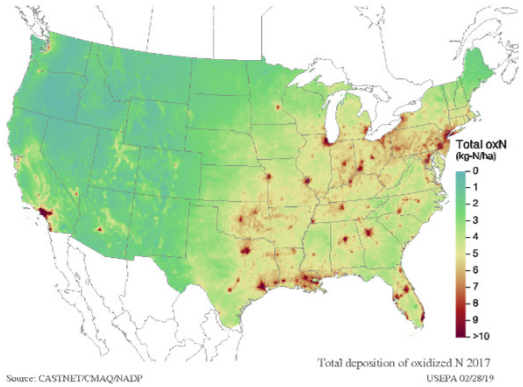
Measurement Model Fusion



1990 Total Oxidized N Deposition



2000 Total Oxidized N Deposition

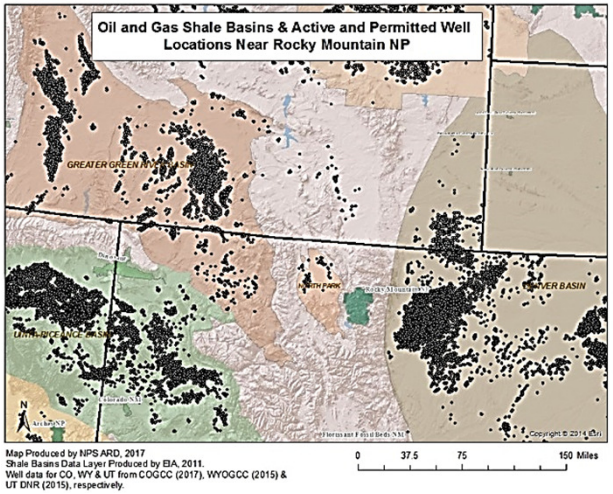


2017 Total Oxidized N Deposition

- Multi-layer model provided deposition estimates at CASTNET sites (1km) using on-site meteorology
- MMF method provides a more complete deposition budget over the contiguous US within a 12km grid
  - Using modeled meteorology, emissions from 2012

Current Issues

- Oil and gas development
- Agricultural emissions
- Greenhouse gases and climate
- Total deposition and critical loads
  - Dry deposition in arid areas
- Mercury and toxics effects, cycling, and emissions
- Wildfires, prescribed burns, and smoke
- Visual Resources
- Microplastics



Current Issues

► Oil and gas development

E&E NEWS PM

AN E&E NEWS PUBLICATION

NATIONAL PARKS

NPS to superintendents: Opposed to drilling? Call us first

Rob Hotakainen, E&E News reporter

Published: Thursday, September 19, 2019

David Vela, the acting deputy director of operations for the National Park Service, has told superintendents to notify Washington before making official comments on projects related to Interior Department priorities. @the_sca/Twitter

