Perspectives and Updates on Regional Haze Planning from the Great Lakes Region

Zac Adelman

LADCO Executive Director

Presented at the AAPCA 2018 Fall Business Meeting
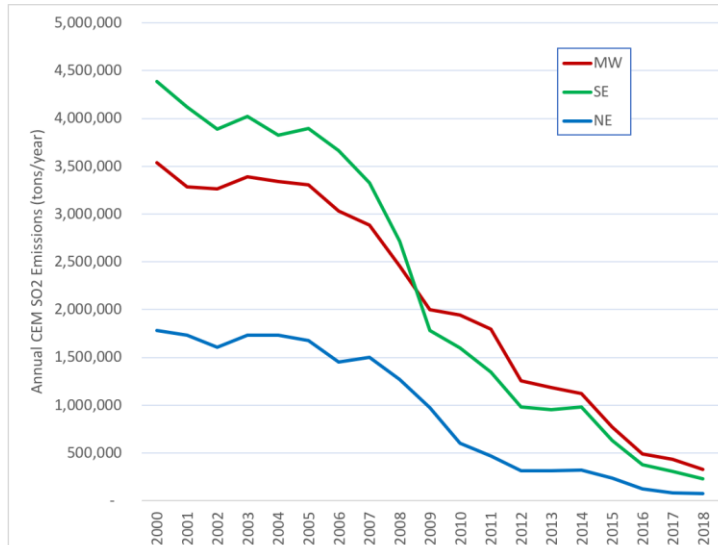Raleigh, NC

November 14, 2018

LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

Isle Royale NP, MI

Boundary Waters Wilderness, MN

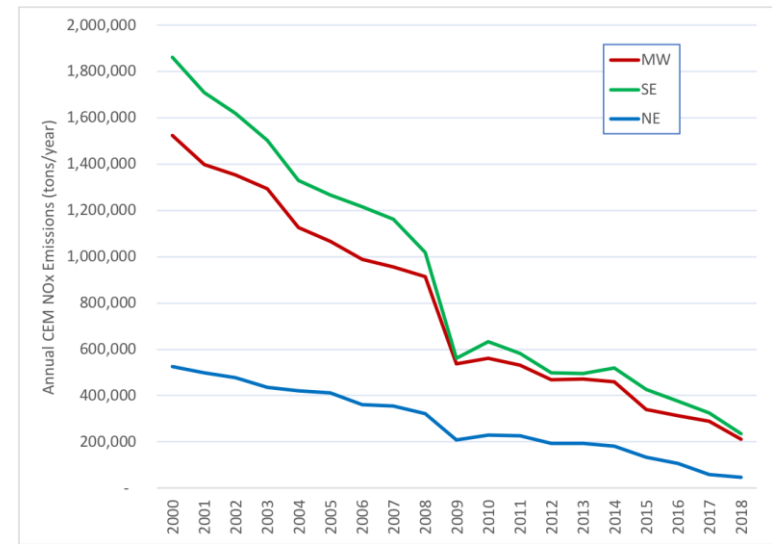# Regional Changes in CEM Emissions: 2000-2018

