Intermountain West Ozone Challenges

Ryan Bares

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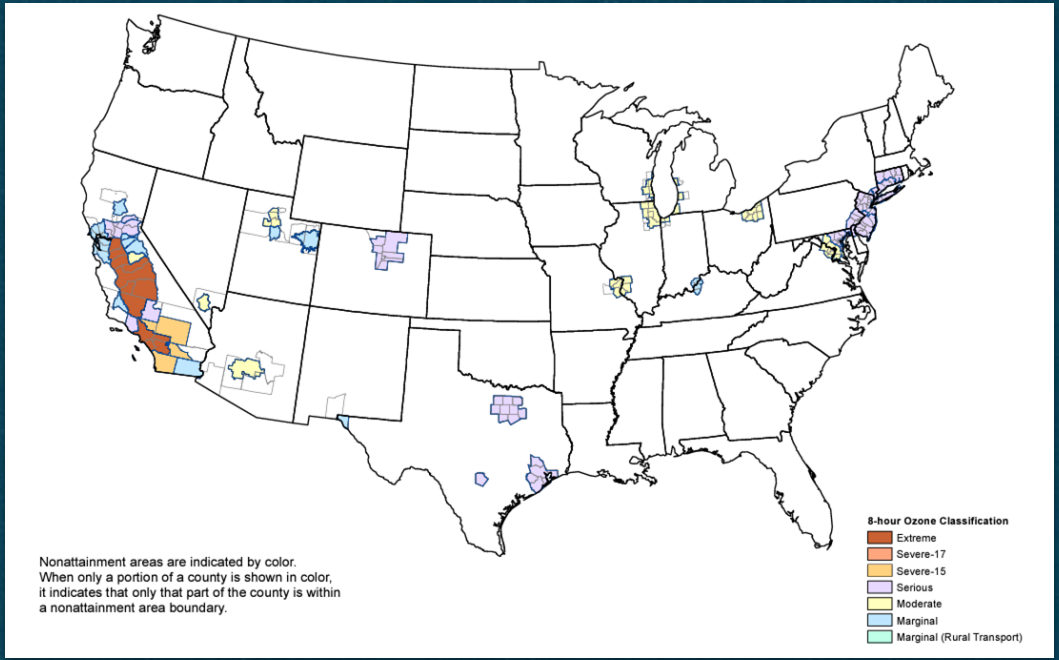
What is Background Ozone?

Ozone is *usually* a good proxy of urban oxidative chemistry

Ozone that results from natural events or from man-made pollution from sources outside the U.S.

Any ozone attributable to sources, natural or anthropogenic, that originate outside of the state.

8-hour Ozone Nonattainment Areas (2015 Standard)



NAAQS Standard

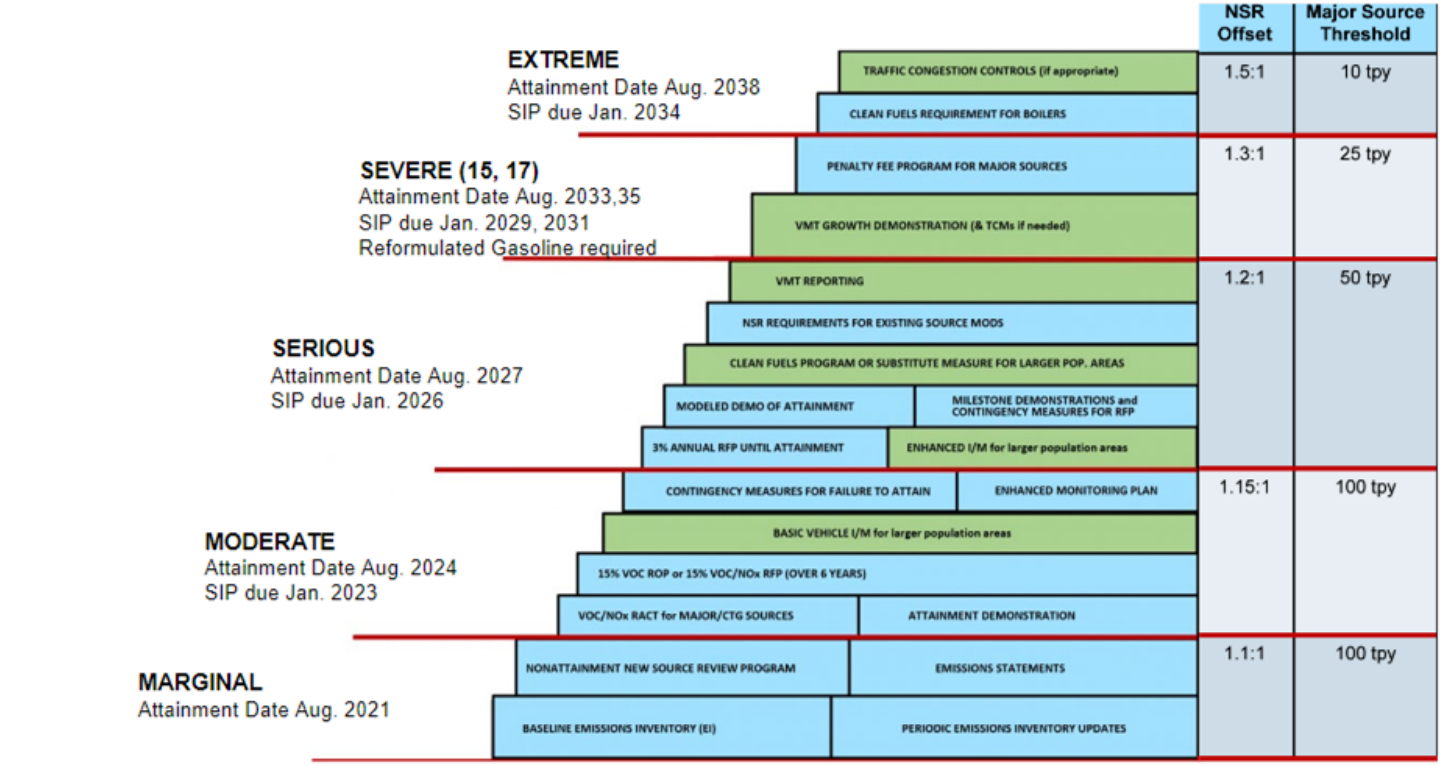
In 2015 EPA strengthened the NAAQS for ground level ozone and designated 51 areas as nonattainment.

