



The Effects of Mining on Air Quality

Trent Wickman, US Forest Service





Goals for the Presentation

Introduce myself

What are the air emissions from mining?

What types of environmental impacts are possible?

What types of monitoring can be done to assess impacts?

What regulations apply?

Who are the agencies involved?

Case examples



Who am I?

- Environmental Engineering and Biology degrees from Michigan Tech
- Worked for the State of MN for 5 years as an air permit engineer
- Been with Forest Service since 2001
- Native of NE MN and UP of MI



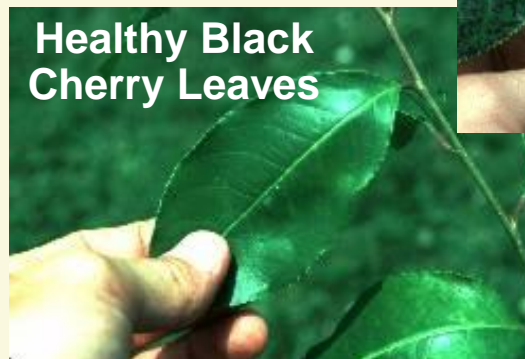


Air Emissions from Mining

- Vary based on type of mine, processing technology, and controls implemented
- Source types: Stack, fugitive, mobile-tailpipe
- Hundreds of individual pollutants
- Regulated pollutants – two main classes
 - Criteria: SO₂, NO_x, PM_{2.5}
 - Air Toxics: 188 listed chemicals: mercury, benzene

Effects of Air Pollution?

Very small amounts of air pollution can affect forest health.



Healthy Black Cherry Leaves



Stippling and Necrosis



Tissue Injury

Visitors rank “breathing fresh, clean air” a principle reason for visiting the national forests. Poor air quality and impaired visibility are an economic drag on local communities who rely upon tourism.



Air Quality

The integrating resource !





Air Quality Impacts

- Mercury Deposition
- Visibility
- Acid Deposition
- Ozone (smog)/Particulates

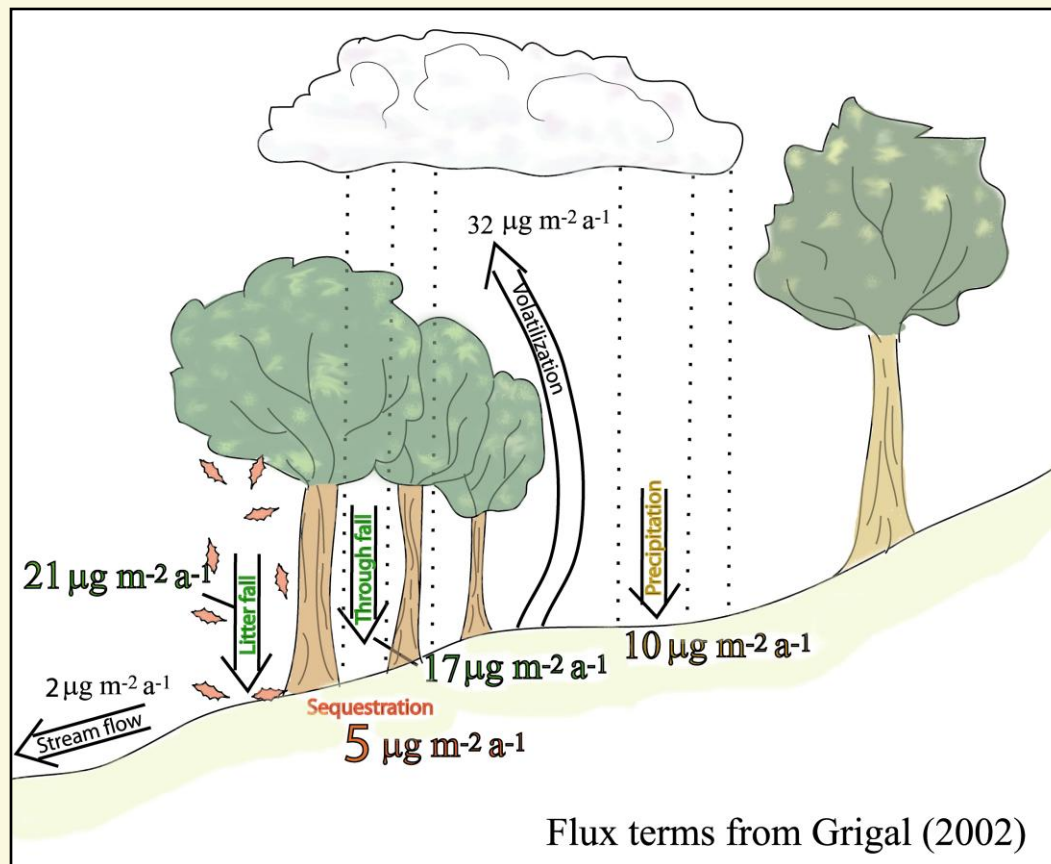




What it's All About !



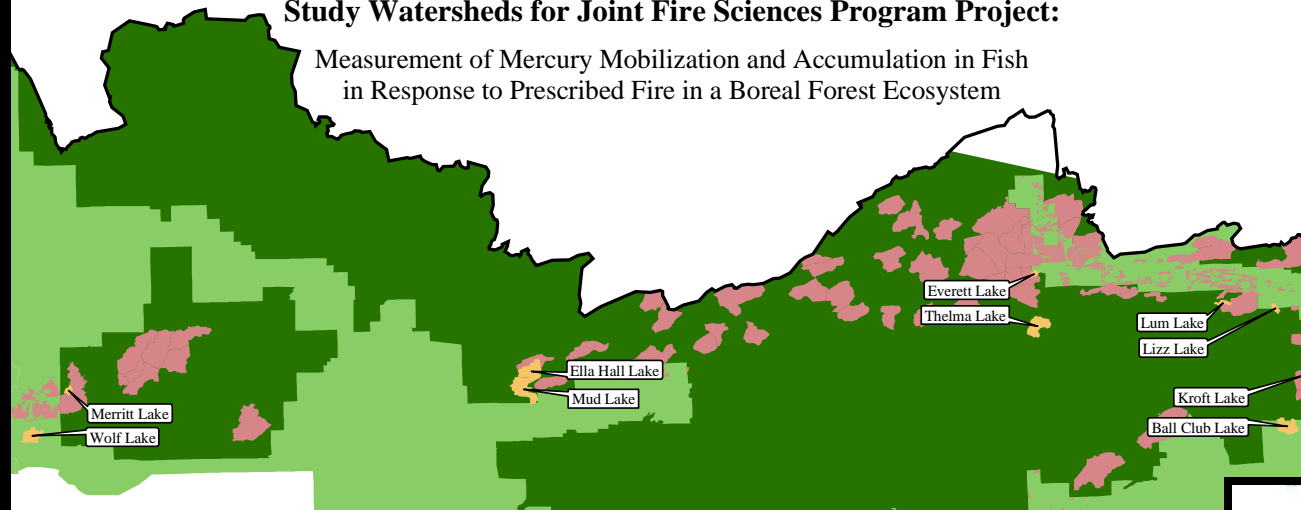
Forest Mercury Cycle





Study Watersheds for Joint Fire Sciences Program Project:

Measurement of Mercury Mobilization and Accumulation in Fish
in Response to Prescribed Fire in a Boreal Forest Ecosystem