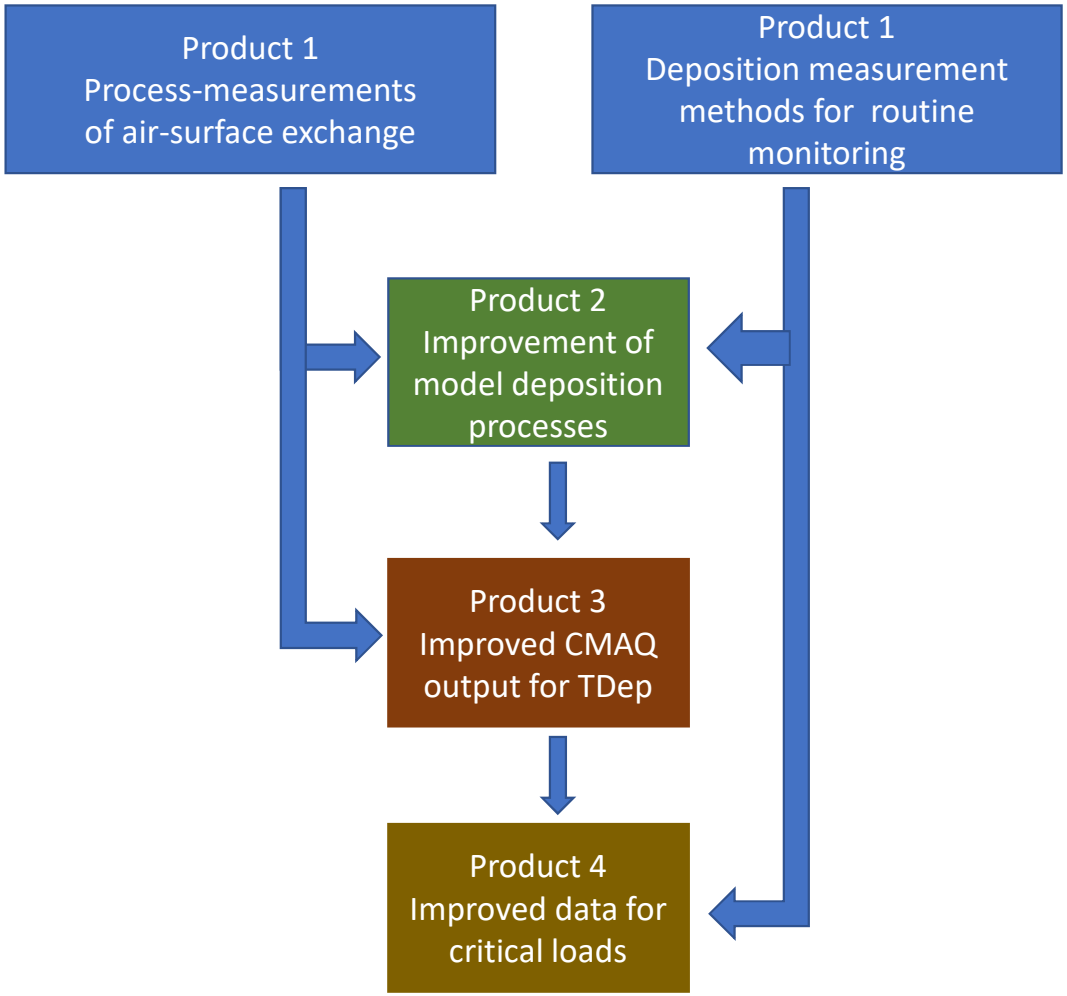
Any national park superintendent who fears the effects of nearby energy development may want to think twice before speaking out.

David Vela, the acting deputy director of operations for the National Park Service, has ordered superintendents to flag Washington before making any official comments on projects that pertain to Interior Department priorities, including **energy development**.

In a **memo** made public today, Vela said it's important that the Washington office be notified in advance **"to ensure that NPS comments receive appropriate senior level awareness and coordination."**