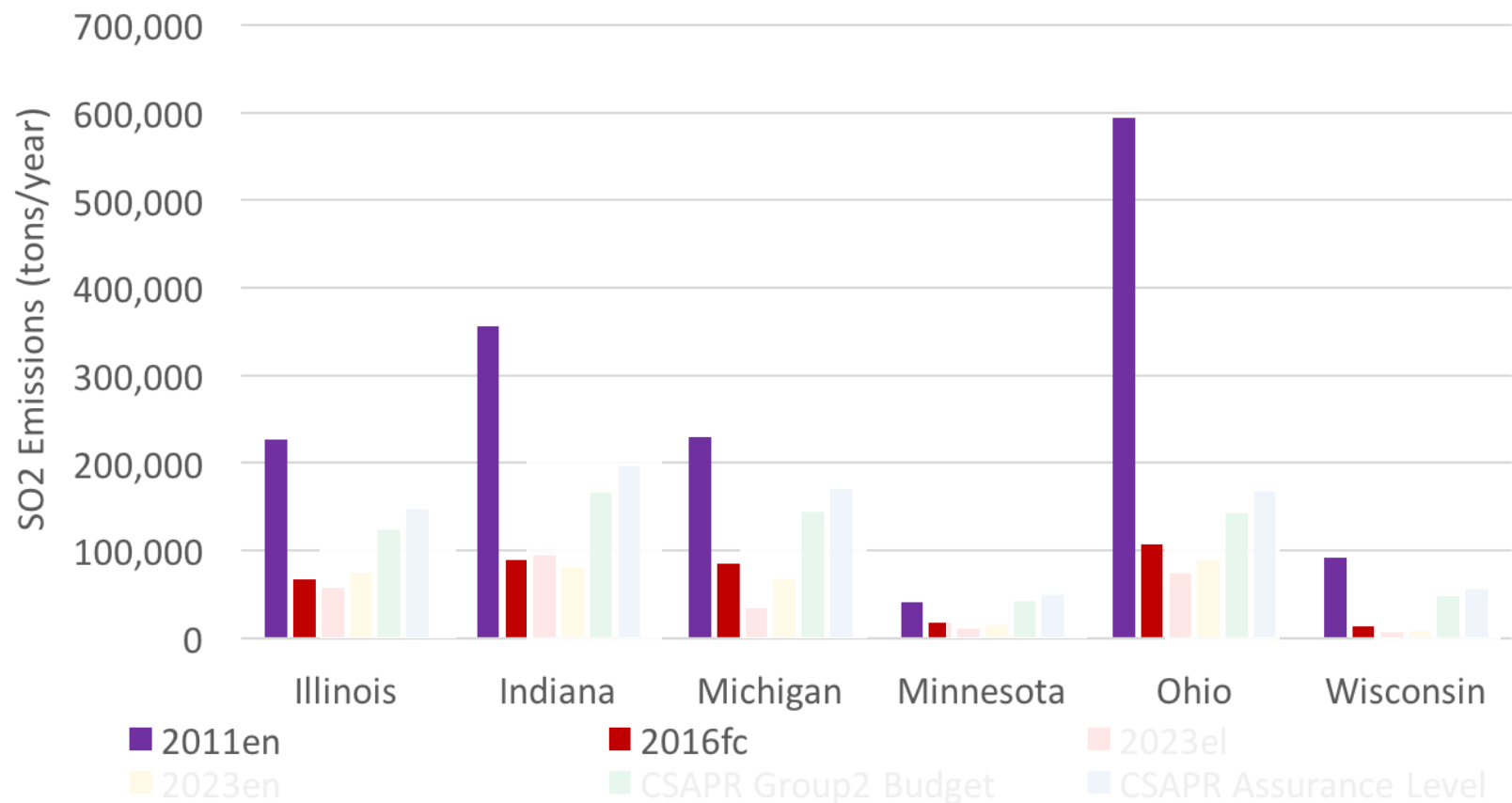**Annual Total**

SO₂ Emissions   NOₓ Emissions

dE/dT (2000-2018)
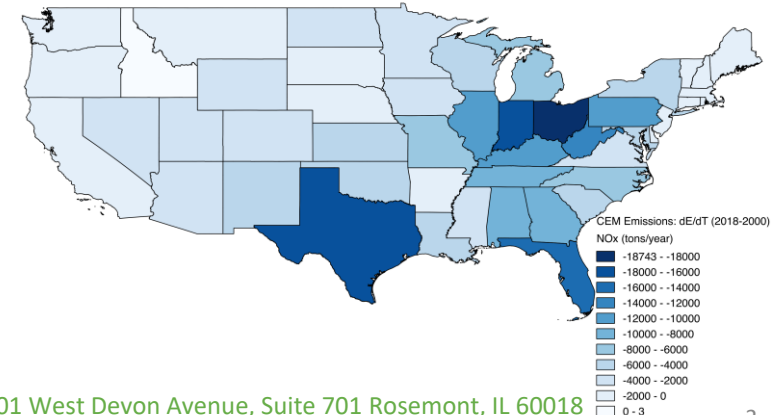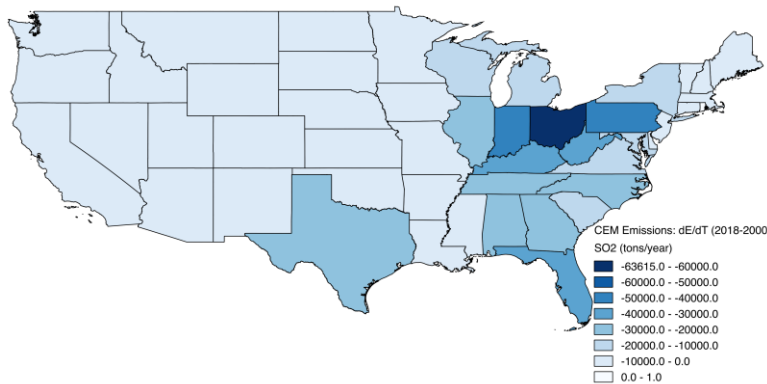
Energy Sector Changes Impact on Midwest Air Quality

US EPA Transport Modeling: Annual EGU SO2 Emissions

Y-axis: SO2 Emissions (tons/year) — 0; 100,000; 200,000; 300,000; 400,000; 500,000; 600,000; 700,000

X-axis categories: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

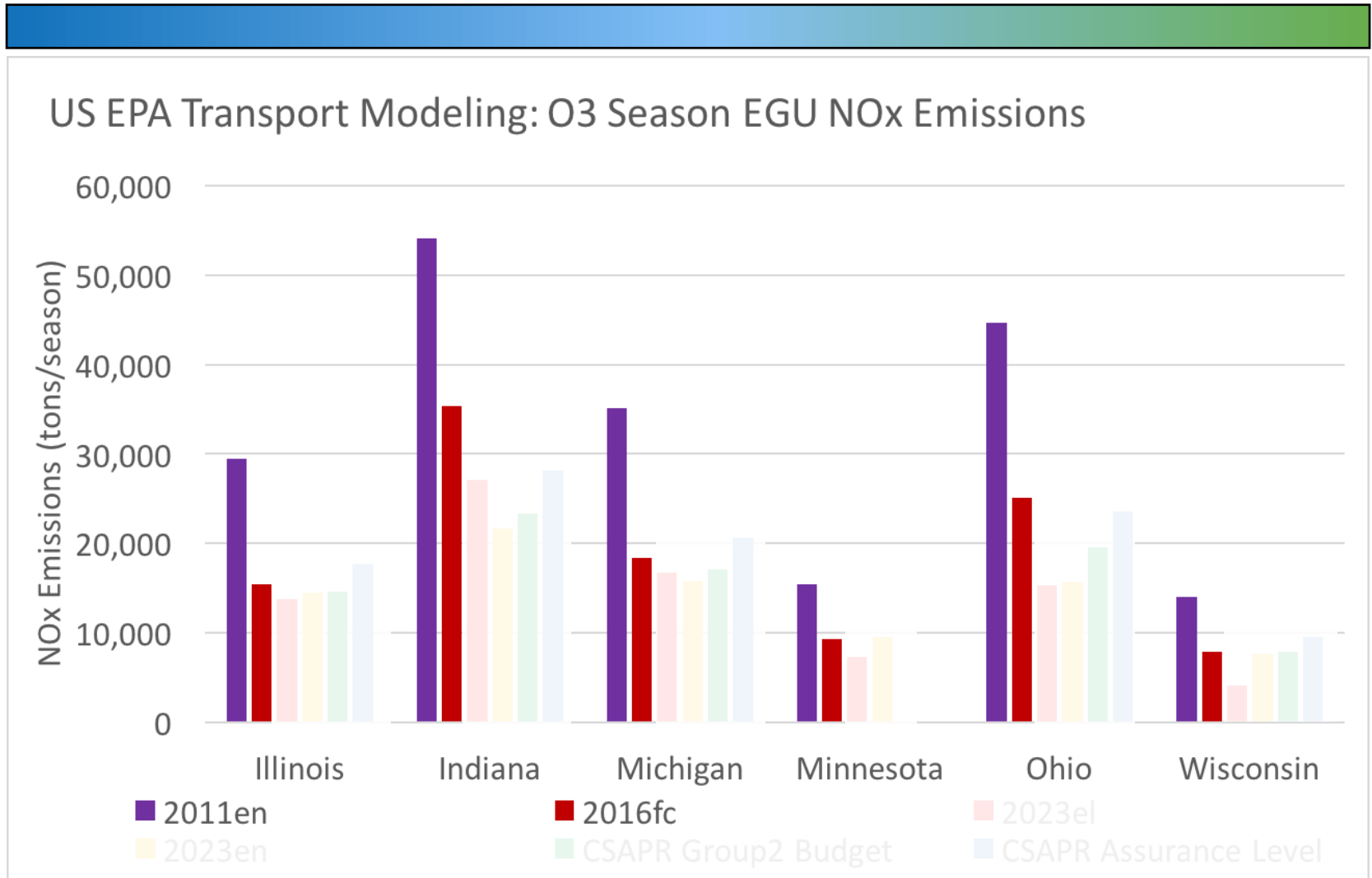Legend: 2011en, 2016fc, 2023el, 2023en, CSAPR Group2 Budget, CSAPR Assurance Level