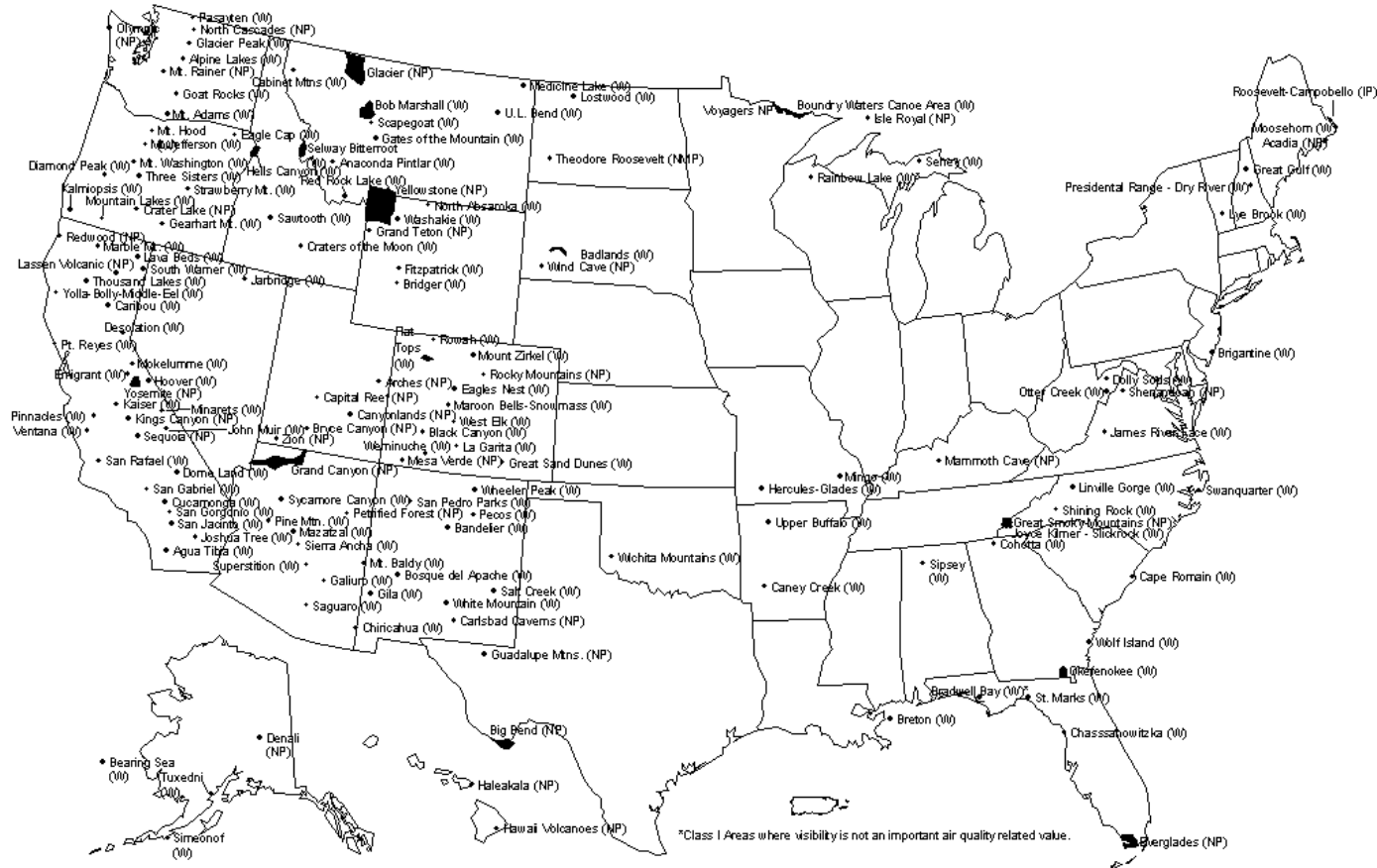
Air Quality Impacts

- Mercury Deposition
- Visibility
- Acid Deposition
- Ozone (smog)/Particulates



USDA Forest Service

Caring for the land and serving people

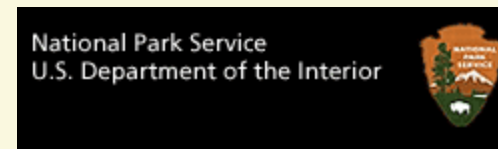


Map of 156 National Park and Wilderness Areas Protected by EPA's Regional Haze Rule



Who are the Federal Land Managers? (FLMs)

- USDA Forest Service –
Class I Wildernesses
- National Park Service -
Class I National Parks
- US Fish and Wildlife
Service - Class I National
Wildlife Refuges



Example of Visibility Impairment

BWCAW IMPROVE Camera Site



Clear Day

Natural Visibility
> 125 miles



Hazy Day

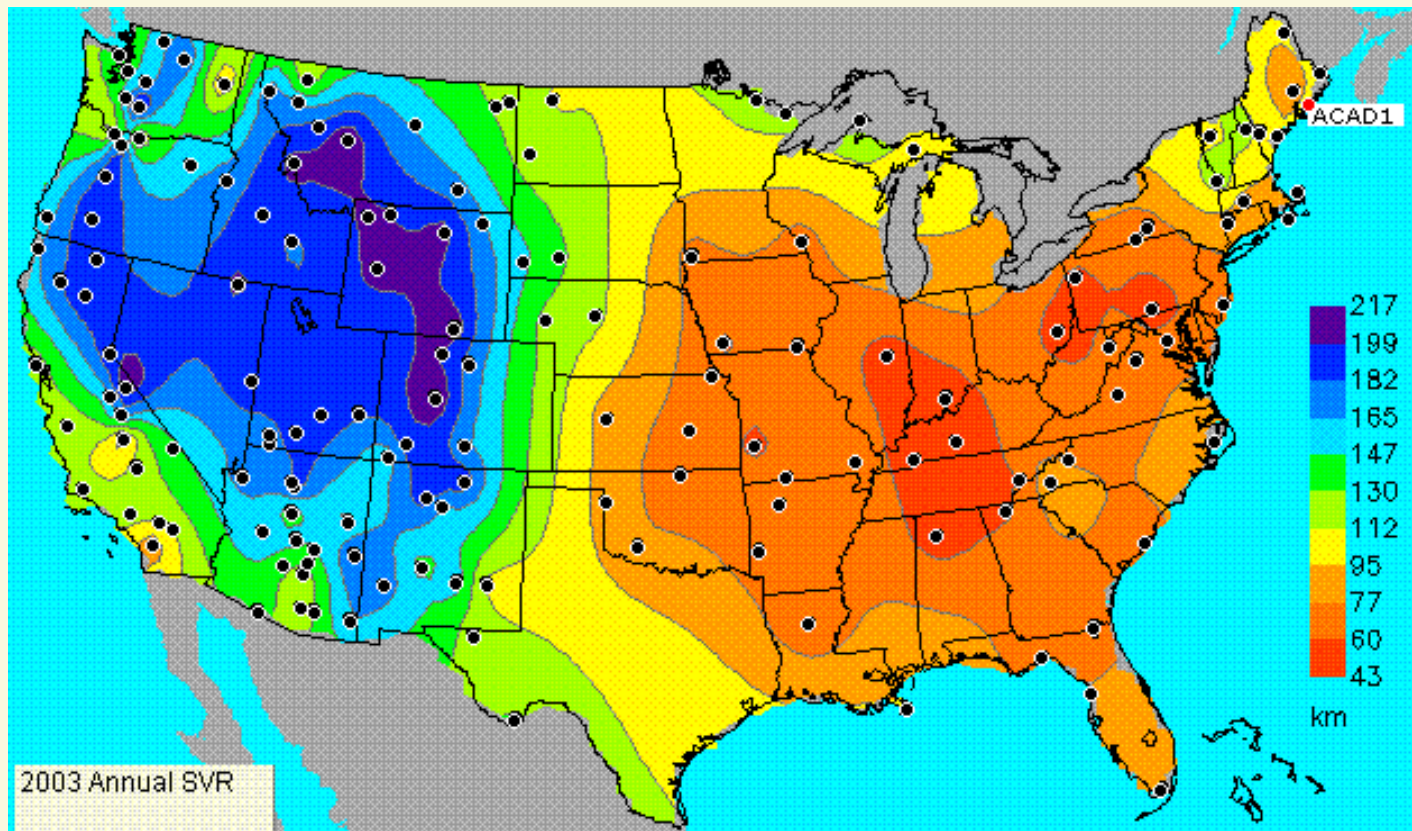
Degraded Visibility
< 30 miles

IMPROVE Monitoring Network



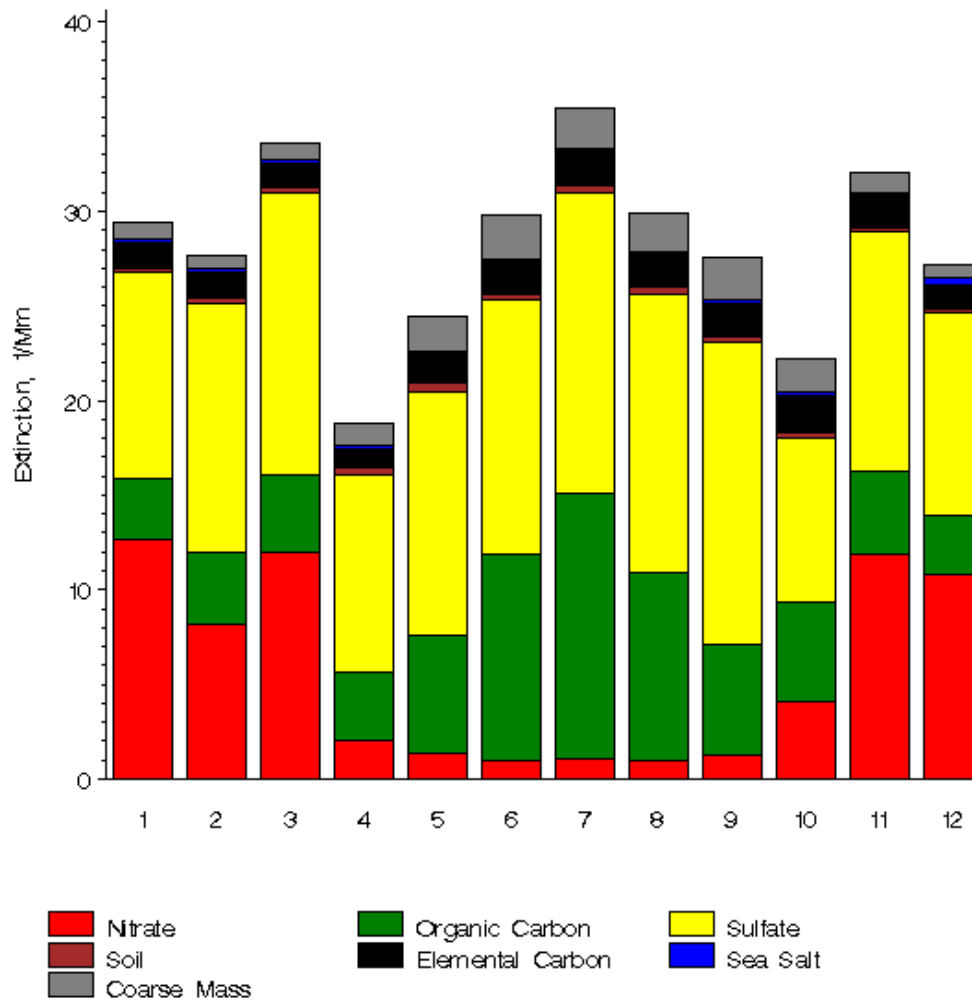
IMPROVE is the national visibility and fine particulate monitoring program with over 163 monitoring sites

What Do IMPROVE Data Show ?