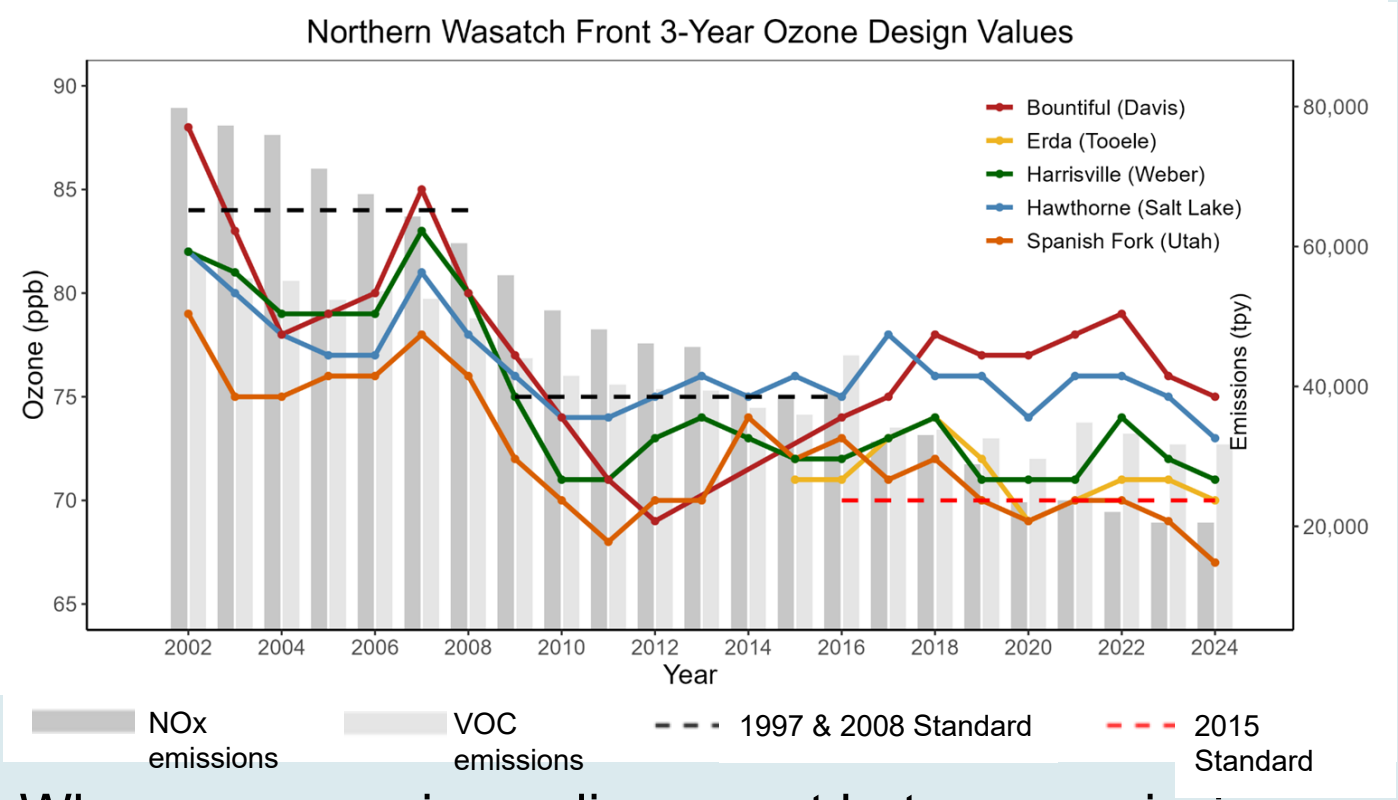
Standard: 70 ppb

Design Value

Three year average of the 4th highest daily 8-hour average ozone concentrations (MDA8).

Ozone Requirements By Classification





Why are we seeing a disconnect between emission reductions and observed ozone concentrations?

Ozone and emissions trends in the Northern Wasatch Front and Intermountain West

Ozone in the Intermountain West

Regional Challenges

Intermountain West Ozone Challenges

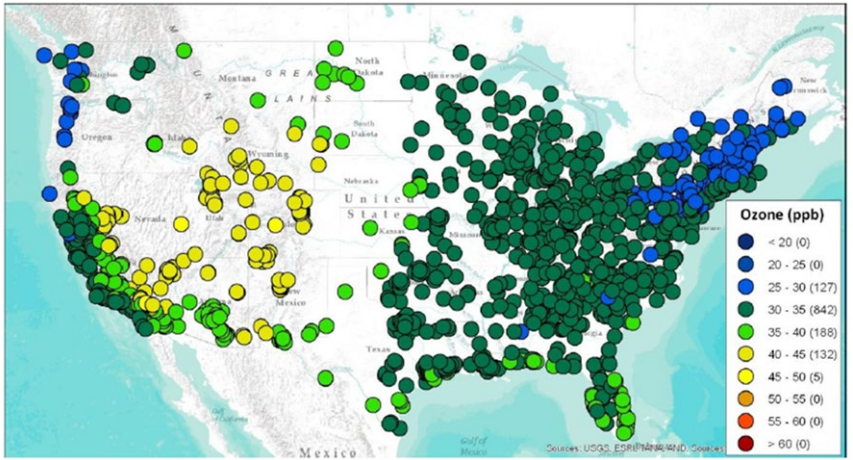
The region faces a range of challenges when working to reduce ozone:

- High elevation
- Natural emissions of VOCs
- Transported pollutants
- Wildfire emissions
- Longer, hotter, drier summers
- Change in ozone chemistry
- Some of the fastest growing populations in the nation

~ 80% of ozone and ozone forming emissions are naturally occurring or transported to Utah.

Summertime average background concentrations can be as high as 50 ppb.