Energy Sector Changes Impact on Midwest Air Quality

US EPA Transport Modeling: O3 Season EGU NOx Emissions

Energy Sector Changes Impact on Midwest Haze
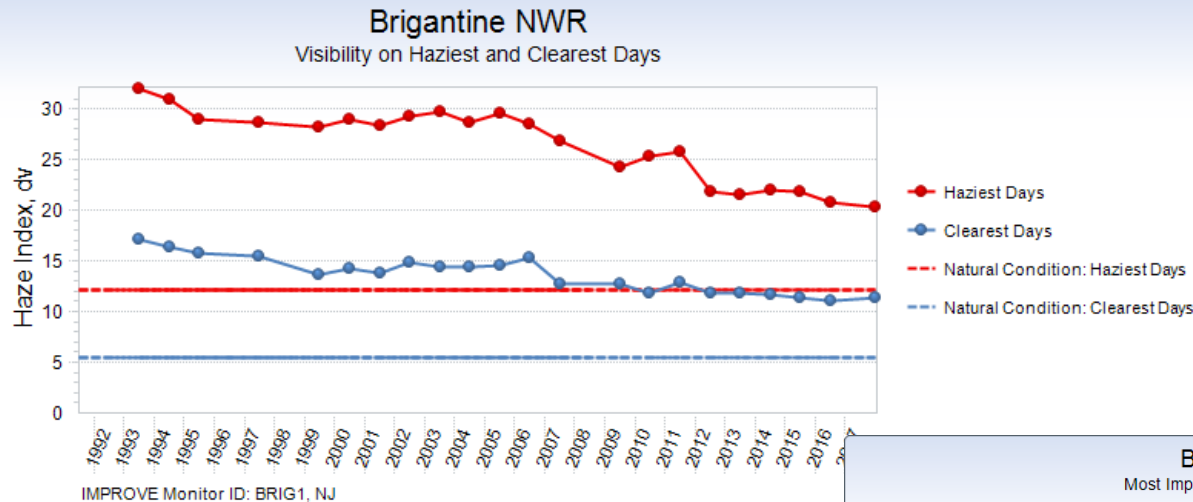
LADCO

Boundary Waters Canoe Area
Visibility on Haziest and Clearest Days

Haze Index, dv

- Haziest Days
- Clearest Days
- Natural Condition: Haziest Days
- Natural Condition: Clearest Days

IMPROVE Monitor ID: BOWA1, MN

Voyageurs
Isle Royale
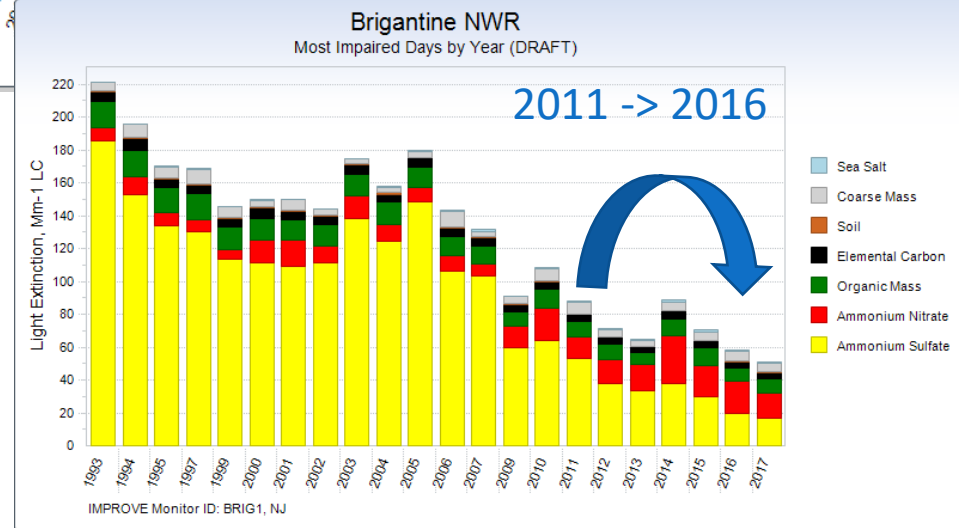Boundary Waters Canoe Area
Seney
Rainbow Lake
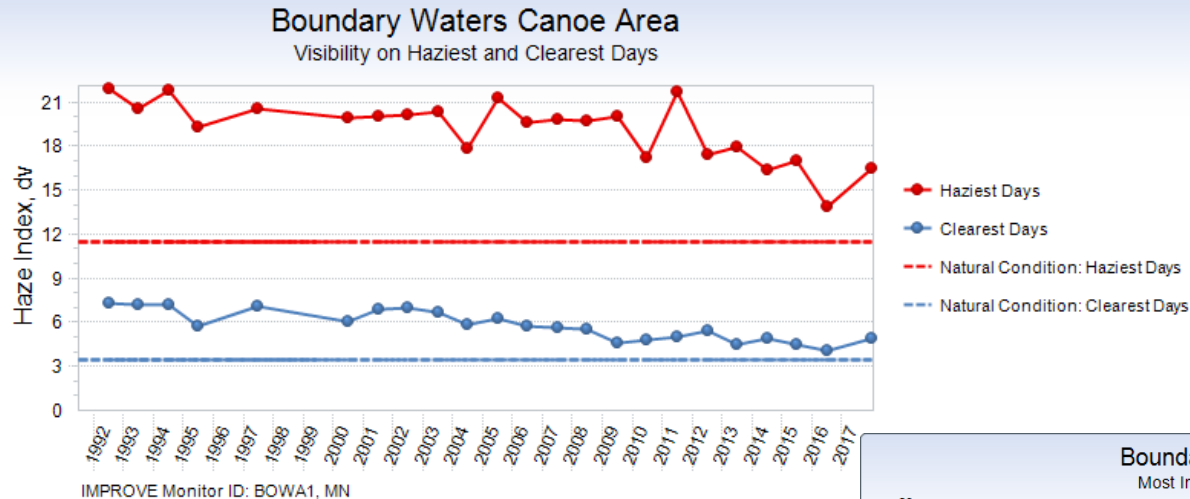
- Boundary Waters (MN) shows improvement in Most Impaired Days metric, starting around 2010
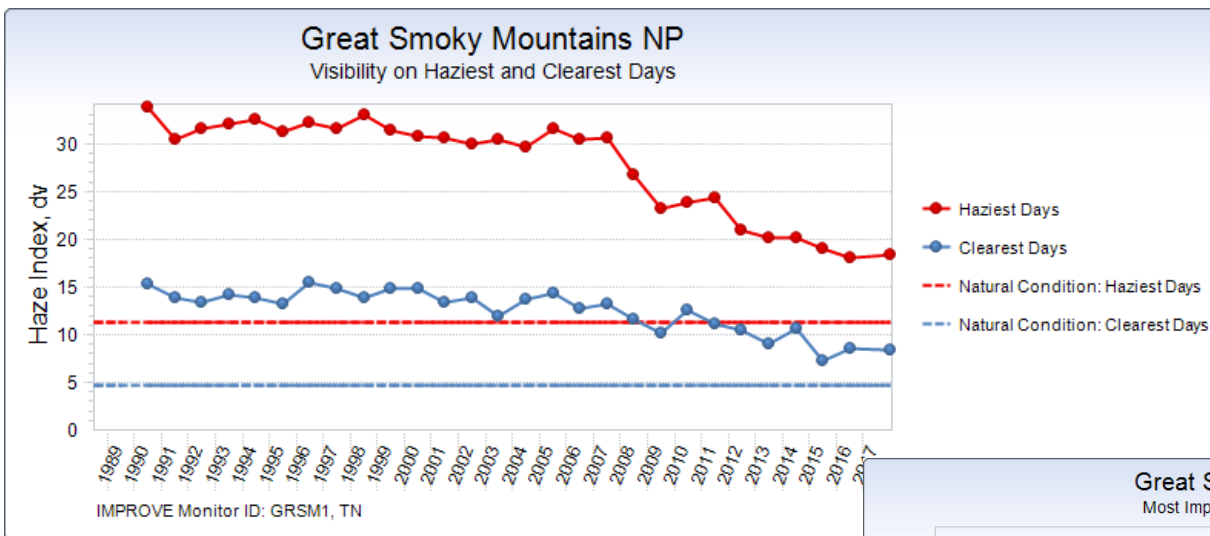- 2011 to 2017 trend follows EGU SO_2 emissions
- Driven by NO_3 and SO_4