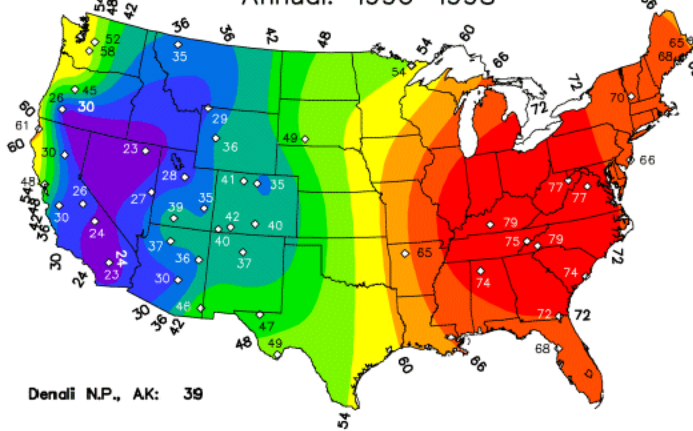
Average visibility (km) calculated from aerosol concentrations measured in the IMPROVE program

Monthly Extinction, Boundary Waters Canoe Area

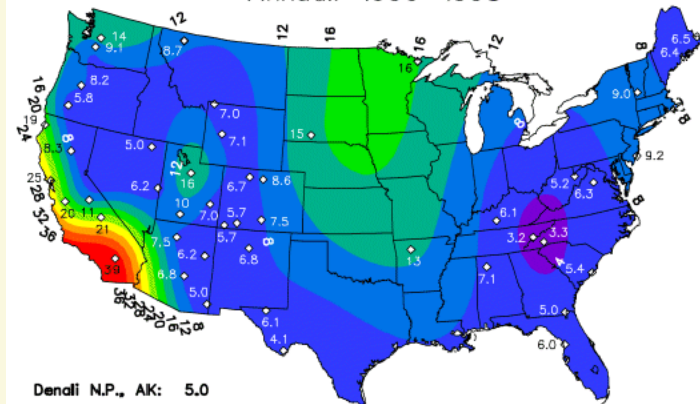


What Do IMPROVE Data Show ?

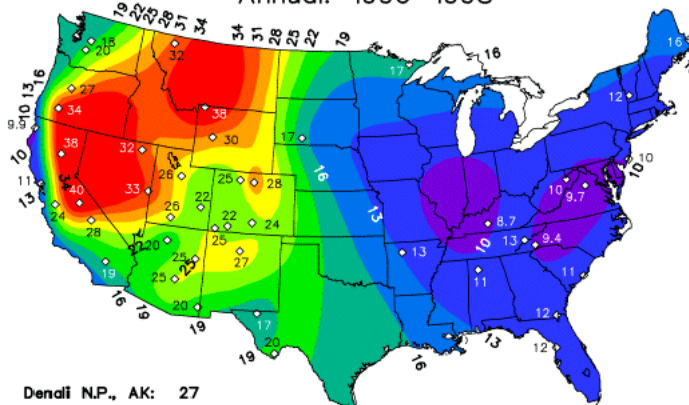
Ammonium Sulfate Percent of Aerosol Extinction
Annual: 1996–1998



Ammonium Nitrate Percent of Aerosol Extinction
Annual: 1996–1998



Organic Percent of Aerosol Extinction
Annual: 1996–1998



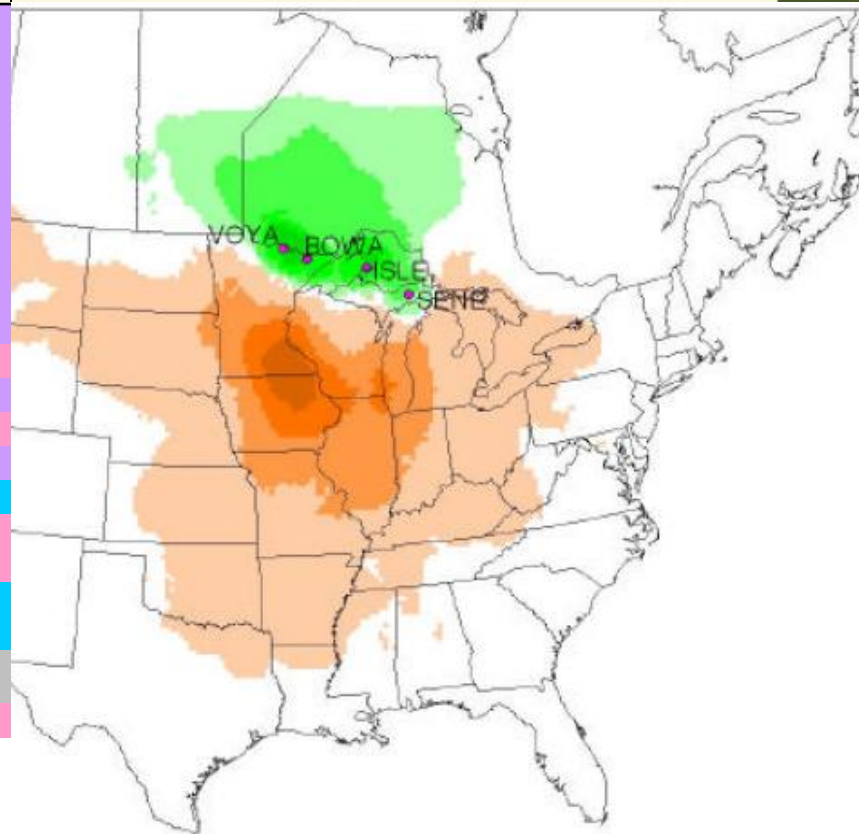
**New IMPROVE report:
IMPROVE V**

http://vista.cira.colostate.edu/improve/Publications/improve_reports.htm



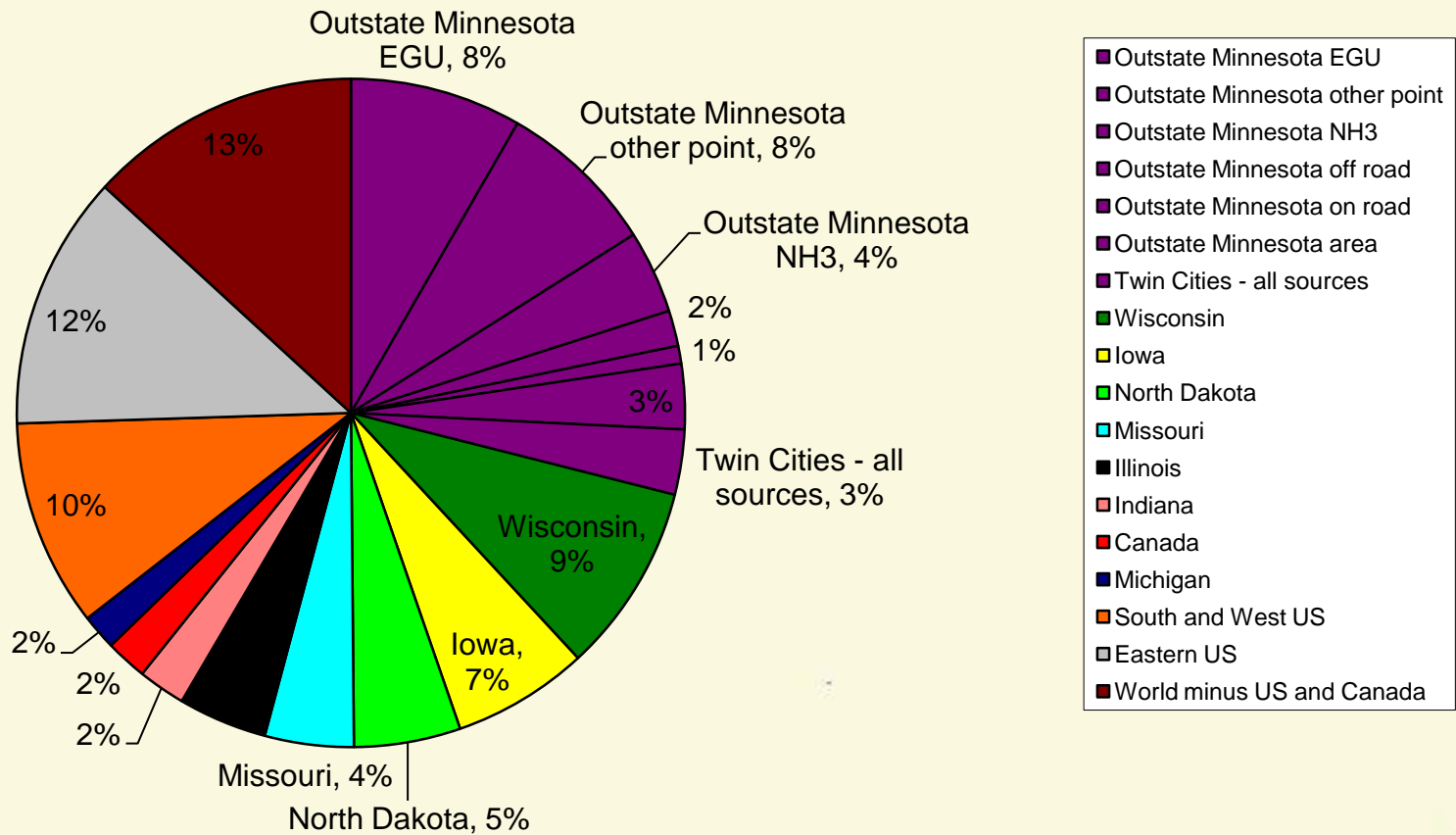
Is it the Guy Down the Street?