Background Ozone in the Intermountain West

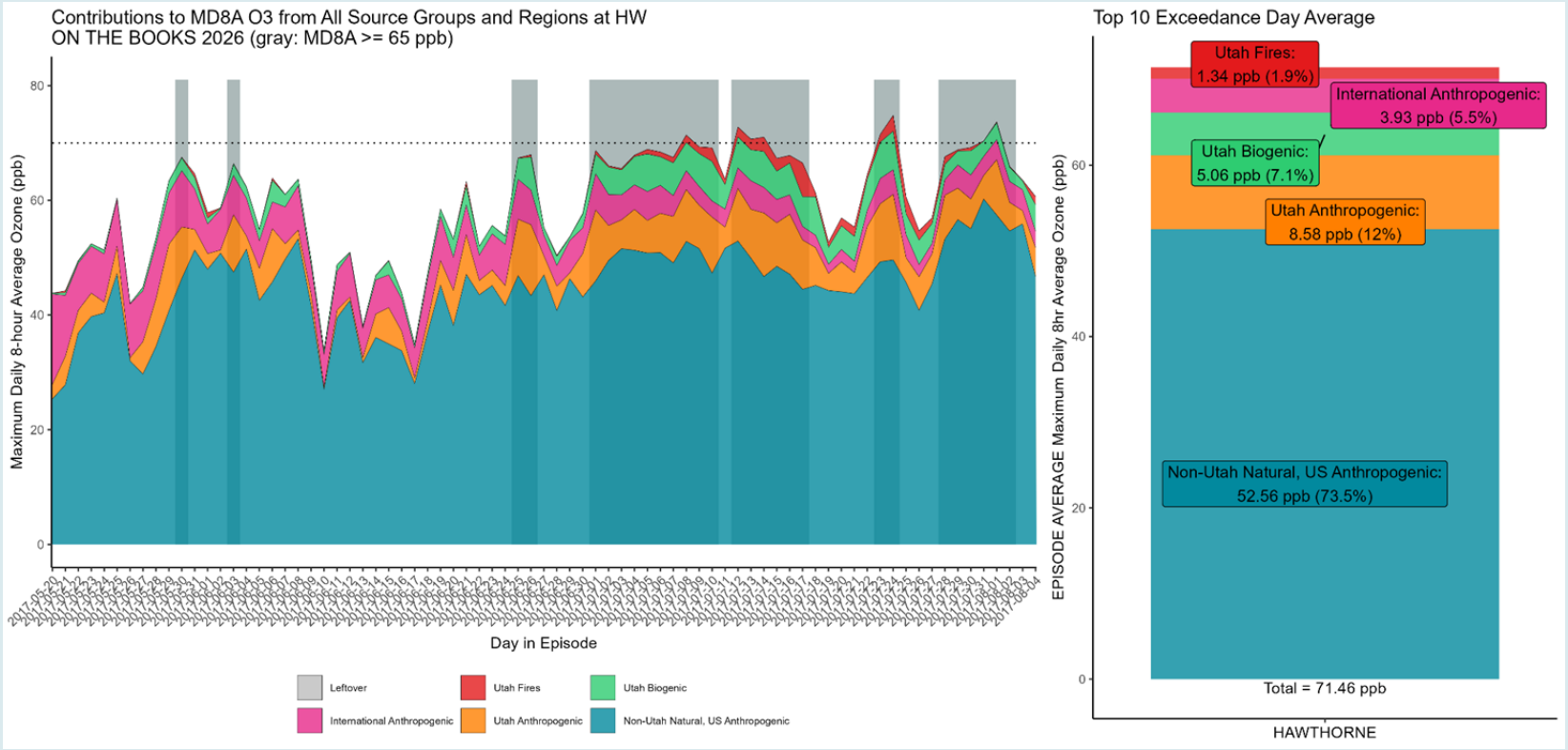


CMAQ estimates of *average* background (USB) ozone at monitoring locations across the U.S. in 2007

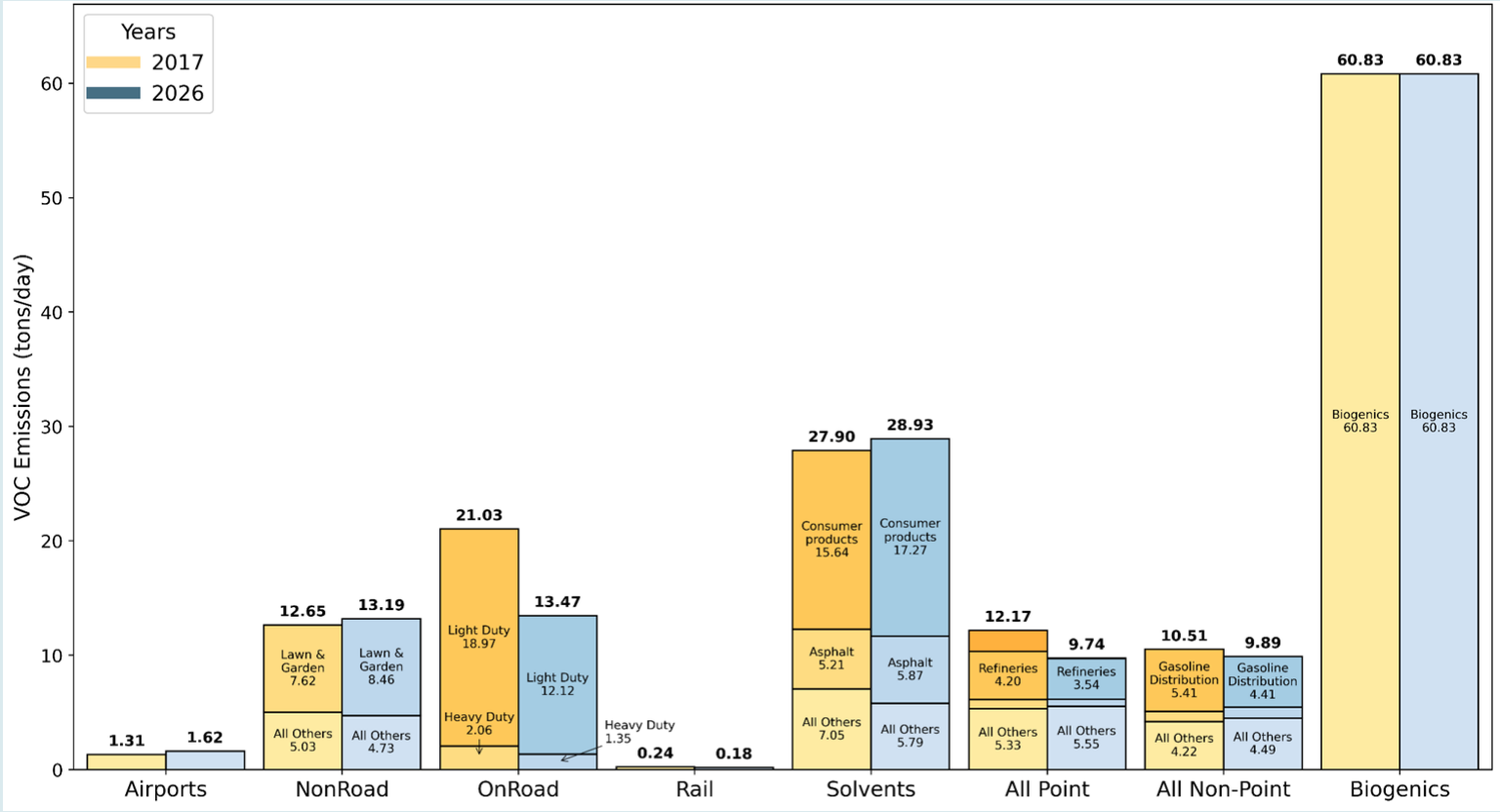
EPA modeled background ozone concentrations in the continental United States. This demonstrates the effect of elevation and transport on background ozone concentrations in the west.

"background ozone can exceed 60 ppb in the intermountain west"

Regional Ozone Source Contributions



VOC Emissions Northern Wasatch Front on an ozone season day



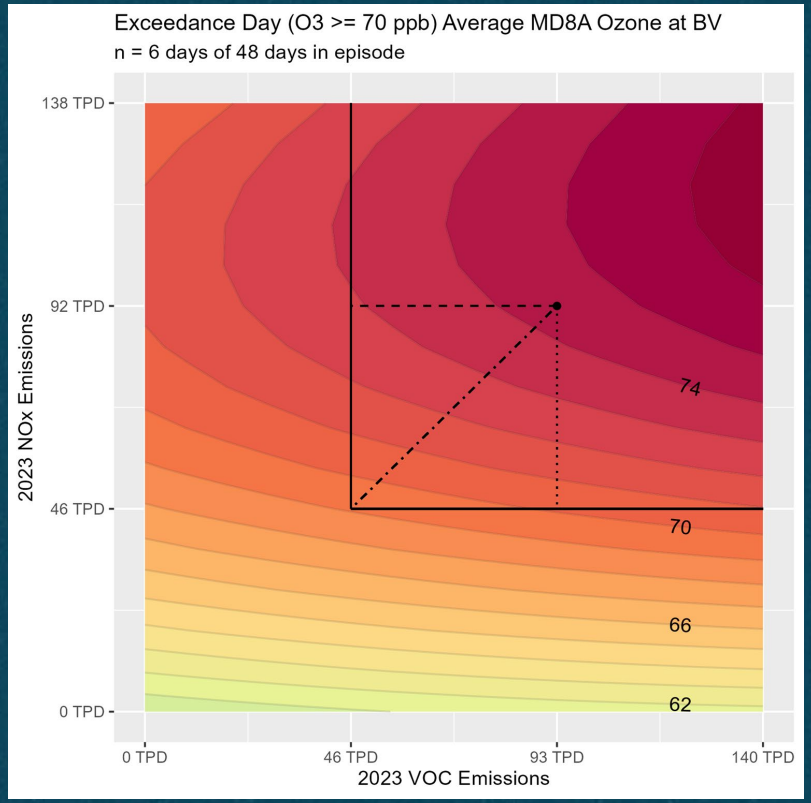
Biogenic emissions play a critical role in the VOC budget for the air shed.
The majority of the anthropogenic NOx and VOC sectors are already extensively controlled or fall under federal purview.