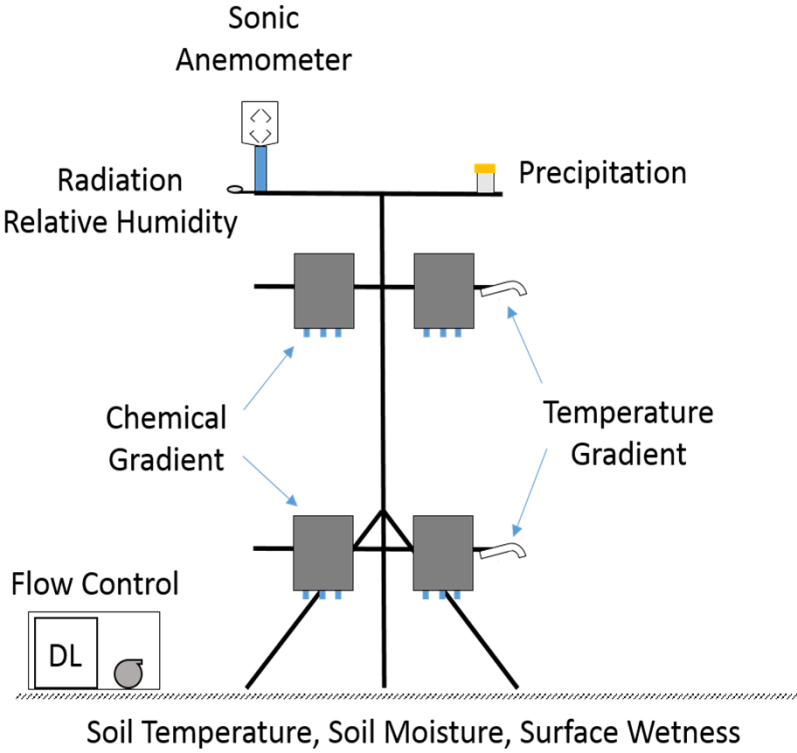
ORD/OAP Collaboration

- Evolving research planning process within ORD
  - OAP/CAMD has always worked closely with ORD in the planning and execution of research projects to support CASTNET and related deposition/ecosystem response research areas
  - Method and model improvements can be implemented. Examples:
    - Small footprint/off-grid CASTNET sites
    - Nitrotrain
    - Measurement model fusion
    - MARGA direct deposition measurements
- In the past CASTNET funded research projects but now must rely on ORD to improve deposition methods and models to keep sites operating and deploy new measurements



Examples of CASTNET Needs Under Research Area 3 Output 14

- Product 1: Advanced measurements of air-surface exchange and ecosystem exposure
  - Development of COTAG for routine monitoring: CASTNET has helped develop SOPs for preparation/extraction/analysis of the denuder filterpacks
  - Prototype system is being tested in the field
  - Deployment at CASTNET sites is a priority to measure dry deposition -> will link to product 3 and 4 with improved model estimates
  - Support for Duke Forest as a long-term flux measurement site that will provide trends in deposition fluxes
- Product 2: Advanced modeling of air-surface exchange processes
  - CASTNET and ORD have collected seasonal vegetation and soil chemistry from 3 AMoN sites to parameterize bi-directional NH_3 flux model
  - Data are being reduced – including micrometeorological data
  - Model is phase II and will be used for AMoN dry deposition fluxes
- Product 3: Atmospheric modeling to support human and ecosystem assessments
  - CMAQ 5.3 timeseries will be used for 2020 Tdep maps
  - Grids from Tdep are used by CASTNET to report dry deposition – MLM no longer supported
- Product 4: Advances in critical loads and quantifying impacts from atmospheric deposition to natural ecosystems
  - End users of CASTNET and TDep data