Boundary Waters Canoe Area
Most Impaired Days by Year (DRAFT)

2011 -> 2016

Light Extinction, 1/Mm

- Sea Salt
- Coarse Mass
- Soil
- Elemental Carbon
- Organic Mass
- Ammonium Nitrate
- Ammonium Sulfate

IMPROVE Monitor ID: BOWA1, MN
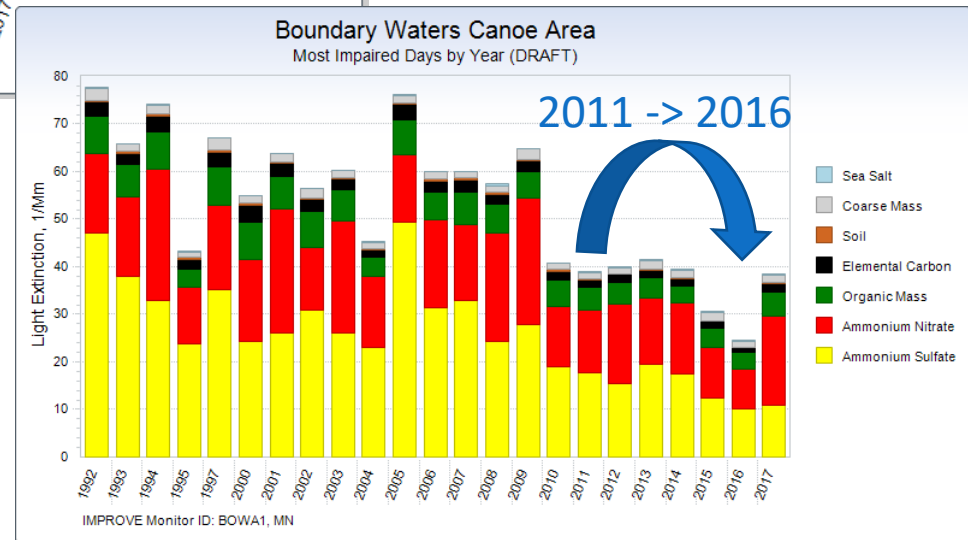
Energy Sector Changes Impact on Northeast Haze

Brigantine NWR
Visibility on Haziest and Clearest Days

- Haziest Days
- Clearest Days
- Natural Condition: Haziest Days
- Natural Condition: Clearest Days

IMPROVE Monitor ID: BRIG1, NJ

Brigantine NWR
Most Impaired Days by Year (DRAFT)

2011 -> 2016

- Sea Salt
- Coarse Mass
- Soil
- Elemental Carbon
- Organic Mass
- Ammonium Nitrate
- Ammonium Sulfate

IMPROVE Monitor ID: BRIG1, NJ

- Brigantine (NJ) 2017 measurements follow the continued improvements in haze since mid-2000's
- Driven by NO_3 and SO_4

# Energy Sector Changes Impact on Southeast Haze

Great Smoky Mountains NP
Visibility on Haziest and Clearest Days

IMPROVE Monitor ID: GRSM1, TN

Great Smoky Mountains NP
Most Impaired Days by Year (DRAFT)