Pathway to Attain

NO_X reductions provide as great or greater an improvement in air quality than VOC reductions.

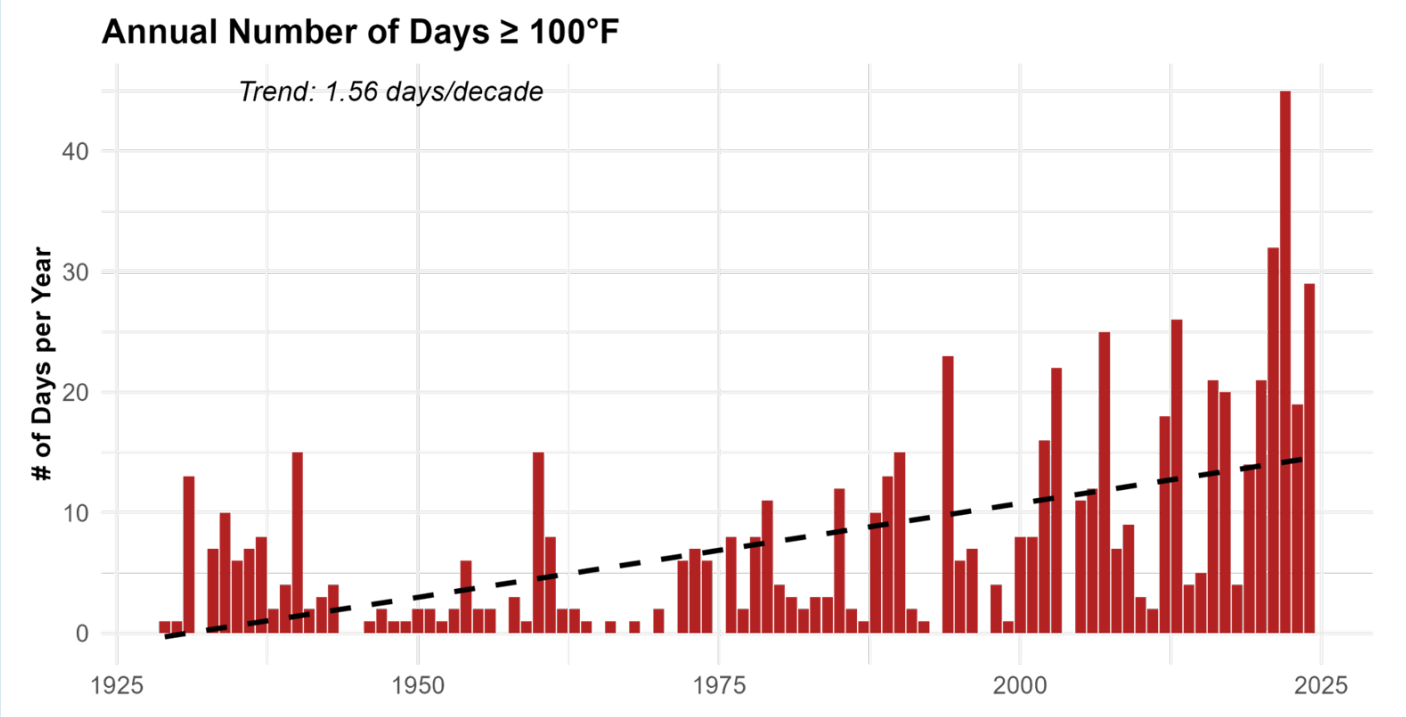
A paired NO_X and VOC approach is the most beneficial pathway to attaining the standard.

Good example why greater flexibility in what emissions are targeted is needed, especially early on in the SIP process.



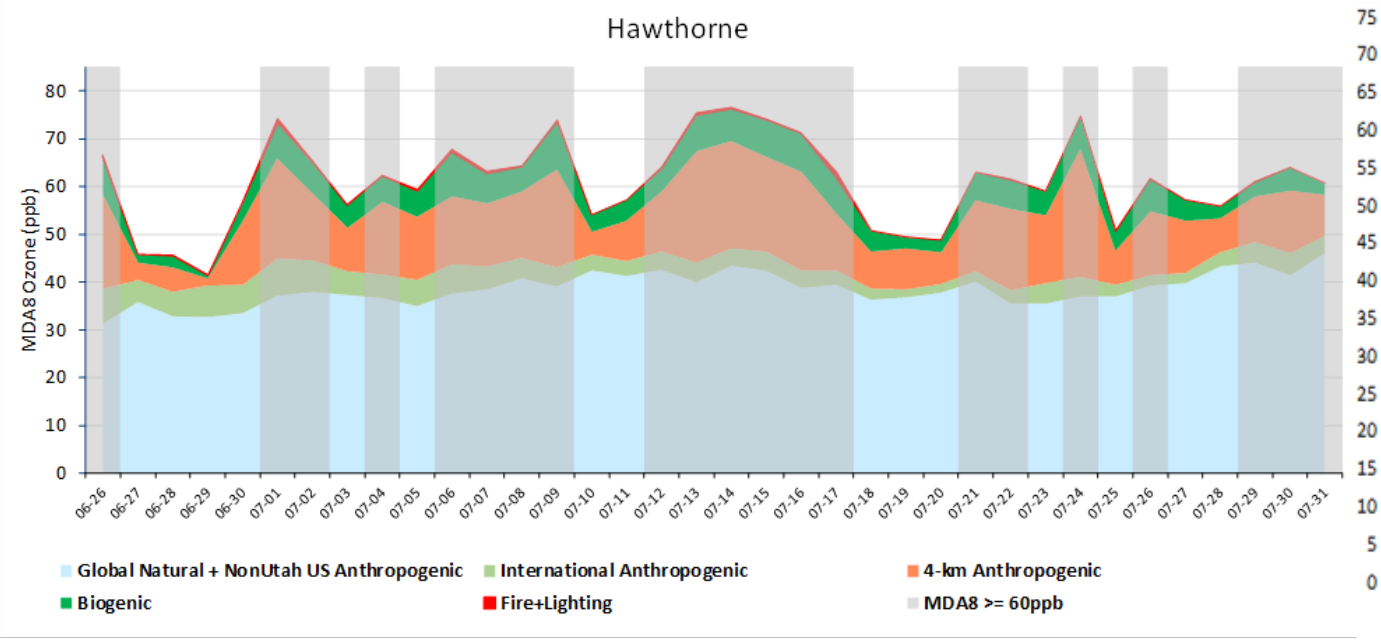
8-hour ozone isopleths representing NO_x and VOC reductions and the resulting predicted ozone concentrations at Bountiful monitoring station in the NWF NAA. Analysis was conducted using CAMx version 7.1 High-Order Decoupled Direct Method (HDDM) and demonstrates the sensitivity of the NWF NAA to changes in anthropogenic NO_x and/or VOC reductions.