Conditional time-averaged gradient method for direct flux measurements

Greenhouse Gas Monitoring

We have the infrastructure…

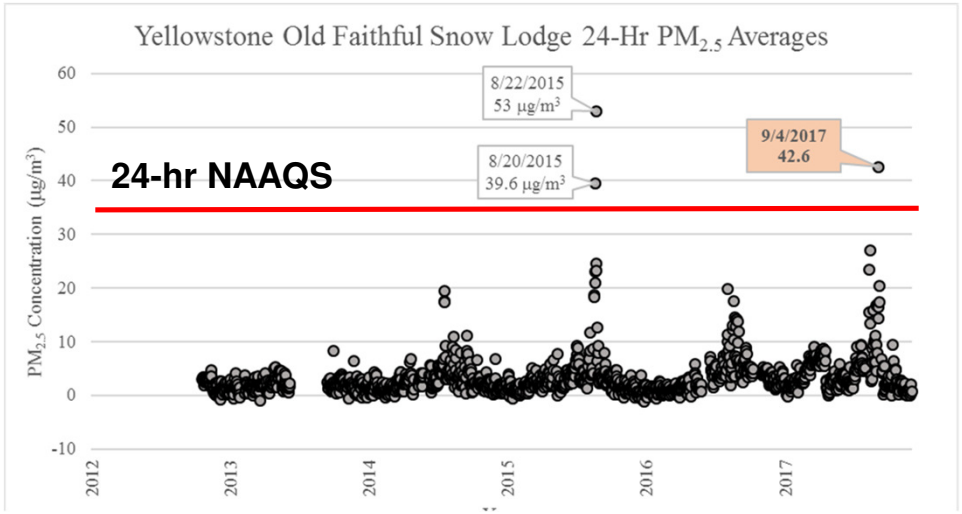


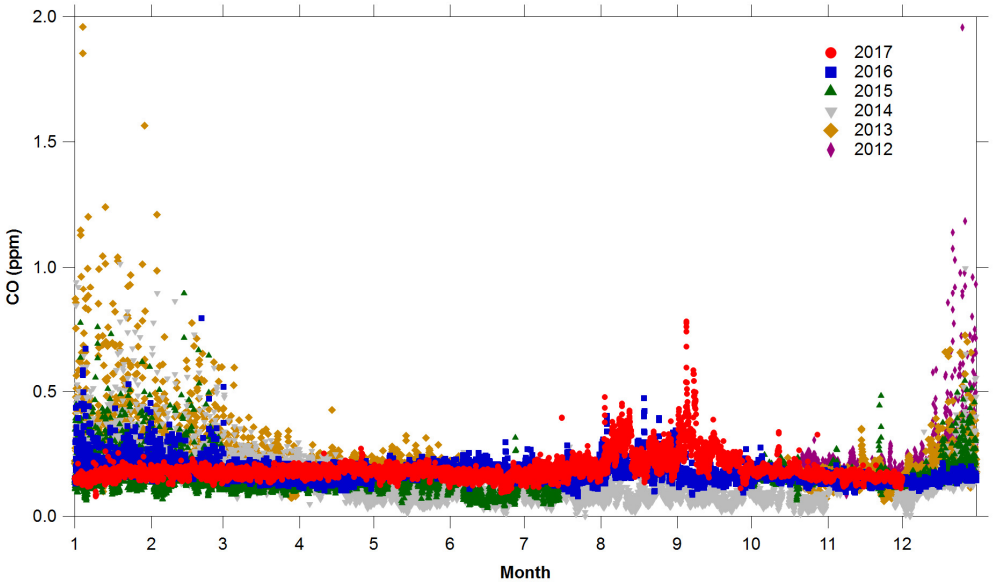
Atmospheric Gas	Anthropogenic Sources	Natural Sources	Sinks
CO_2	combustion of fossil fuels (coal, oil and gas in power plants, automobiles, etc.) and deforestation	animal and plant respiration, and ocean-atmosphere exchange	oceans and growing plants
CH_4	decomposition of wastes in landfills, natural gas and oil systems, coal mining, livestock enteric fermentation manure management	wetlands, rice agriculture, biomass burning, oceans, rivers and estuaries	reaction with hydroxyl radical (OH)
N_2O	agricultural soil management, fossil fuel combustion, nitric acid production and adipic acid production	bacterial breakdown of nitrogen in soils and in the earth's oceans	photolysis and reaction with $O(^1D)$
SF_6	industrial processes including electrical, semiconductor, magnesium and aluminum industries	-	-
CO	biomass burning and fossil fuel combustion	oxidation of CH_4 and NMHCs	reaction with hydroxyl radical (OH)

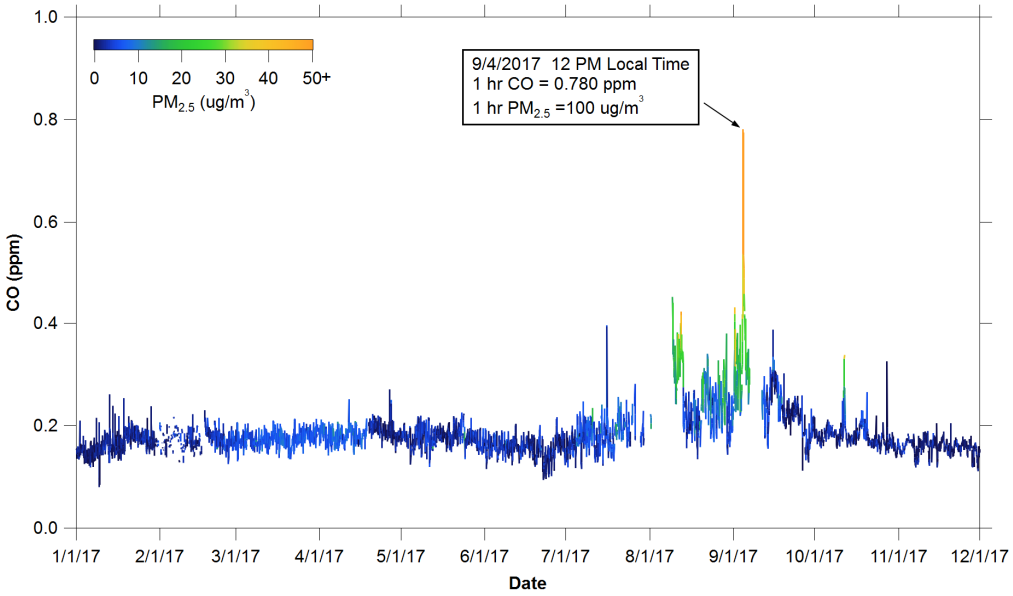




Wildfires in the Intermountain West (YELL)