2011 -> 2016

IMPROVE Monitor ID: GRSM1, TN

- Great Smokey Mts (NC) showing haze improvements since 2010
- Driven more by SO_4 than the NE and MW sites
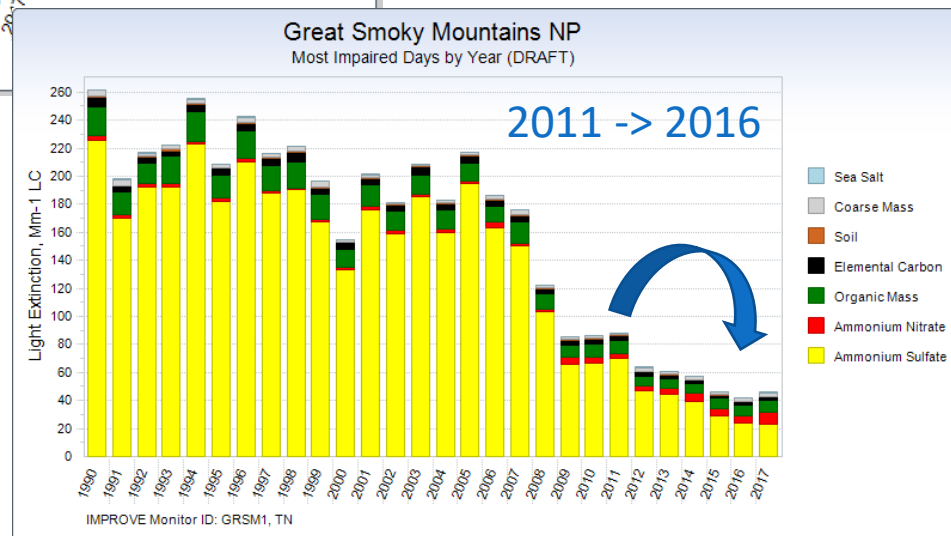
U.S. Total Anthropogenic Emissions Trends: NEI Annual SO$_2$
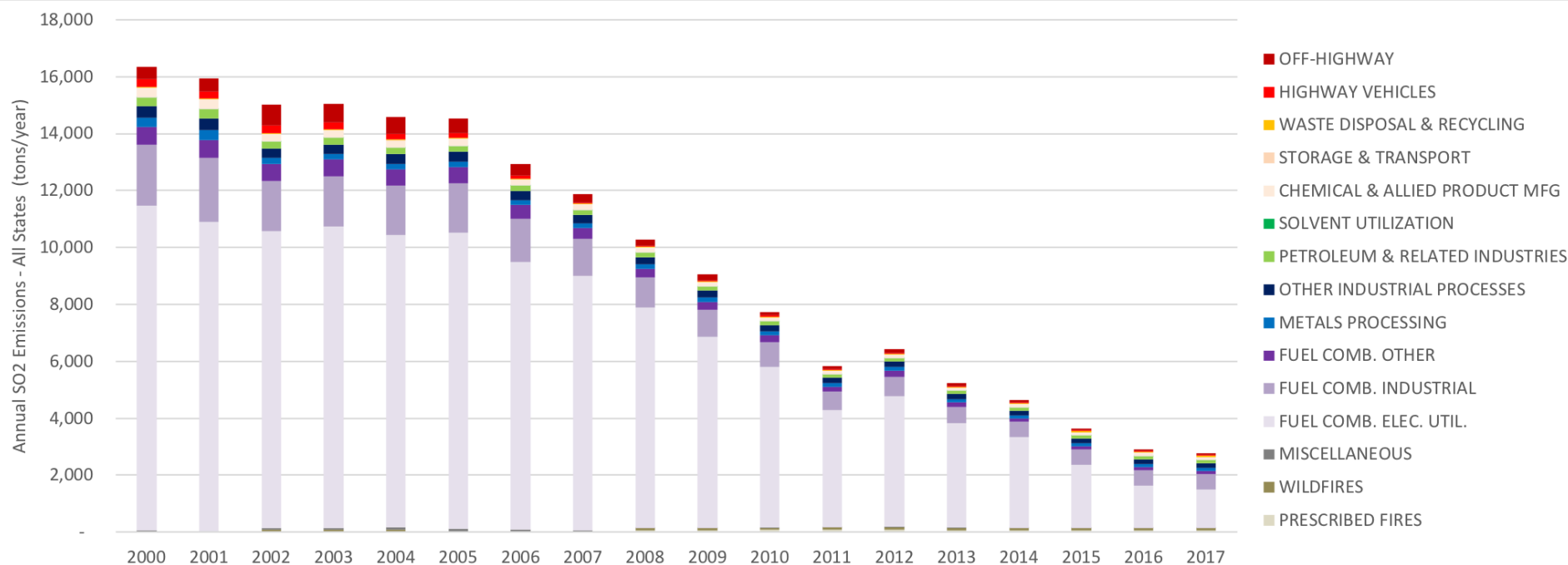
Annual Emissions Totals for the Lower 48 States: 2000-2017
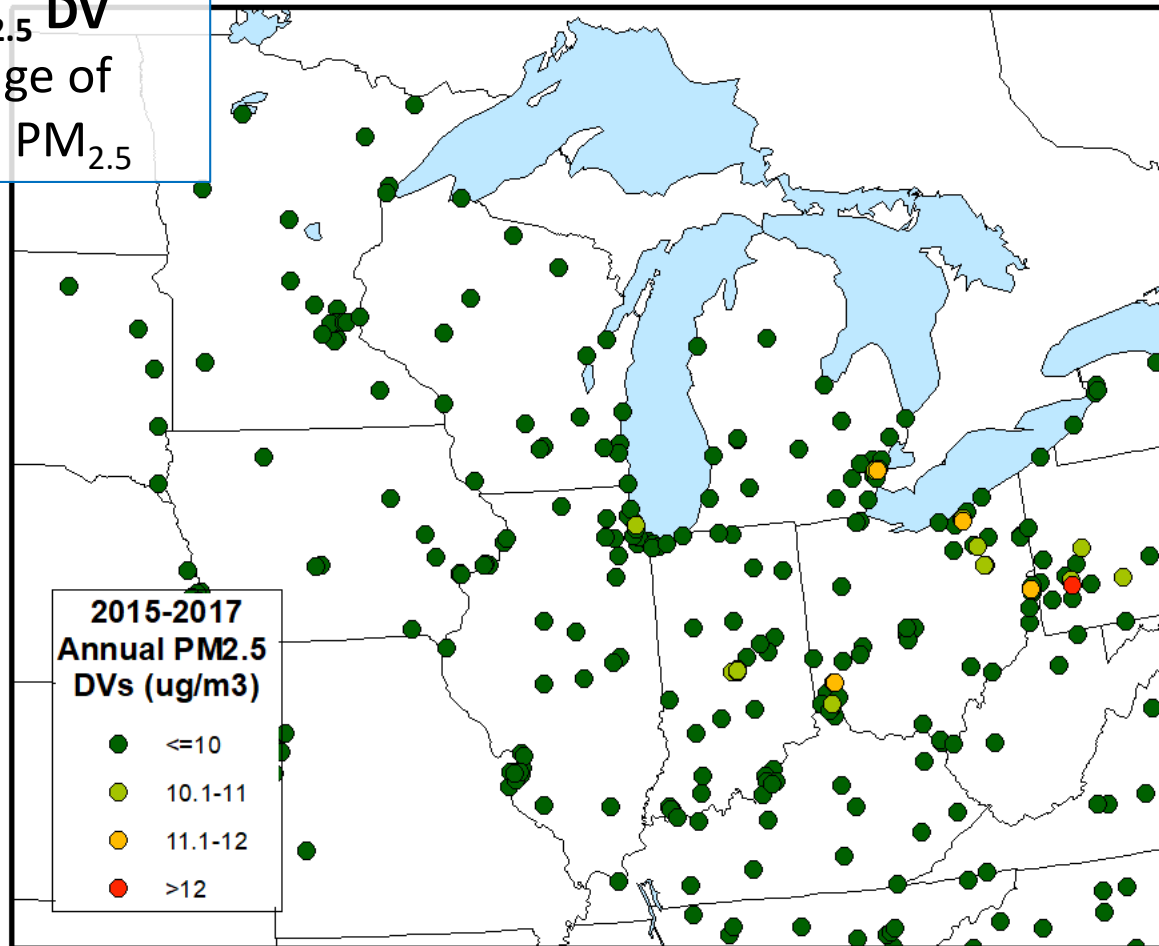US EPA Air Pollution Emissions Trends