stname	cyid	cyname	fcid	name
Minn	31 Cook		2703100001	Minnesota Power - Taconite Harbor
Minn	137 St_Louis		2713700005	US Steel Corp - Mi
Minn	137 St_Louis		2713700063	Keewatin Taconite
Minn		Lake		Northshore Mining
Minn	61 Itasca		2706100004	Minnesota Power - Boswell
Minn	137 St_Louis		2713700062	Ispat Inland Minin
Minn	137 St_Louis		2713700013	Minnesota Power - Laskin
Minn	137 St_Louis		2713700061	Hibbing Taconite C
Minn	137 St_Louis		2713700113	EVTAC Mining - Fai
Minn	141 Sherburne		2714100004	NSP - Sherburne Ge
Wisc	3 Ashland		802033320	NSP - Bayfront
		St_Louis	NEW	Mesabi Nugget
Wisc	11 Buffalo		606034110	DAIRYLAND POWER CO - ALMA
Minn	61 Itasca		NEW	Excelsior Energy
Mich	103 Marquette		B4261	WISCONSIN ELECTRIC
Wisc	21 Columbia		111003090	Alliant Energy-Col
Wisc	73 Marathon		737009020	WIS PUBLIC SERVICE
Mich	147 St_Clair		B2796	ST. CLAIR / BELLE RIVER
Mich	139 Ottawa		B2835	J. H. CAMPBELL PLA
South Dakota	51 Grant		1001	BIG STONE
Wisc	31 Douglas		816009590	MURPHY OIL USA





Contribution to 20% Worst Visibility Days at BWCAW in 2018



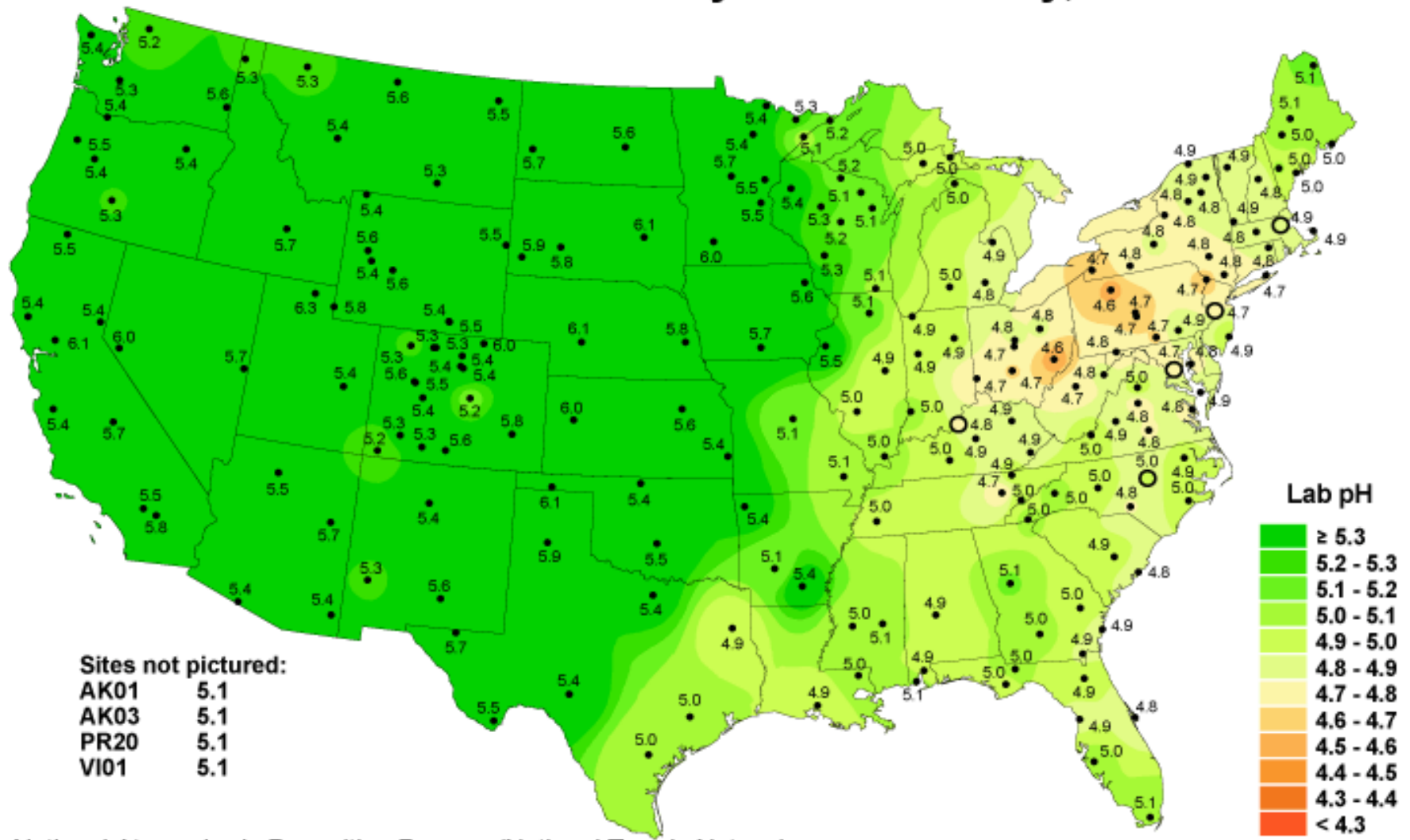


Air Quality Impacts

- Mercury Deposition
- Visibility
- Acid Deposition (rain)
- Ozone (smog)/Particulates



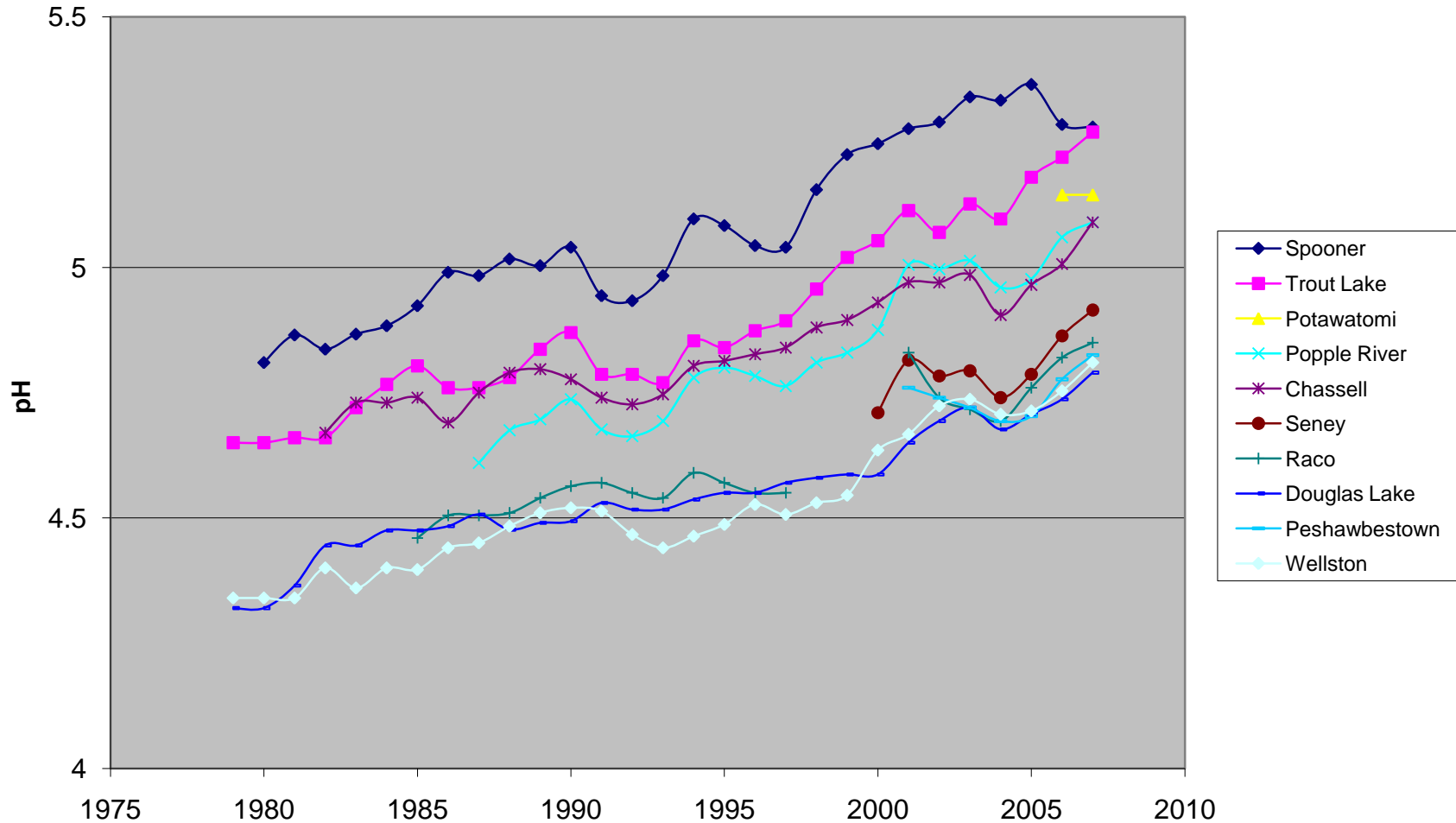
Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2009



National Atmospheric Deposition Program/National Trends Network
<http://nadp.sws.uiuc.edu>