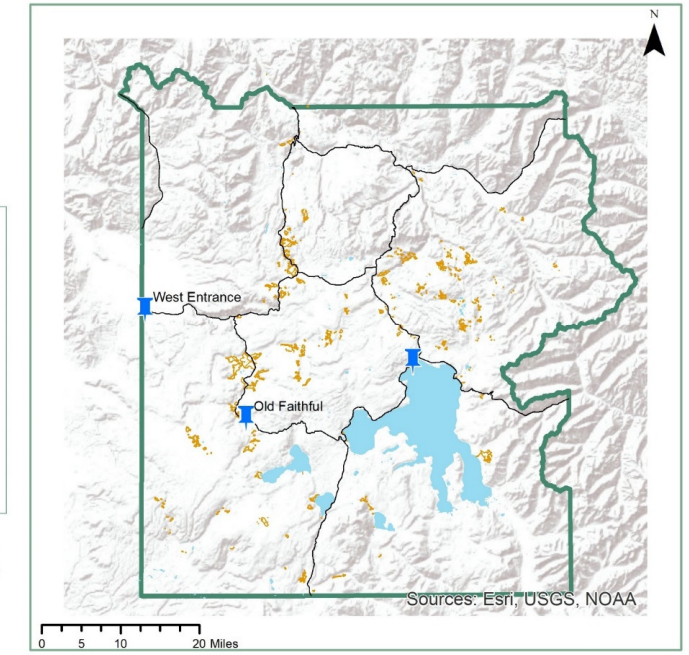


Summer Use AQ Issues YELL

Monitors:

- CO
- $PM_{2.5}$
- NOx
- Traffic count

High-use corridor betw WS & OF

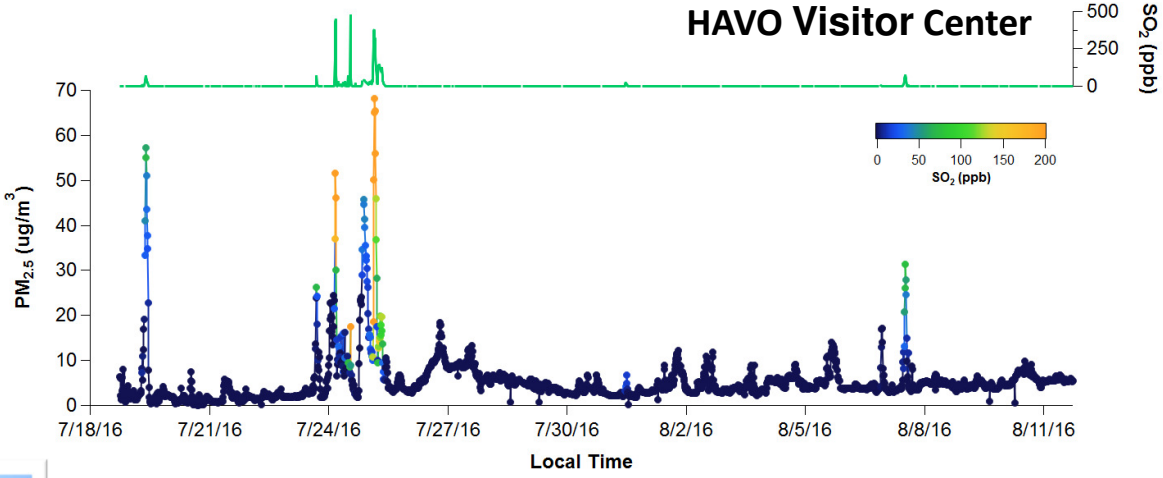


Sensor Based Survey Measurements

Klondike Gold Rush NHP

ARISense:
Particle Size Range: 0.38 ≤ d ≤ 17 μm (16 size bins)
Gas Measurements:
- Electrochemical: NO, NO_2, Ox (O_3 + NO_2), CO
- NDIR: CO_2