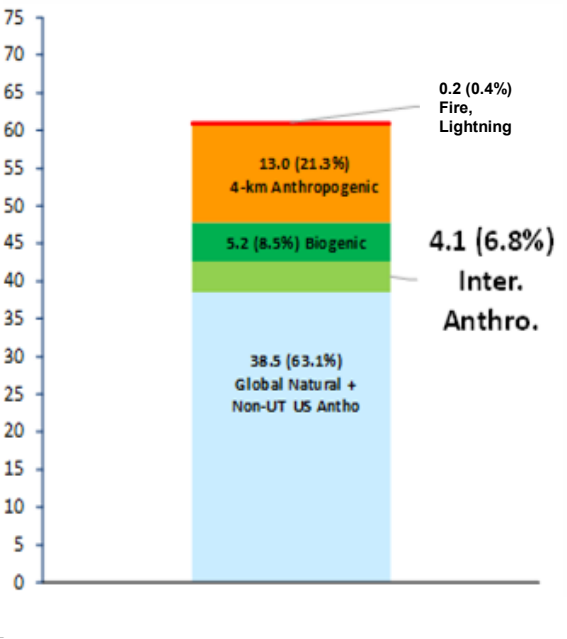
Ozone Season Temperatures

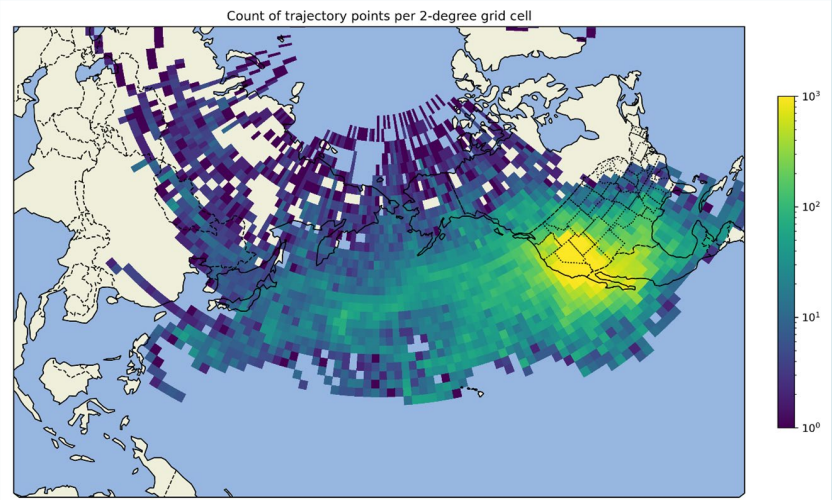


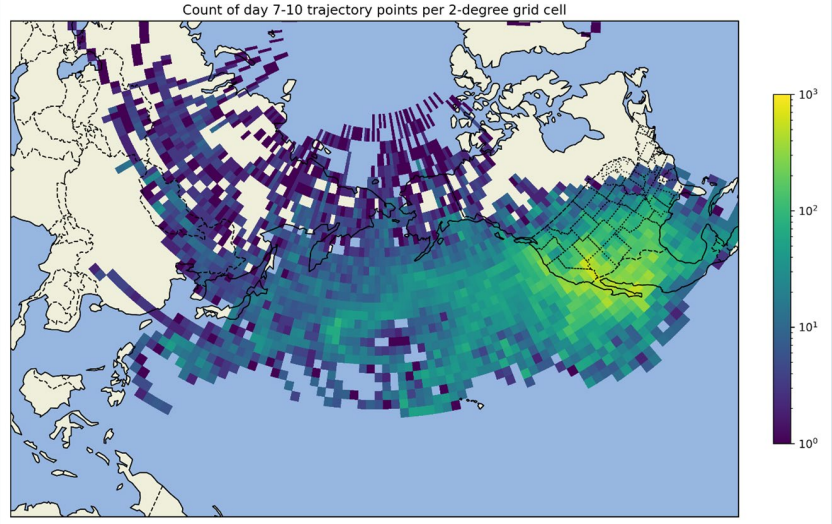
Longer ozone seasons, increased high photochemical days, increased wildfire influenced days

International Contributions









Clean Air Act 179B

179B(a)

- Prospective (will attain the standard)
- Included in a State Implementation Plan
- Can rely on the other info in the SIP
- “Completeness requirement”
- Serves as a weight of evidence element in a SIP attainment demonstration

Utah included a prospective 179B(a) demonstration in the moderate State Implementation Plan for the Northern Wasatch Front.

179B(b)

- Retrospective (would have attained)
- Stand alone demonstration
- Submitted independent of a SIP
- Requires more information to be included
- Not contingent on “completeness requirement” of an associated SIP
- Serves to prevent further reclassification

Utah Submitted a retrospective 179B(b) demonstration for both the reclassification to moderate and recently for the serious redesignation.

“Would have attained the national ambient air quality standard for ozone by the applicable attainment date, but for emissions emanating from outside of the United States…“

East Asian Transport of Pollutants

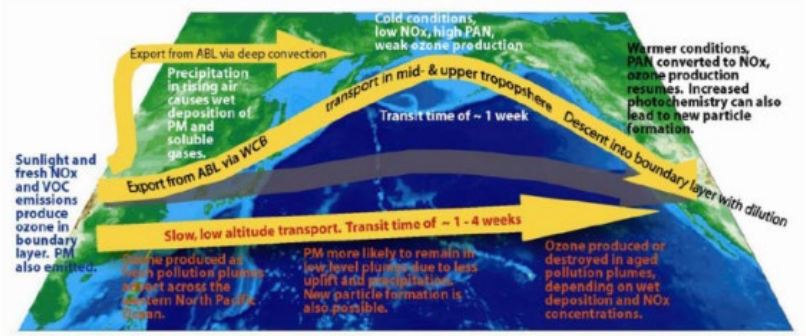


Figure 14. Schematic conceptual model of pollutant transport from Asia to North America (from HTAP, 2010). Blue text on left refers to Asian continental boundary layer processes, red text along bottom refers to low level transport, and black/white text along top and right refers to high altitude transport.