Acidity of Precipitation in Northern WI and MI





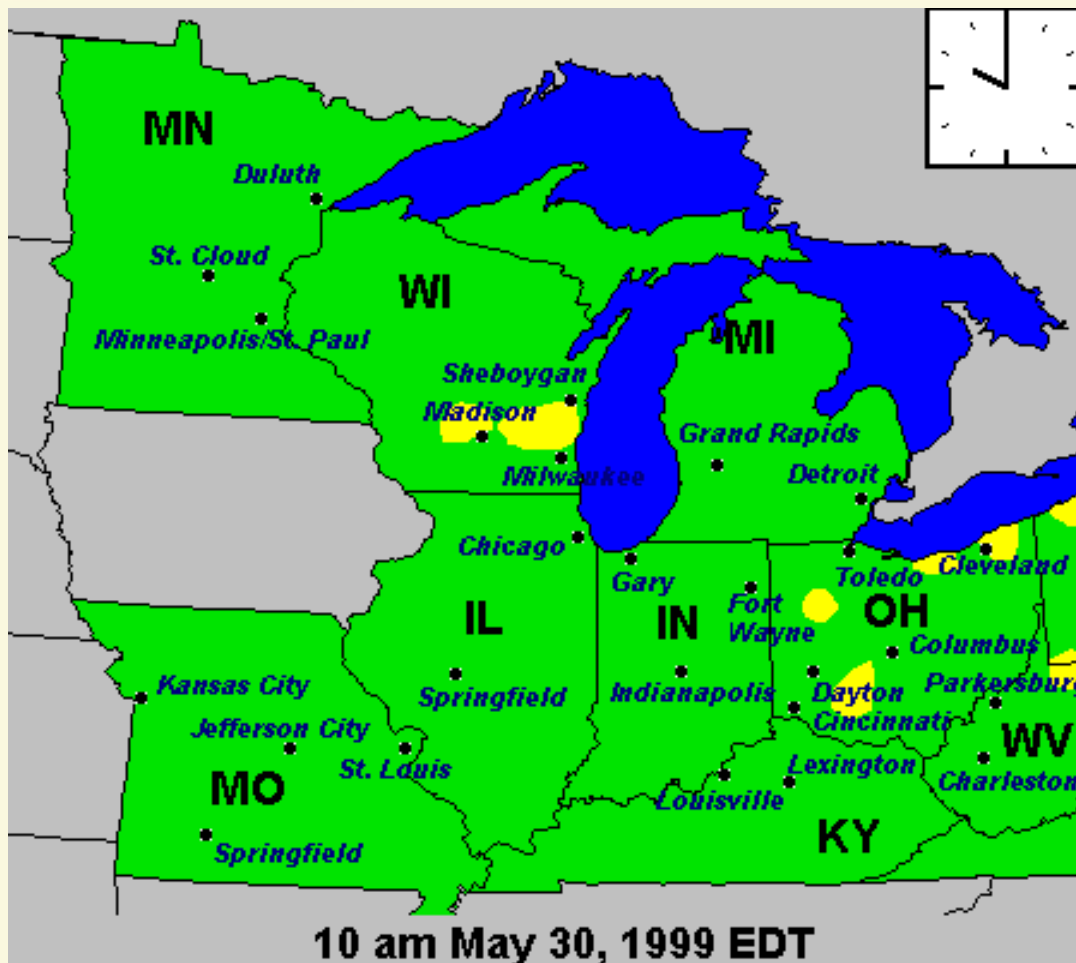
Air Quality Impacts

- Mercury Deposition
- Visibility
- Acid Deposition
- Ozone (smog)/Particulates



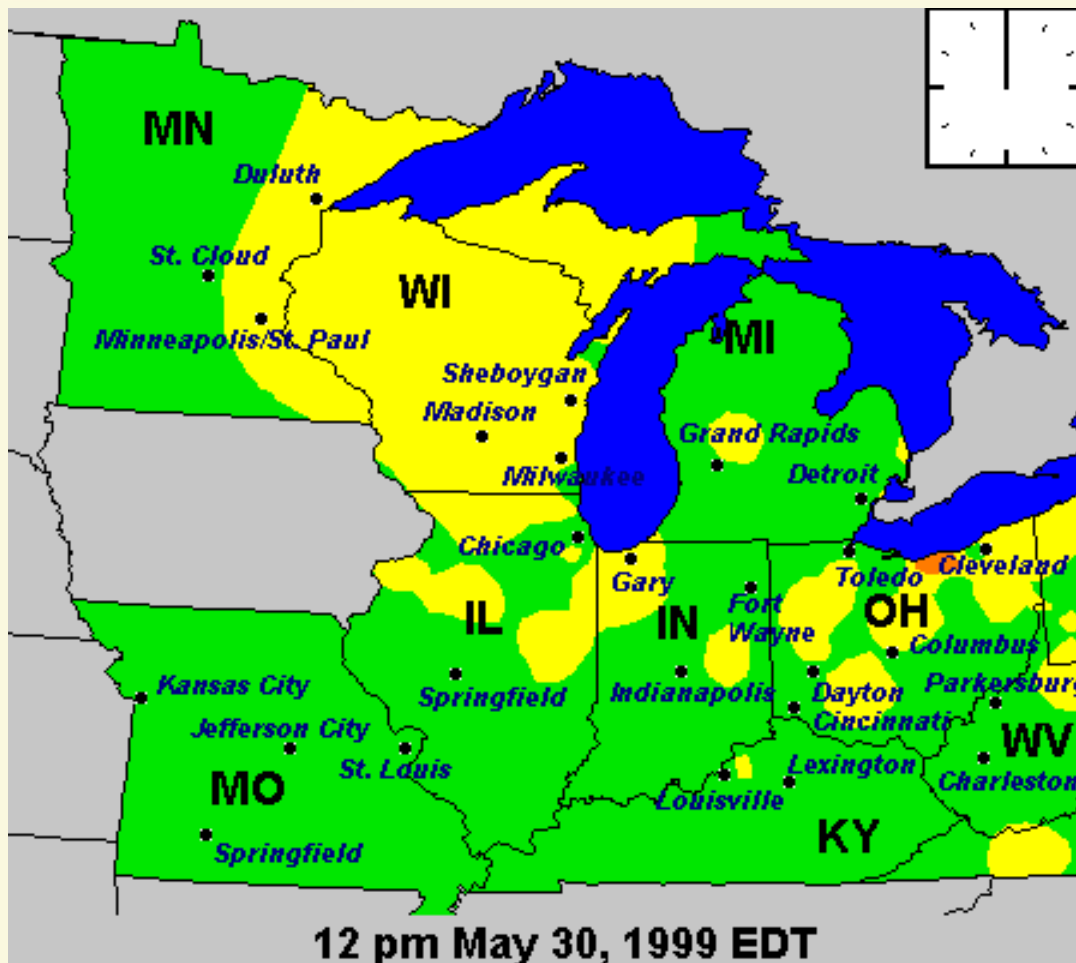
USDA Forest Service

Caring for the land and serving people



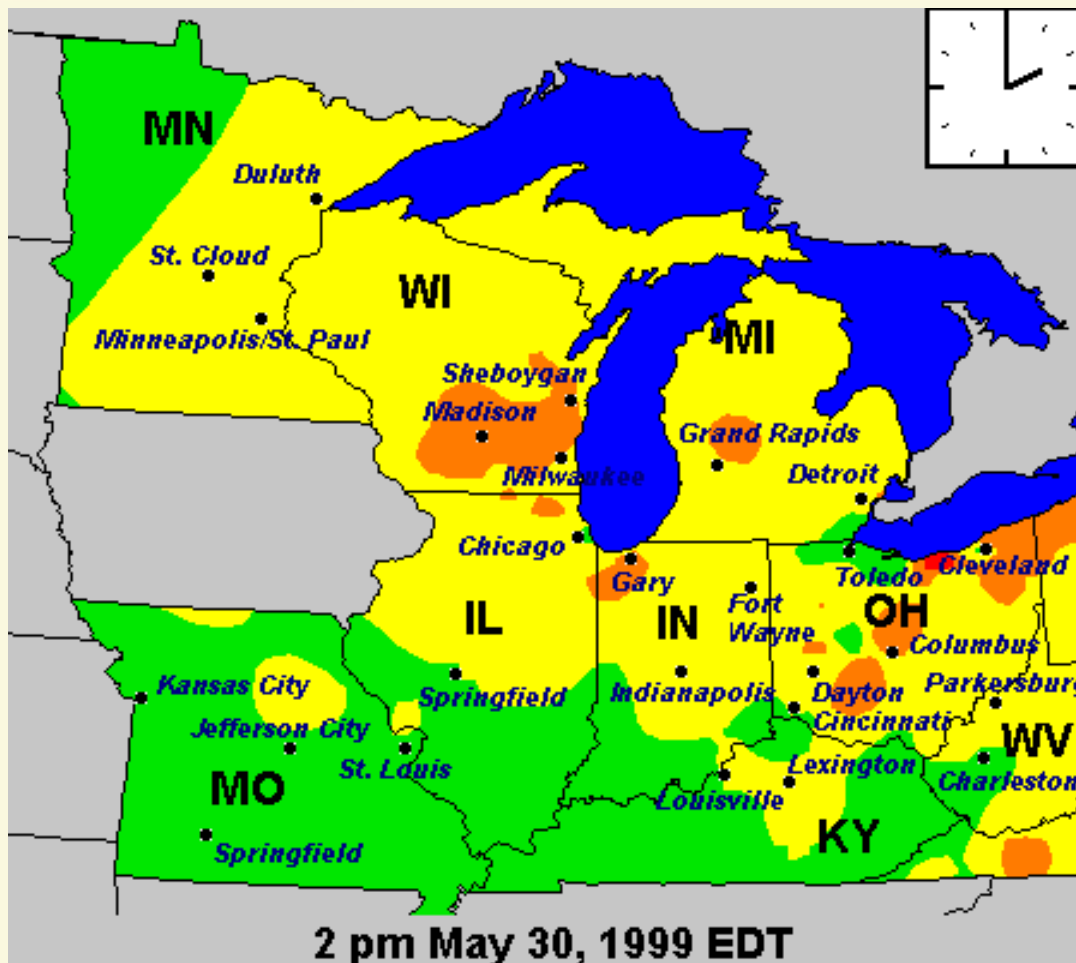
USDA Forest Service

Caring for the land and serving people



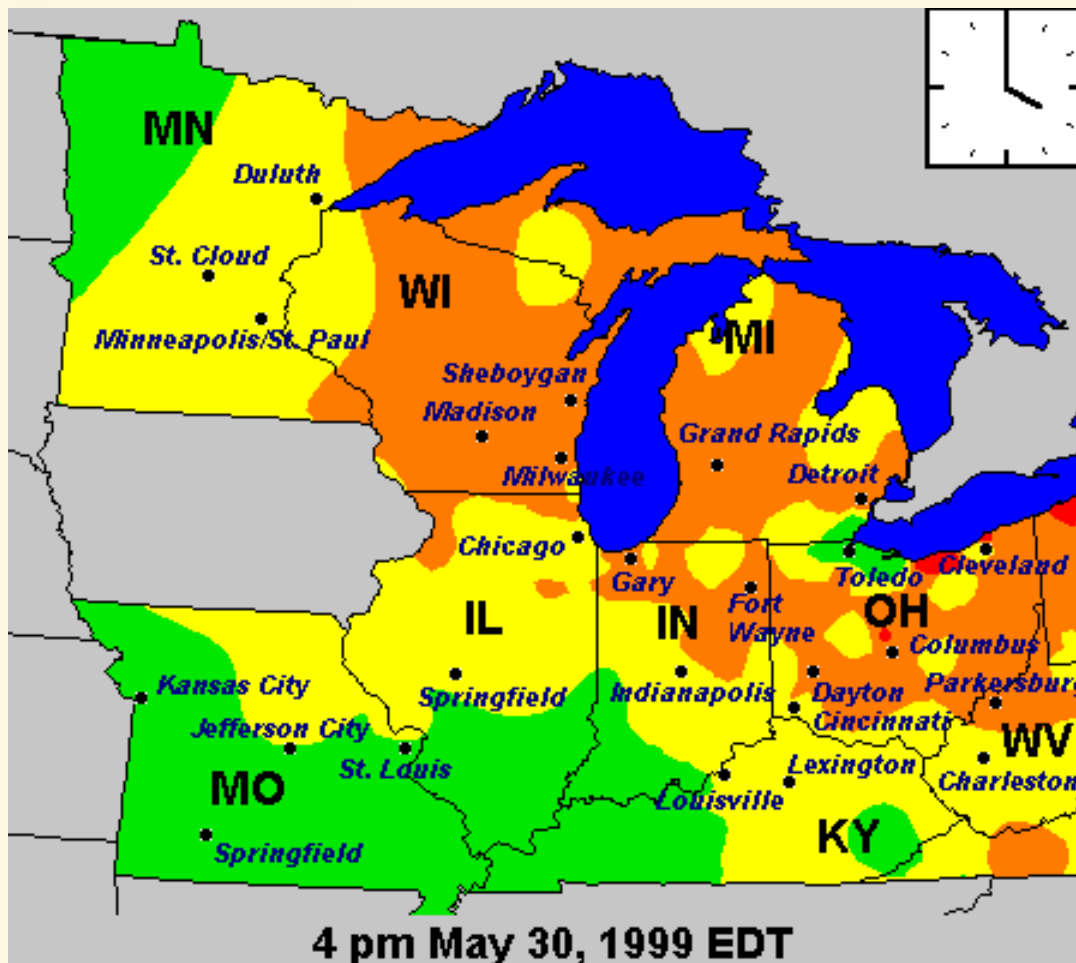
USDA Forest Service

Caring for the land and serving people



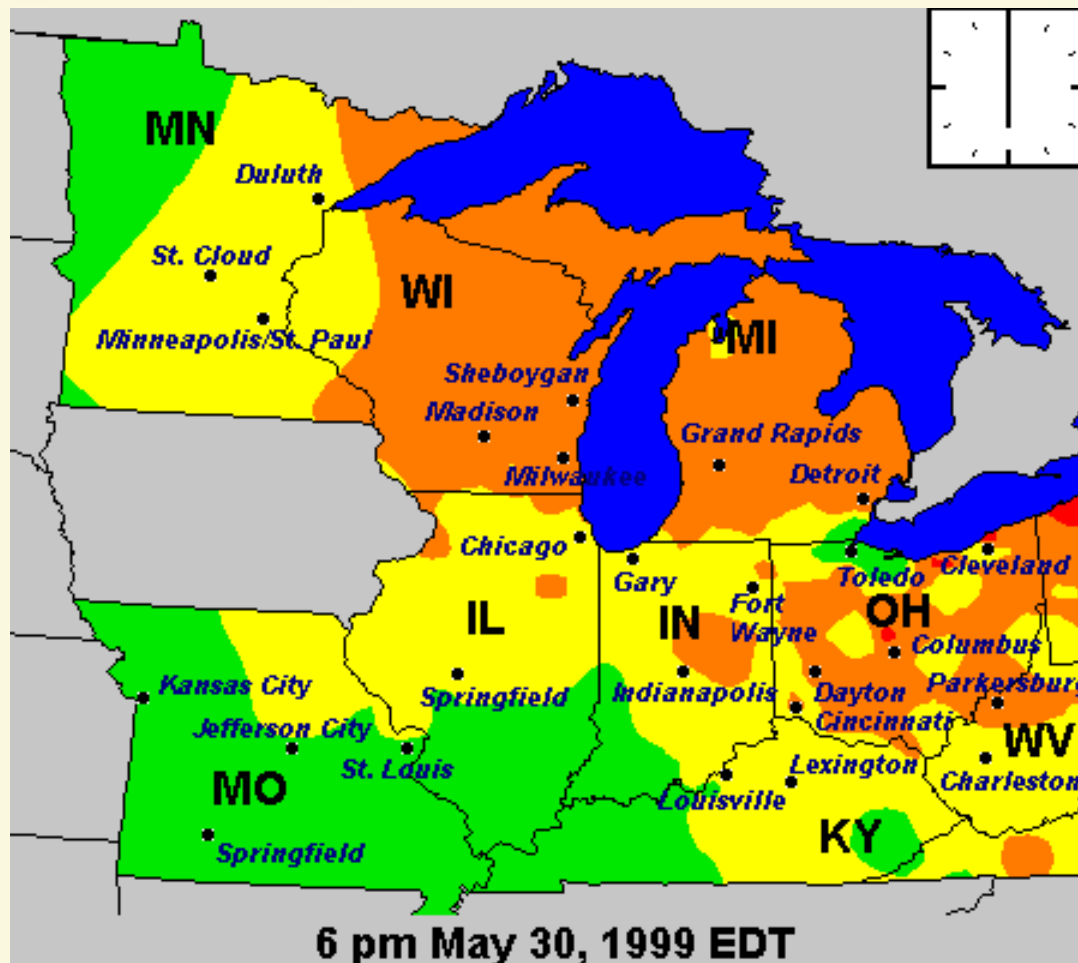
USDA Forest Service

Caring for the land and serving people



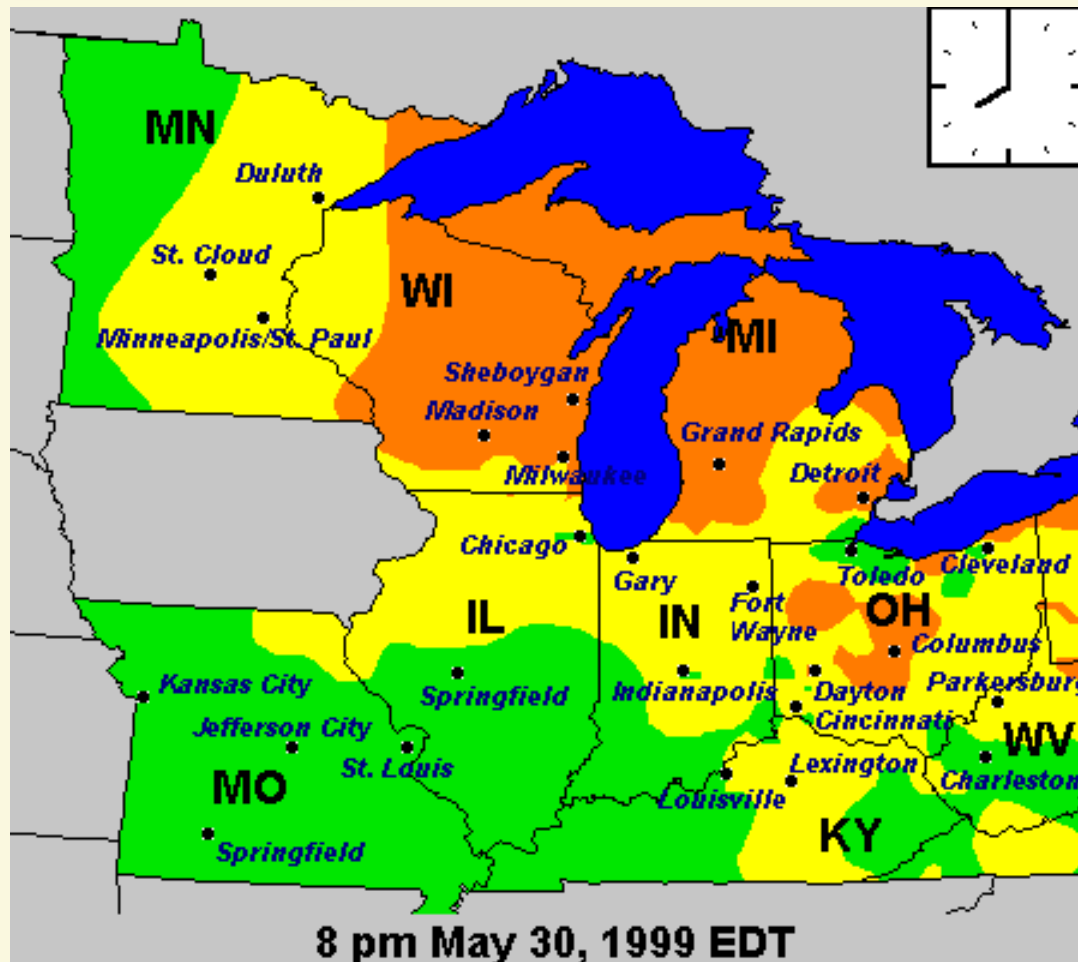
USDA Forest Service

Caring for the land and serving people



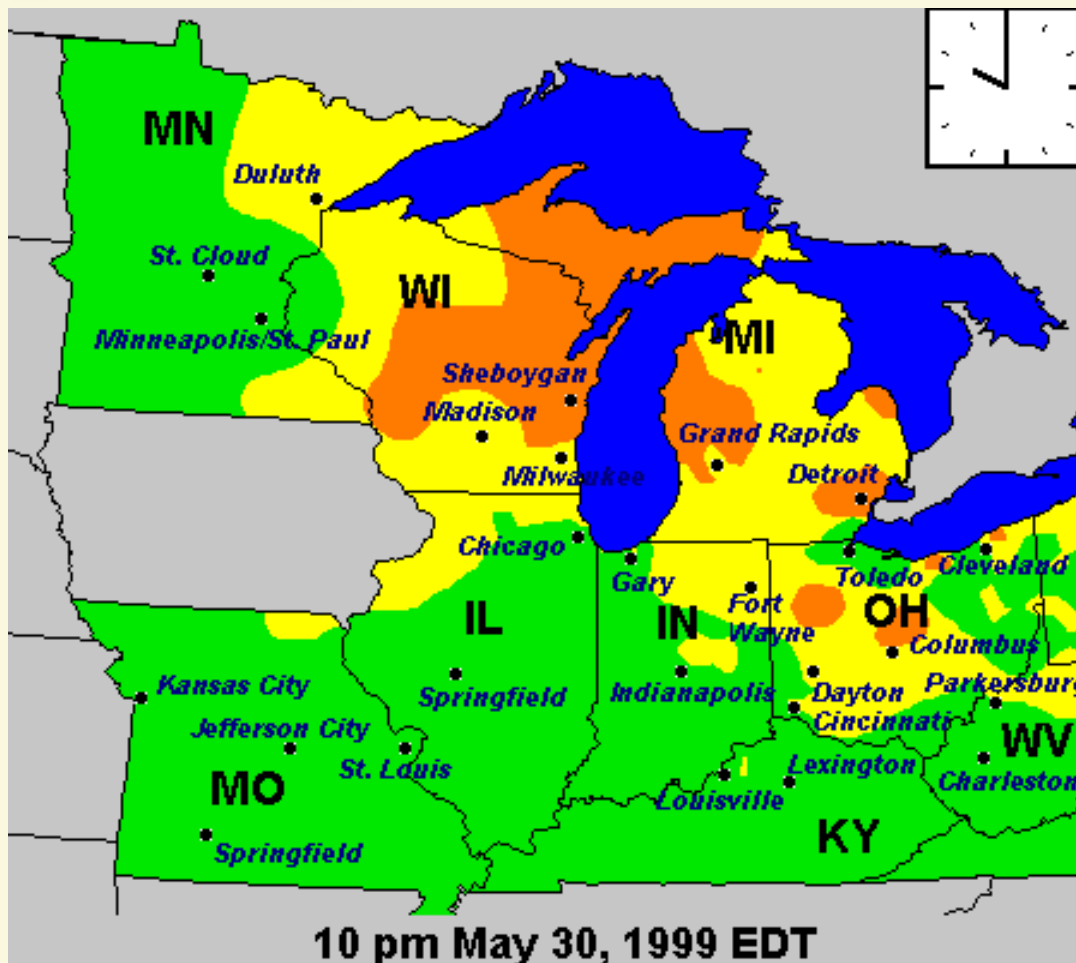
USDA Forest Service

Caring for the land and serving people



USDA Forest Service

Caring for the land and serving people





Water Quality Monitoring



Fernberg Air Monitoring Site