Sensor Based SO_2 Alert System at HAVO

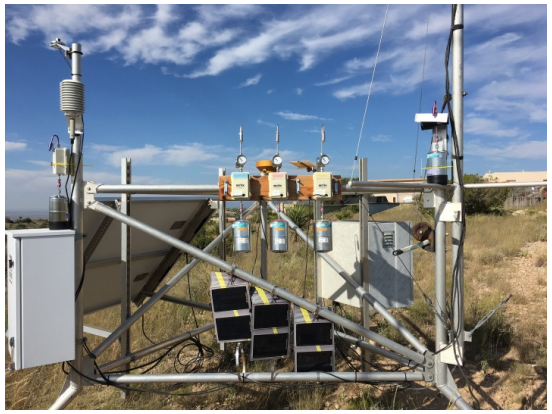


Kealakomo Overlook/Naulu Trailhead

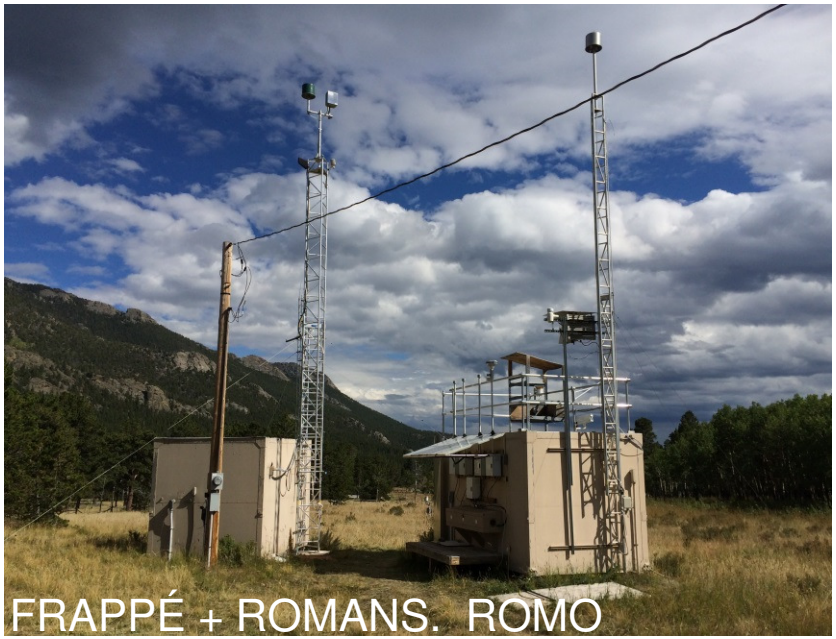
Special Studies

Larger scale coordinated efforts between agencies?