U.S. Total Anthropogenic Emissions Trends: NEI Annual NOx
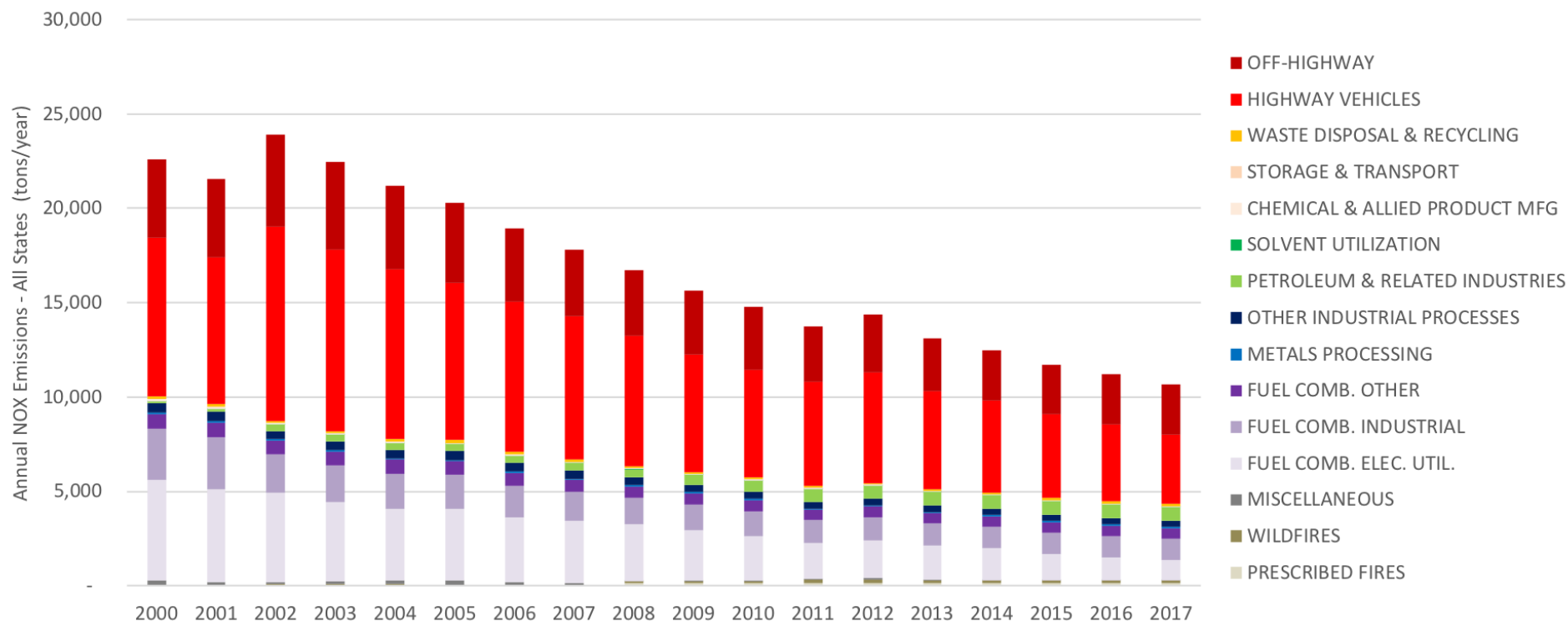
Annual Emissions Totals for the Lower 48 States: 2000-2017
US EPA Air Pollution Emissions Trends

Recent PM$_{2.5}$ Design Values

Annual PM$_{2.5}$ DV
3 year average of annual mean PM$_{2.5}$

2015-2017
Annual PM2.5
DVs (ug/m3)

- <=10
- 10.1-11
- 11.1-12
- >12

LADCO Regional Haze Planning Milestones

- Regional Haze committee was reconvened in January 2018
- Members from LADCO states, FLMs, R5, EPA-HQ, tribes
- Meet monthly via teleconference
- **Goal:** develop documentation, analyses, modeling, and inventories to assist states in meeting the July 2021 RH SIP submittal target
- Tasks described on timeline (next slide); 3 years remaining to SIP submittal

LADCO Round 2 Regional Haze Planning Timeline

Responsible parties	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21
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Timeline activities:
- IMPROVE data analysis using new methodology, updating trends, URP determination, back trajectory analysis.
- Projecting 2011 base year inventory to 2028 by merging EPA's EN and EL
- Screening sources for 4-factor analysis
- Develop 2016 base year inventory
- Develop 2016 meteorology
- Develop Long-term Strategy using 4-factor analysis
- Source apportionment modeling
- Regional modeling incorporating LTS to determine 2028 RPG
- Draft SIP completed
- State agency approval of draft SIP, FLM consultation begins
- FLM consultation complete, public comments and hearings begin
- Public comments end
- Respond to comments, revise drafts, final state approval, submittal to EPA showing 2028 progress

Accomplishments to Date

- **IMPROVE Data Analysis**
  - Official data have been screened using both the new IMPROVE algorithm and LADCO's own methodology, which retains some measurements that IMPROVE discards.
  - Continuing dialogue with IMPROVE to have LADCO method adopted by IMPROVE.
  - IMPROVE steering committee will consider adopting the change in October.
  - Next slide shows an example comparison.

Accomplishments to Date

4-factor analysis: each state examined emissions by sector; table shows the ranking of NOx sources by state and category.

NAICS	NAICS_Description	2016 NOx Emissions, tons/year						REGION TOTAL	NOx Ranks						
		MI	MN	OH	WI	IN	IL		Region	MI	MN	OH	WI	IN	IL
2211	Fossil Fuel Electric Power Generation	32,767	18,258	57,776	16,679	74,583	30,866	230,929	1	1	1	1	1	1	1
2122	Metal Ore Mining	17,066	16,510	0	0	0	0	33,576	2	2	2	14	13	11	12
4862	Pipeline Transportation of Natural Gas	2,297	2,834	9,869	533	5,736	7,976	29,246	3	6	6	2	7	3	2
3311	Iron and Steel Mills and Ferroalloy Manufacturing	2,063	136	5,945	140	15,001	348	23,633	4	7	9	4	9	2	8
3221	Pulp, Paper, and Paperboard Mills	2,839	5,958	2,074	9,473	152	0	20,496	5	5	3	6	2	10	12
3273	Cement and Concrete Product Manufacturing	4,841	7	1,461	36	4,543	3,098	13,986	6	3	11	7	11	4	4
324110	Petroleum Refineries	390	1,790	3,088	365	1,602	5,240	12,475	7	10	7	5	8	8	3
5622	Waste Treatment and Disposal	1,873	3,506	540	917	1,845	932	9,613	8	8	4	11	6	6	6
327410	Lime Manufacturing	254	0	6,107	1,168	1,556	0	9,085	9	12	13	3	4	9	12
327211	Flat Glass Manufacturing	1,077	0	916	3,000	0	2,289	7,282	10	9	13	10	3	11	5
32419	Other Petroleum and Coal Products Manufacturing	3	9	1,179	0	3,928	656	5,775	11	15	10	9	13	5	7
2111	Oil and Gas Extraction	4,798	0	228	5	0	219	5,250	12	4	13	13	12	11	10
311313	Beet Sugar Manufacturing	294	2,965	0	0	0	0	3,259	13	11	5	14	13	11	12
32521	Resin and Synthetic Rubber Manufacturing	11	4	510	41	1,784	291	2,641	14	14	12	12	10	7	9
212312	Crushed and Broken Limestone Mining and Quarrying	18	177	1,186	1,009	0	9	2,399	15	13	8	8	5	11	11
	80% of total state emissions	77826.4	45280.8	82910.4	33160.8	104114		327,717							