Air Quality Images

Home | Links | About



- Real Time Images
- Image Library
- Historical Gallery
- Search
- Further Info

Current Air Quality

Visual Range **NA** [Details](#)

Monitored Pollutants

Ozone **NA** [Details](#)

W126 **0.0**ppmhr For Season

N100 **0** For Season

Particulate **NA**

PM10 **NA**

PM2.5 **0.0**ug/m3

Display Units In

[About These Data](#)

Current Meteorology

Temp **69°** Humidity **64%**

Wind Speed **9 mph** Wind Direction **SSW**

Precip 1 Hour **NA** Precip 24 Hours **0.00**in

[Data Disclaimer](#)

24 Hour Image Sequence

Image Updated Every 15 Minutes



BOUNDARY WATERS

- Zoom
- High Res
- Save Image
- Map It
- Landmarks
- Refresh



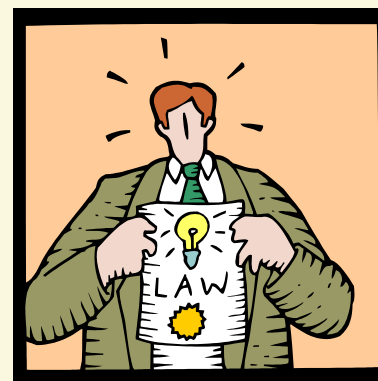
So What?

- How do we affect the decisions by companies, regulators and the public?
 - Federal Land Manager role in the air permit process for individual facilities
 - Review and comment on proposed regulations