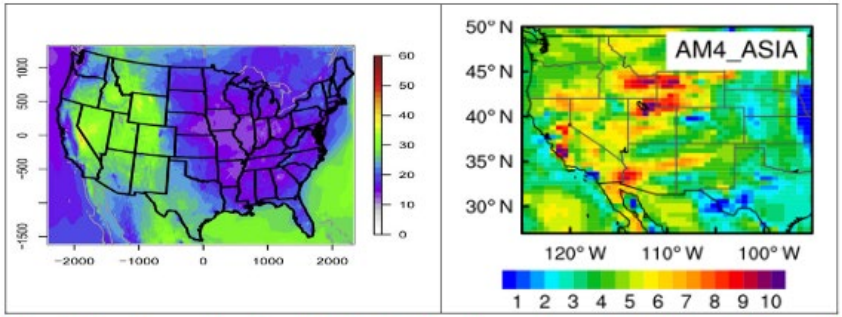


Figure 15. Examples of modeled surface background ozone (ppb) from Baker et al. (2015; left) showing July 2011 average US background from the CAMx regional photochemical model, and from Zhang et al. (2020; right) showing tracked ozone from Asia on May 24, 2017 from the AM4 global model.

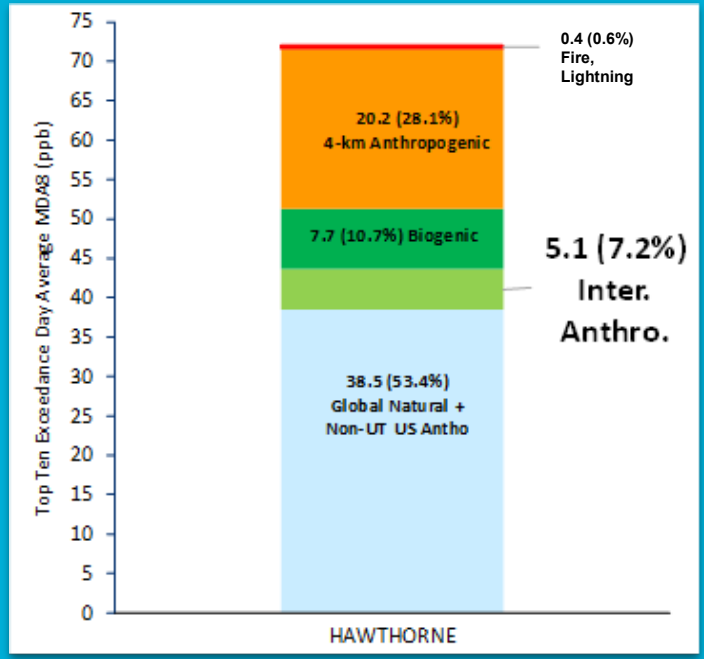
"Most ozone exceedance days were analyzed except those noted with medium and heavy smoke impacts (as reported by UDAQ), resulting in a set of 33 exceedance days. Four types of distinct transport patterns were subjectively identified with 29 of the 33 trajectory days (88%) indicating air parcel origins reaching toward/over Asia or passing over Mexico."

CAA Section 179B(b)

- Demonstration shows that the area would have attained the standard by the moderate attainment date but for the presence of international contributions.
- Modeling funded by the Utah legislature was conducted by Ramboll.

Site	County	2023 DV (ppb)	RRF	Future DV IA Adjusted (ppb)
Bountiful	Davis	76	0.932	70
Hawthorne	Salt Lake	75	0.934	70
Herriman	Salt Lake	75	0.942	70
Erda	Tooele	71	0.933	66
Harrisville	Weber	72	0.931	67
Copper View	Salt Lake	73*	0.944	69
Rose Park	Salt Lake	74	0.936	69

Average Ozone Contributions



What a CAA Section 179B(b)would mean for Utah

An approved 179B would not:

- Negate the requirement to reduce emissions and attain the standard.
- Remove sanctions from previously disapproved SIP elements.

An Approved 179B(b) would:

Give the state greater flexibility in how it approaches attaining the standard:

- What emission reductions are targeted;
- What programs are required; and
- Timeframe for implementation.

Opportunity for the State to remain on the record regarding the significant challenges facing it under current, and future, ozone NAAQS.

More time for the science to catch up and for the area to identify and follow the best pathway to attain.

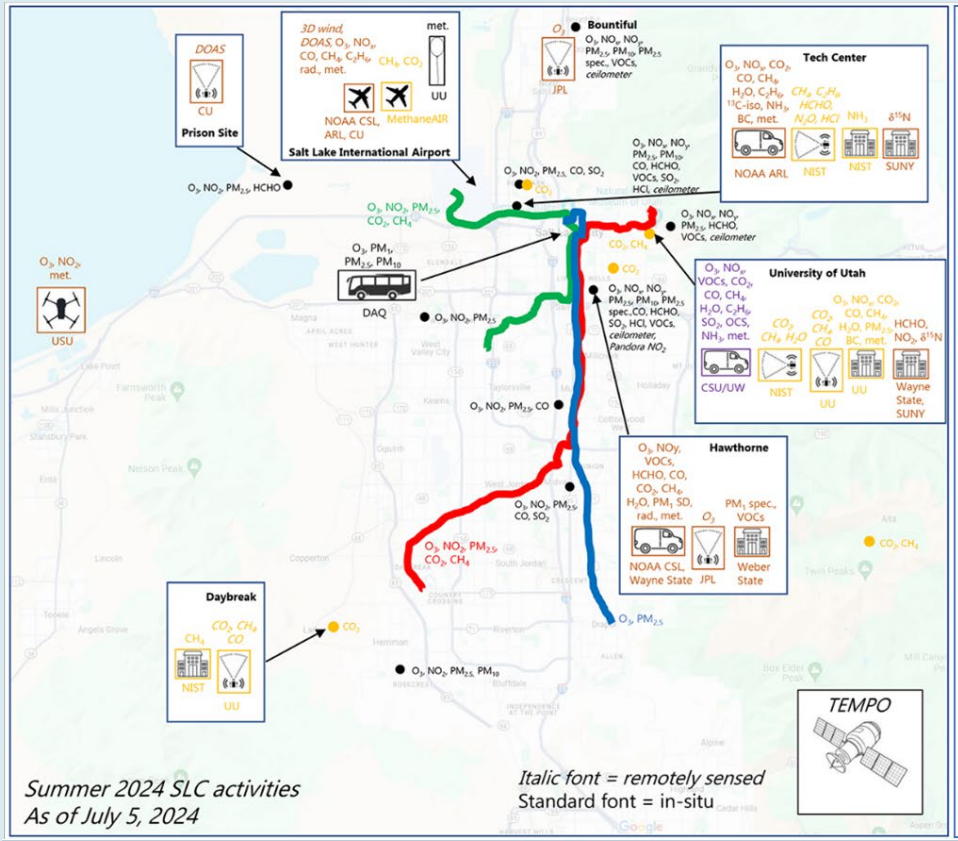
Ongoing Research and Policy Actions

Aims of USOS:

- Complete picture of ozone production
- Improving photochemical modeling
- NO_x/VOC sensitivities
- Wildfire Smoke
- Topography
- Biogenic emissions
- Background concentrations

Slide courtesy of Dr. Caroline Womack

The Utah Summer Ozone Study (USOS) and other summer campaigns measured O_3 and precursors across the SLV



Ongoing measurements:

- DAQ monitoring
- UUCON monitoring
- UTA TRAX (approximate routes)
- UTA Electric bus fleet
- Daily radiosonde launches

Summer 2024:

USOS	SLC-SOS	MEEPC
July 15 – Aug 9 or 18	Aug 1 - 30	Aug 1 – 30 or continuous

- Aircraft
- Mobile lab
- Upward-facing remote sensing
- Long-path remote sensing
- Additional ground-based in-situ measurements
- Drone

Questions? caroline.womack@noaa.gov

Aims of USOS:

Complete picture of ozone production

Improving photochemical modeling

NO_x/VOC sensitivities

Wildfire Smoke

Topography

Biogenic emissions

Background concentrations

Slide courtesy of Dr. Caroline Womack

Acknowledgments

+ many more!