NOTES
The yellow highlighted cells indicate source categories that were covered in the 2015 LADCO 4-factor analysis report:
NOX and SOX from beet sugar and pulp and paper mills
NOX and SOX from cement and lime kilns
NOX from pipeline transport of natural gas

Also, the previous workgroup (in 2015) decided that Iron & Steel Mills (NOx & SO2); Products of Petroleum & Coal (SO2); and Petroleum Refining had or would experience significant reductions because of BART and so they chose not to look at those
Metal Ore Mining (NOx) should be added for BART (at least for Minnesota)
Need to check Iron & Steel Mills BART=CAIR for Indiana since CAIR no longer in place
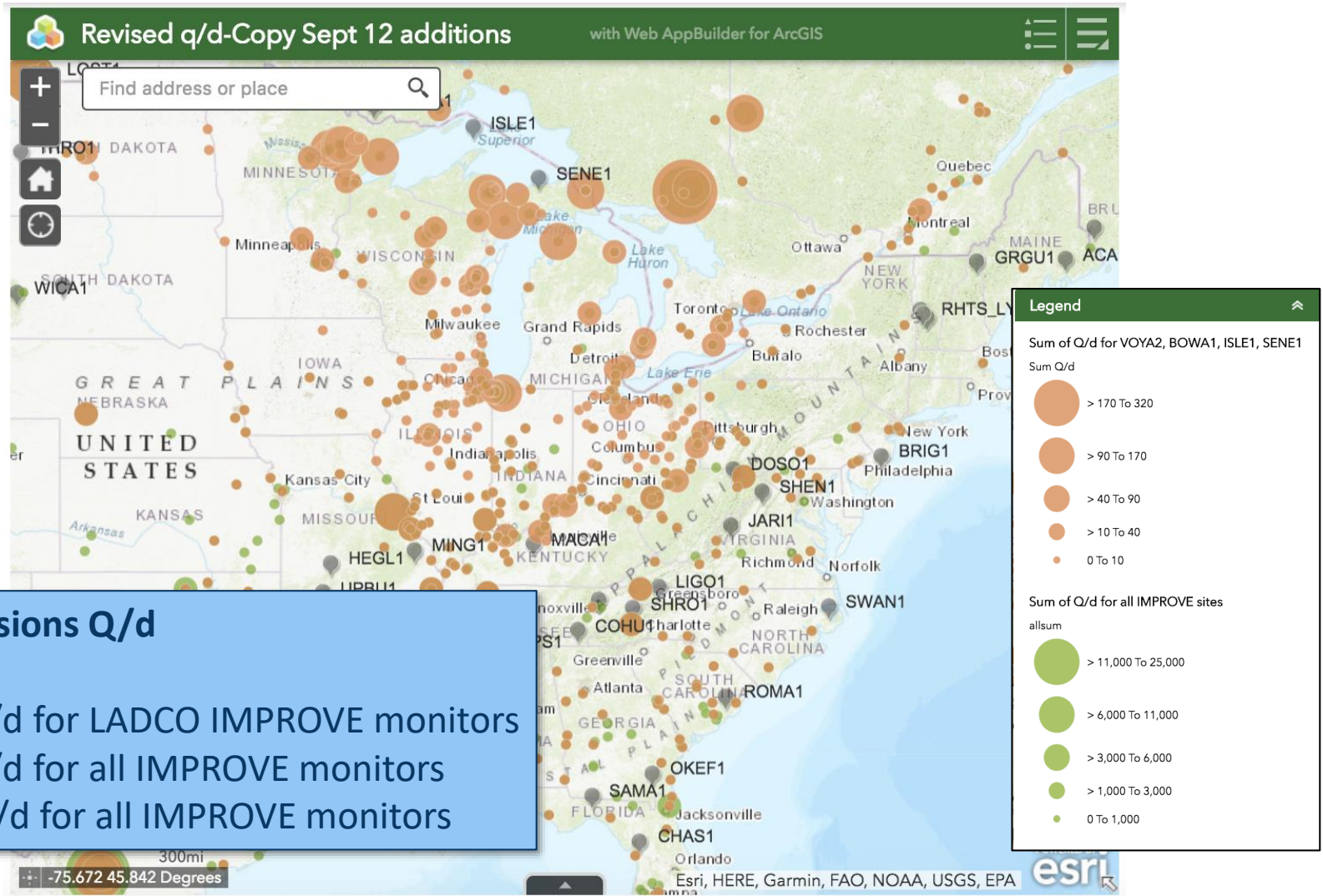
Accomplishments to Date