 - Document impacts to resources through monitoring
 - Foster relationships with state regulators and local industries
 - Education



Regulations

- Clean Air Act
 - Class I Areas
 - New Source Review
 - Regional Haze
- National Environmental Policy Act (NEPA)
- Wilderness Act
- State Rules (state NEPA, state air/water rules)

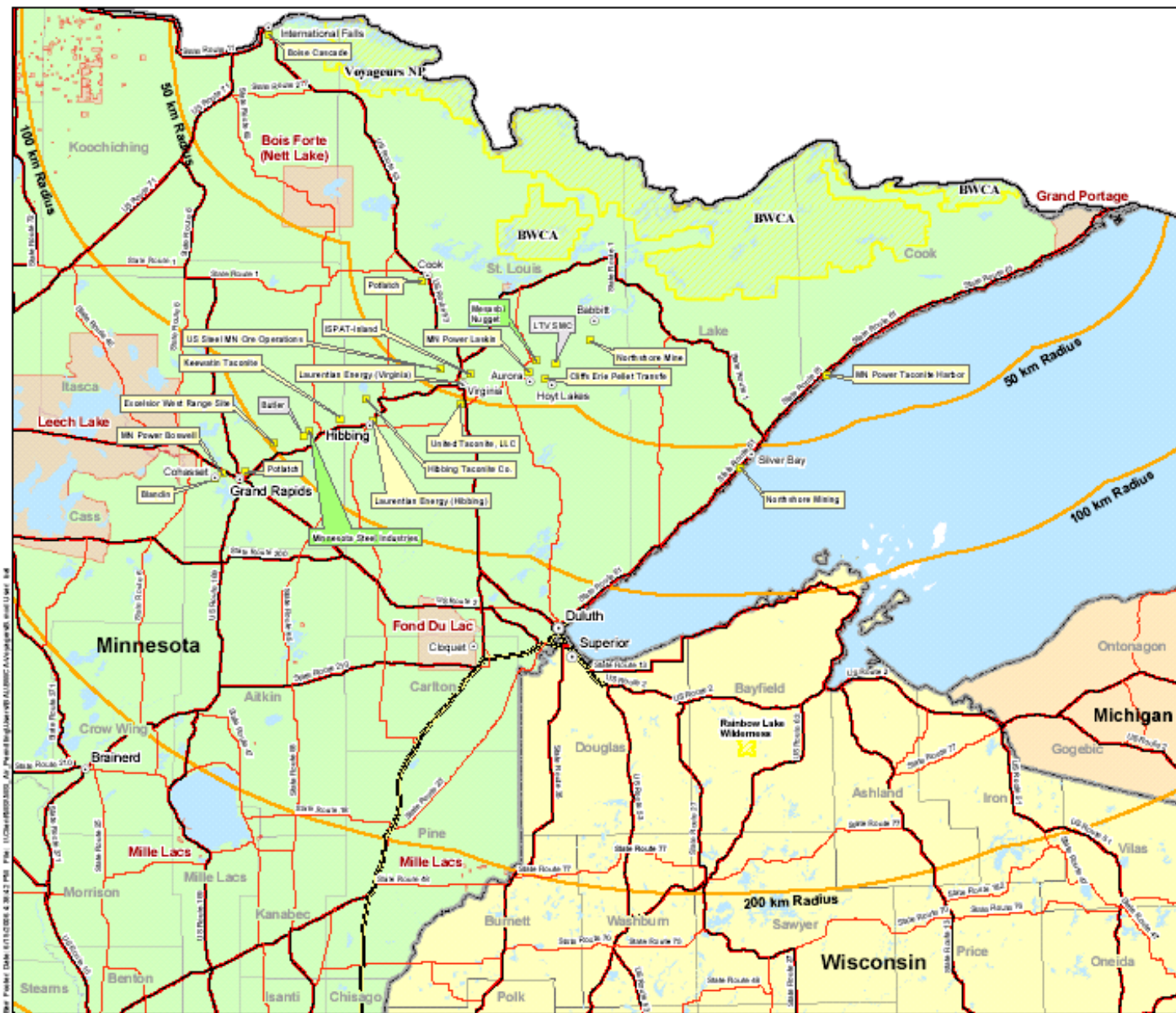




Possible Players

- State permitting agency
- Applicant/consultants
- EPA, Region V
- Federal Land Managers
- Tribes
- Politicians
- Citizens





- Existing Facility
- New Facility
- Closed Facility

- Project Location
- City
- Limited Access Highway
- Other Through Highway
- Principal Highway
- State/Province Boundary
- Class I Areas
- Tribal Lands

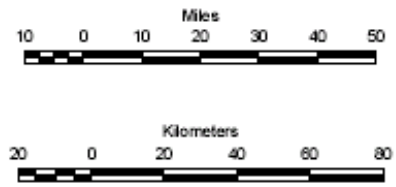


Figure 1
 PROJECT LOCATIONS
 AND NEARBY SOURCES
 Cumulative PM₁₀
 Increment Analysis
 Minnesota Steel



What Impacts are analyzed in Air Permitting?