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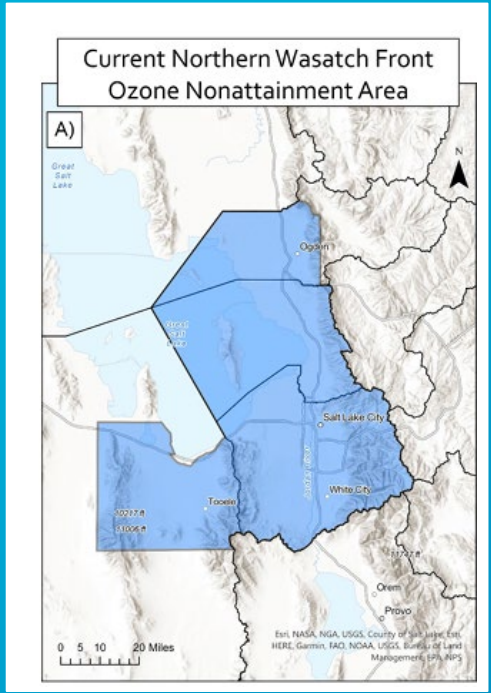
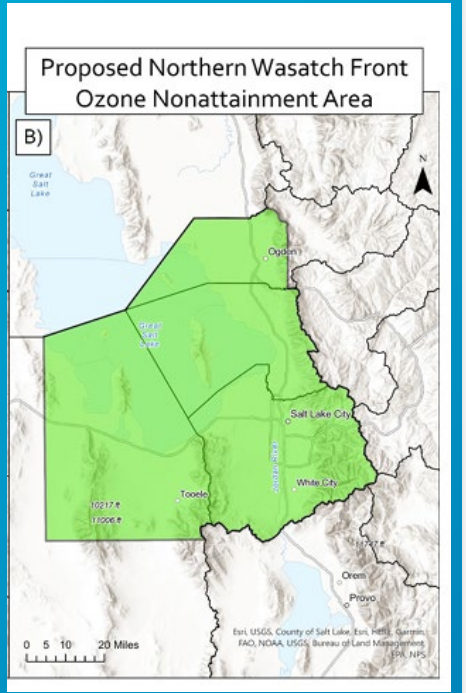
NWF Boundary Expansion





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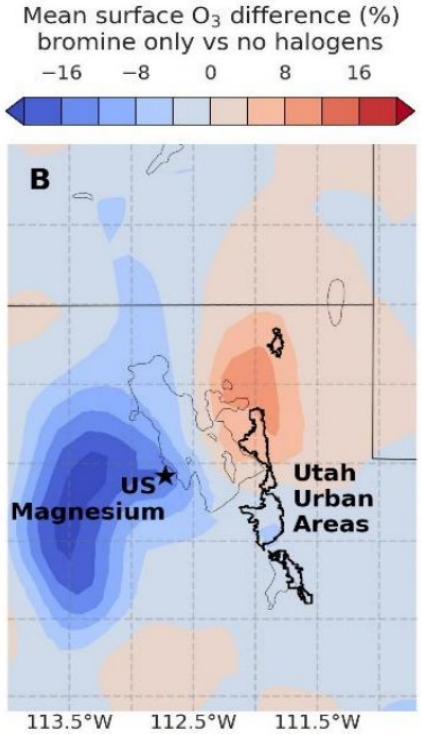
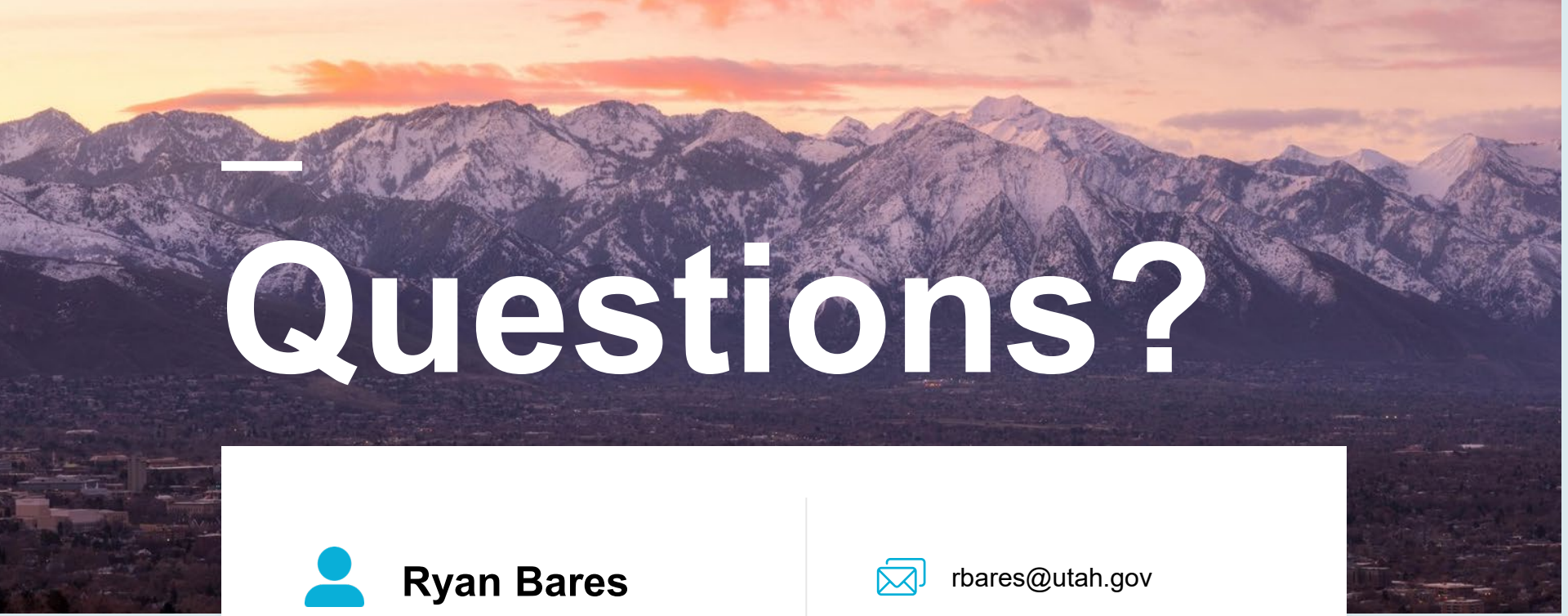
ANTHROPOGENIC IMPACTS ON THE ATMOSPHERE | January 25, 2023

Midlatitude Ozone Depletion and Air Quality Impacts from Industrial Halogen Emissions in the Great Salt Lake Basin

Caroline C. Womack*, Wyndom S. Chace, Siyuan Wang, Munkhbayar Baasandorj, Dorothy L. Fibiger, Alessandro Franchin, Lexie Goldberger, Colin Harkins, Duseong S. Jo, Ben H. Lee, John C. Lin, Brian C. McDonald, Erin E. McDuffie, Ann M. Middlebrook, Alexander Moravek, Jennifer G. Murphy, J. Andrew Neuman, Joel A. Thornton, Patrick R. Veres, and Steven S. Brown





Questions?