- **Q/d Analysis**
  - 2028 emissions and Q/d for sources impacting the LADCO Class 1 areas were calculated and put in a web app (Q/d Web App)
  - States are using the web app and LADCO spreadsheet for detailed screening.
  - Canadian and Mexican sources are included and some have significant contributions. Next slide shows a screenshot from the app.
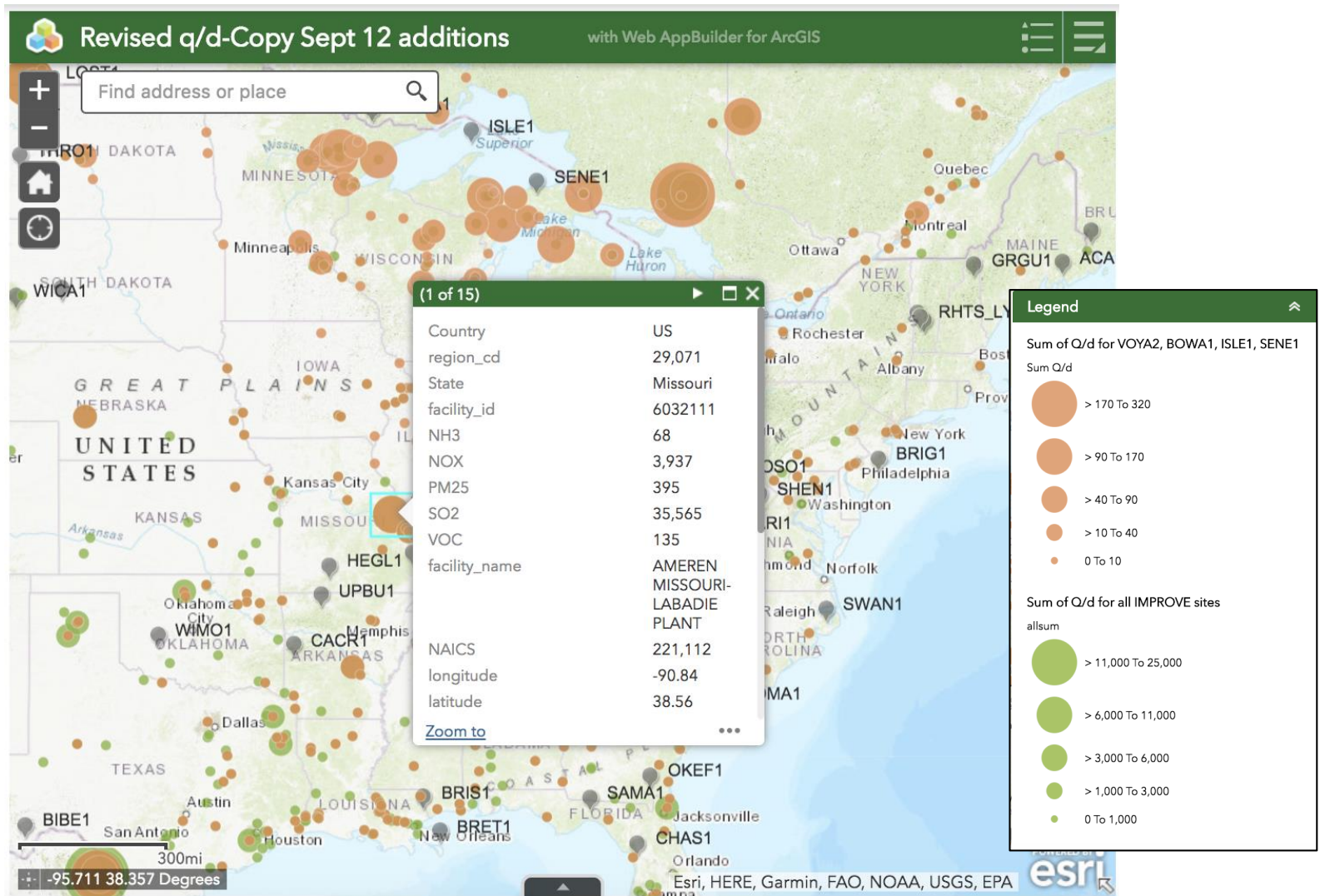
LADCO Q/d Interactive Map

https://www.ladco.org/technical/mapping/

2016 Emissions Q/d

Layers

- Sum Q/d for LADCO IMPROVE monitors
- Sum Q/d for all IMPROVE monitors
- Total Q/d for all IMPROVE monitors

LADCO Q/d Interactive Map

https://www.ladco.org/technical/mapping/

Accomplishments to Date

- **Updated Modeling Platform**
  - Working to move beyond the 2011, EPA-based modeling platform
  - Various WRF model configurations for 2016 are currently being analyzed
  - 2016 and 2028 emissions
  - CAMx modeling with sector, state, and unit source apportionment expected in Spring 2019
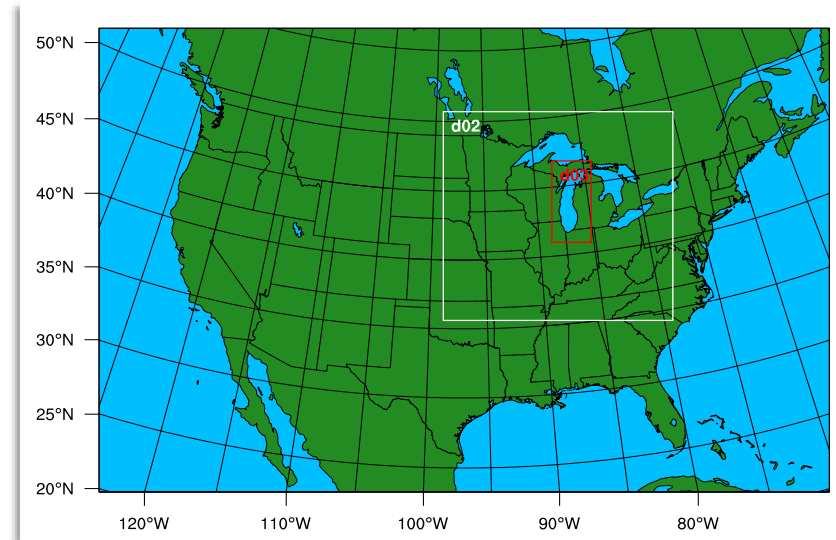
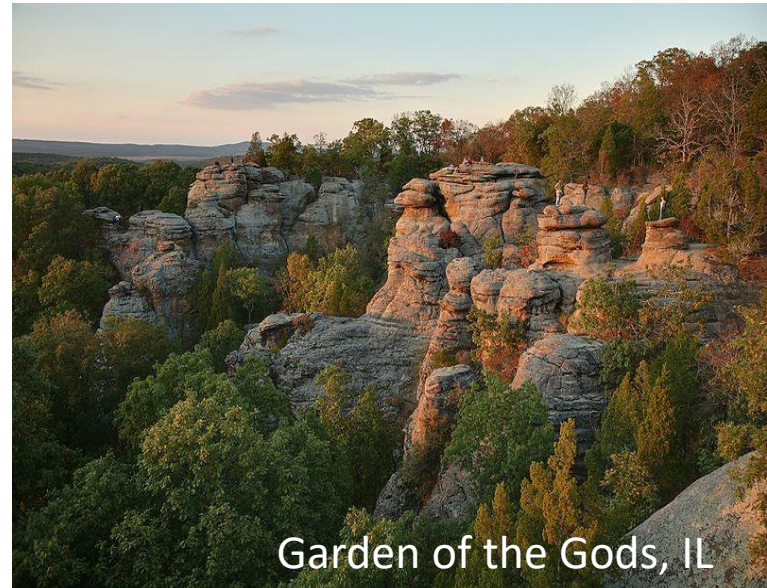# Questions and Contact

Zac Adelman

Executive Director

adelman@ladco.org

Donna Kenski

Data Scientist

kenski@ladco.org

Sleeping Bear Dunes, MI

Garden of the Gods, IL