- Increment
- Visibility
- Acid Deposition
- Mercury (state specific)

All are modeling analyses with thresholds based on monitoring

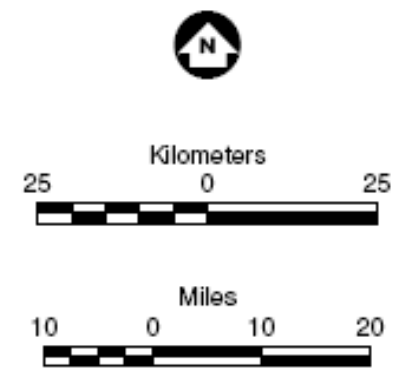
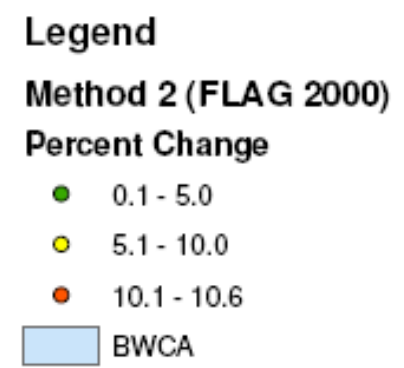
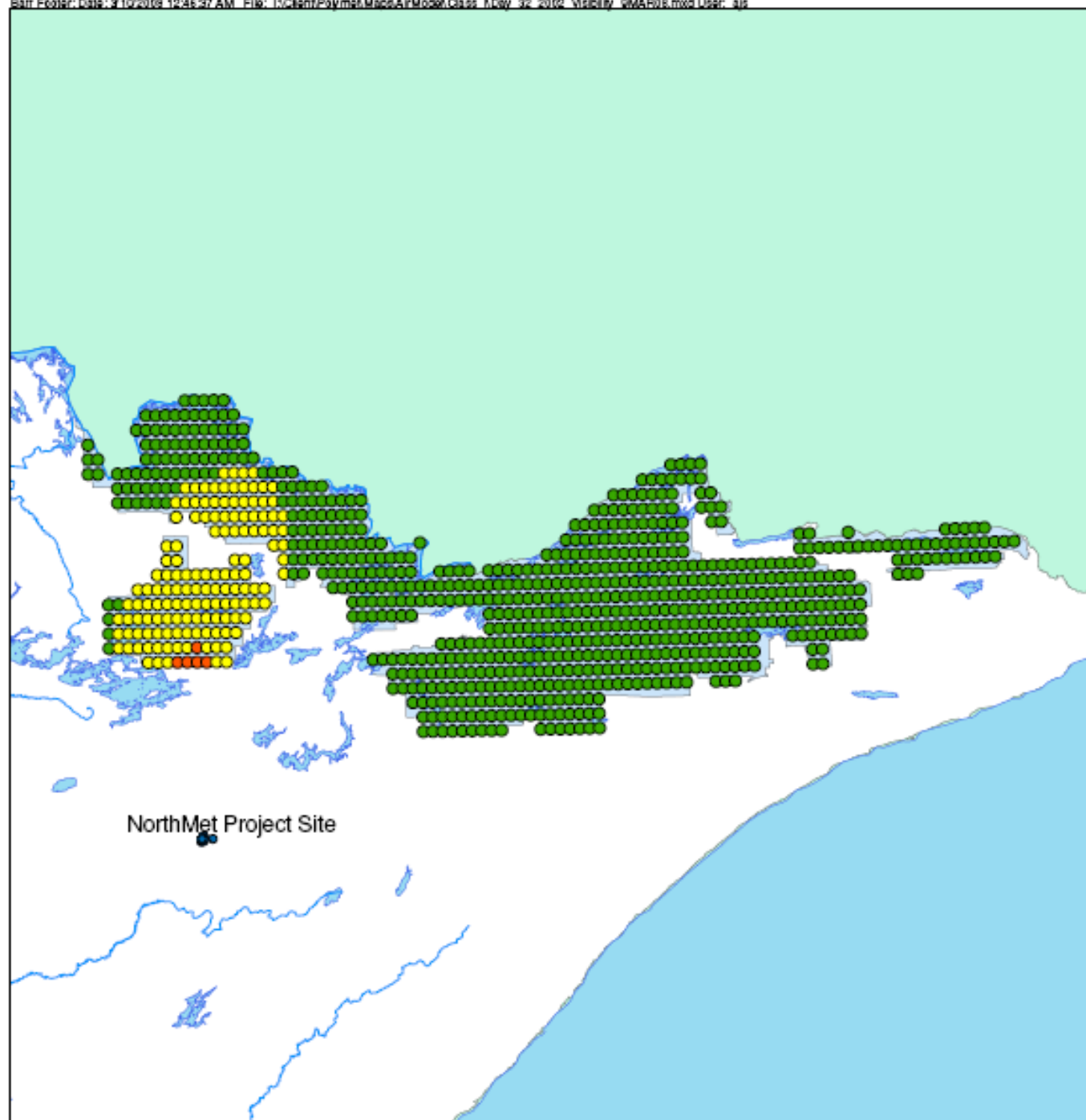


Figure 1

FEB. 1, 2002 VISIBILITY IMPACTS
NorthMet Class I Modeling
PolyMet Mining Corp.
Hoyt Lakes, MN

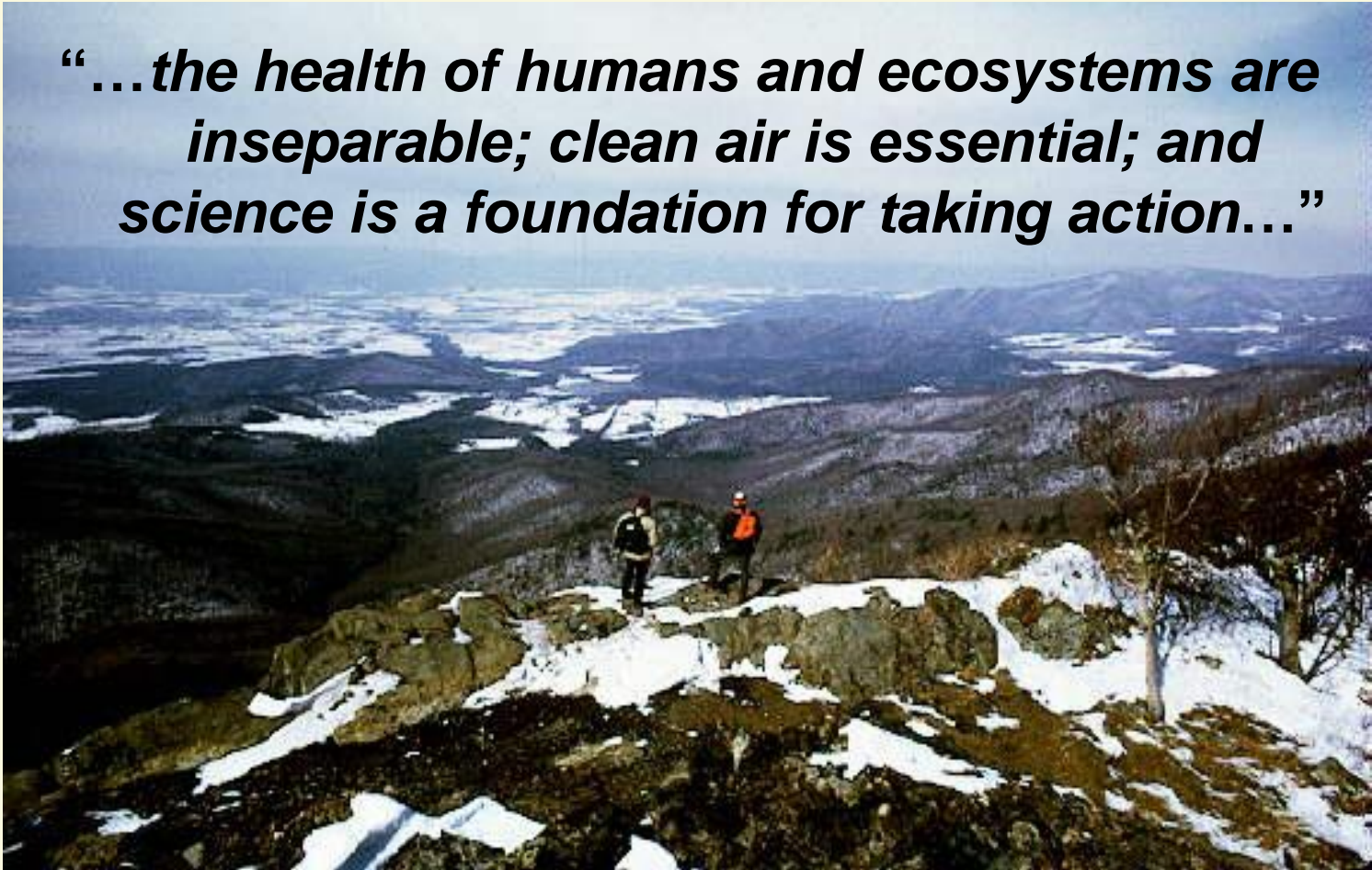


Issues

- Loss of monitoring sites (NADP, IMPROVE)
- Changes in state rules don't change federal regulations
- Communication during permit process with large number of interested parties
- Air (and other media issues) are highly technical and complex. Need an expert in the field to be a real player. Also need to commit to be present.



“...the health of humans and ecosystems are inseparable; clean air is essential; and science is a foundation for taking action...”



National Forest Service Air Program Vision Statement