Carlsbad NM Special Study with EPA in 2020



VOC Source Attribution Study
CAVE, GRBA, GRCA, JOTR

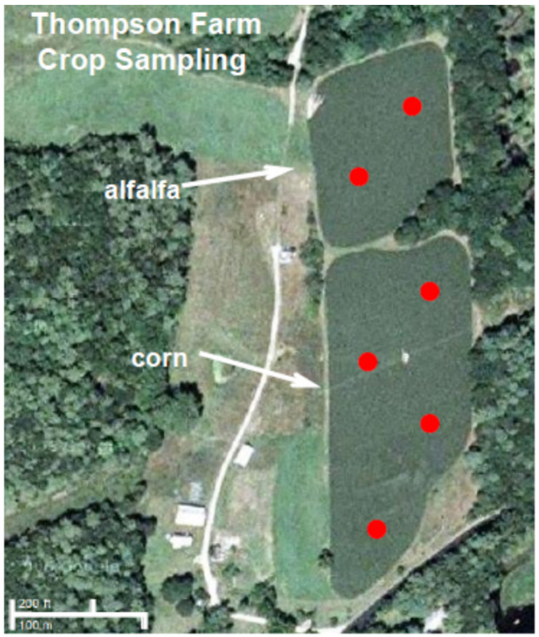


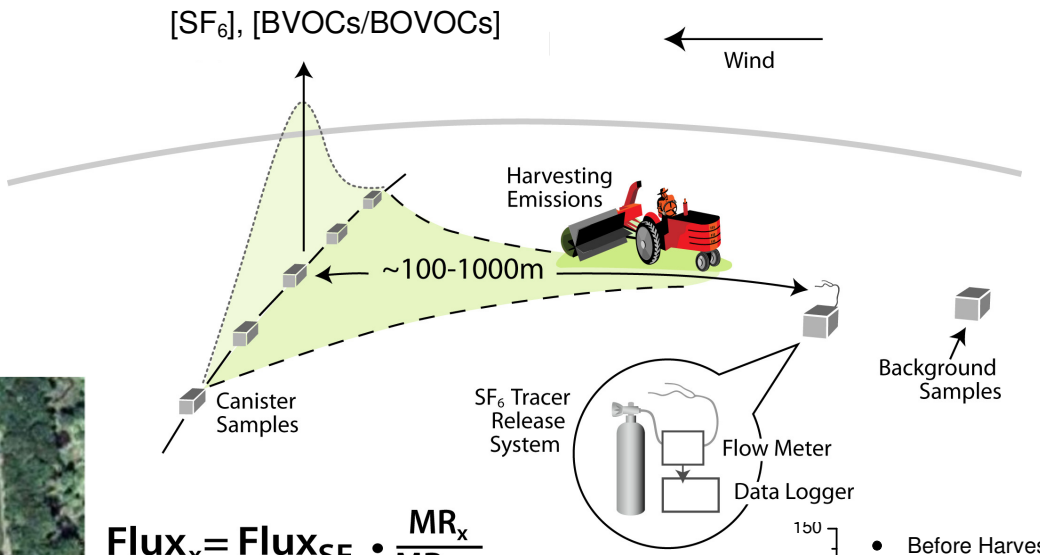
FRAPPÉ + ROMANS. ROMO

GrandTReNDS. GRTE

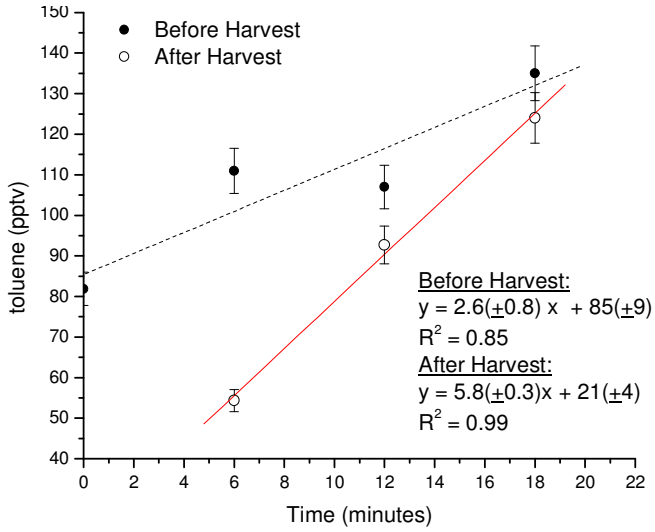
Bakken Air Quality Study. THRO

Ag Issues: Crop Harvesting Emissions and Air Quality Impacts



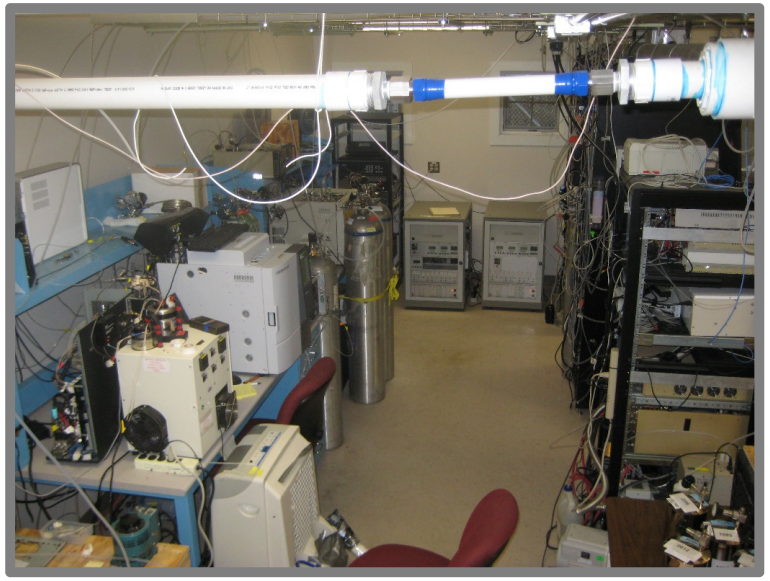


$$Flux_x = Flux_{SF_6} \bullet \frac{MR_x}{MR_{SF_6}}$$



Multi-agency supported “Super Site”

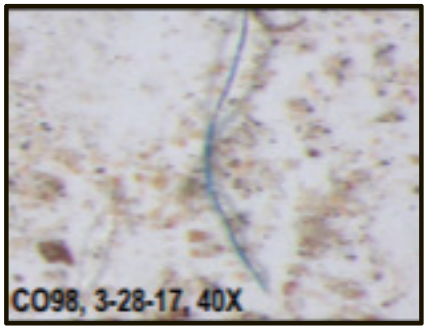
Operate and provide an unequalled facility to the scientific community for measurements and addressing key air quality issues.



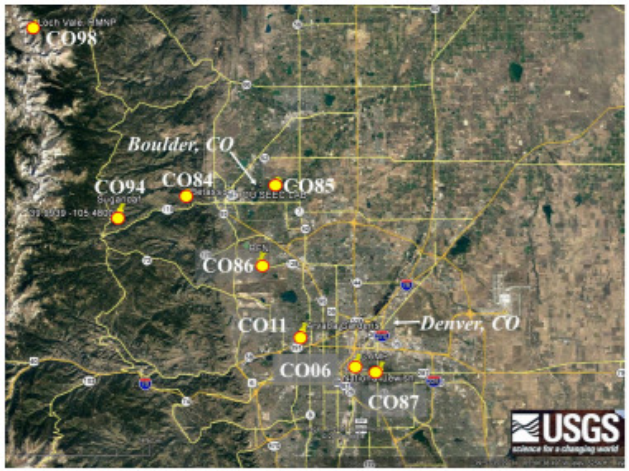
Future Direction of the Program

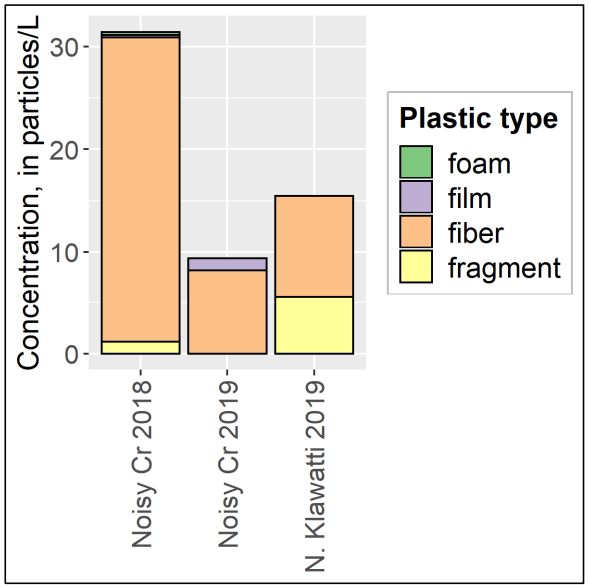
- Maintain existing monitoring sites to preserve long-term data record
- Continue to improve concentrations and total deposition estimates
  - Utilize expertise of the TDep research community
  - Collaborate with ORD on future method and model development
  - Use Tdep white paper (*Science needs for continued development of total nitrogen deposition budgets in the United States)* as a guide to prioritize research
- Engage with federal, state and tribal partners who may utilize CASTNET infrastructure for testing or deploying measurements
  - PANDORA
- Microplastics

Deposition of Microplastics (<5mm)



- In NADP precipitation sample at Loch Vale in RMNP (Wetherbee)
- In snowpack sample at NOCA (Baldwin)
- Source? Transport?
- Ecological Effect?





www.epa.gov/castnet

Melissa Puchalski Puchalski.melissa@epa.gov
Barkley Sive barkley_sive@nps.gov
Kristi Morris kristi_morris@nps.gov
Ryan McCammon rmccammon@blm.gov