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Resource Slides

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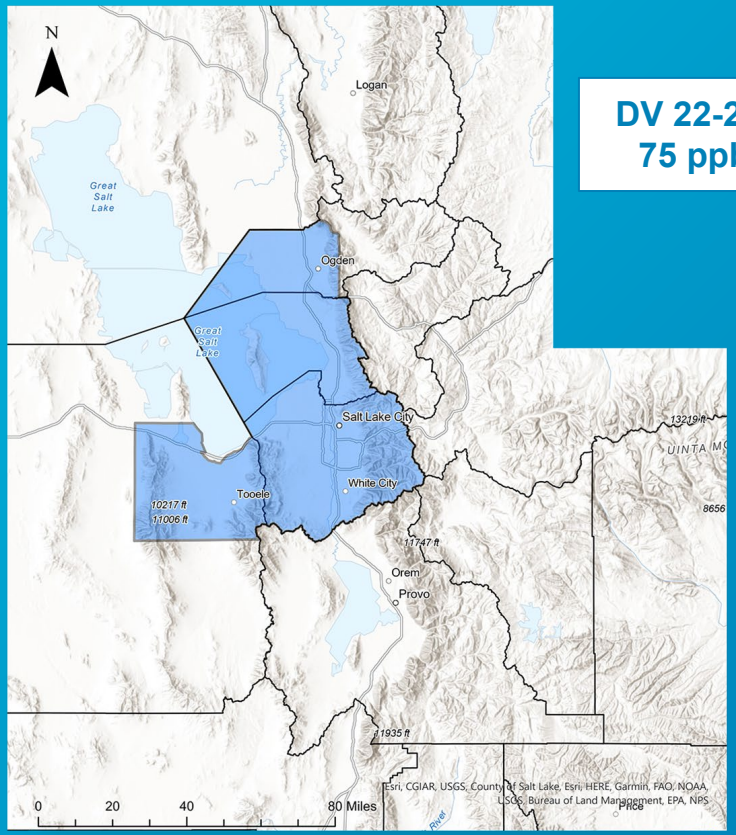
Northern Wasatch Front Ozone Nonattainment Area



DV 22-24: 75 ppb

Pollution

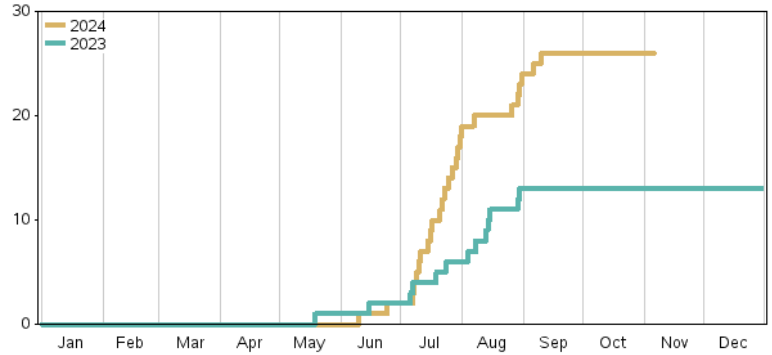
The Northern Wasatch Front is not attaining the 2015 NAAQS for ozone: 70 ppb

Creating a Plan

The State submitted a moderate State Implementation Plan (**SIP**) and has started the process of planning for a serious SIP. Redesignation to serious expected early 2025.

Cumulative Number of Days 8-hr Ozone Daily Max > 0.070 ppm

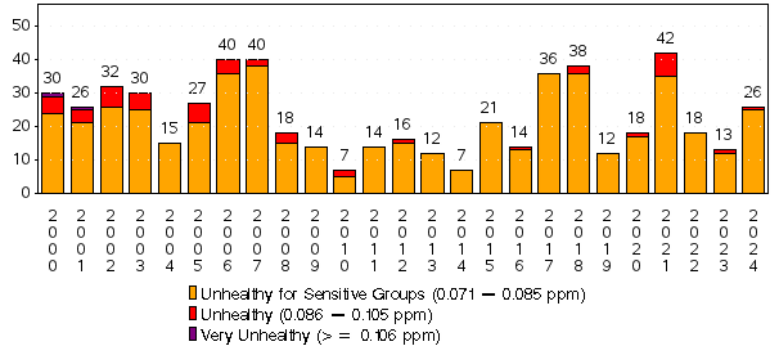
2024 vs. 2023
in Salt Lake City, UT



Note: Based on ALL sites
Source: U.S. EPA AirData <https://www.epa.gov/air-data>
Generated: November 7, 2024

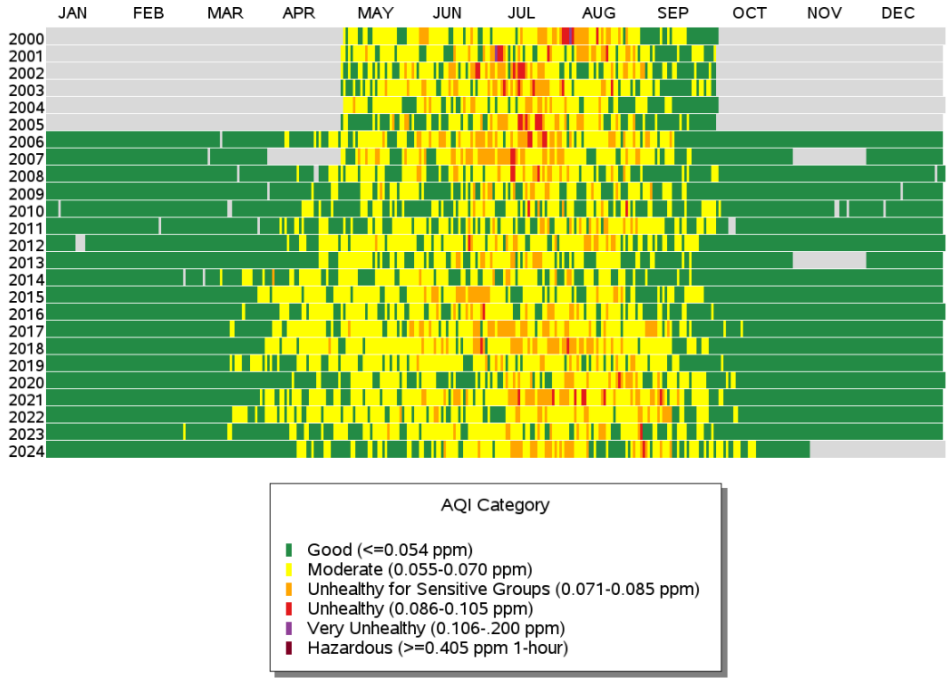
Number of Days 8-hr Ozone Daily Max > 0.070 ppm

2000-2024
in Salt Lake City, UT

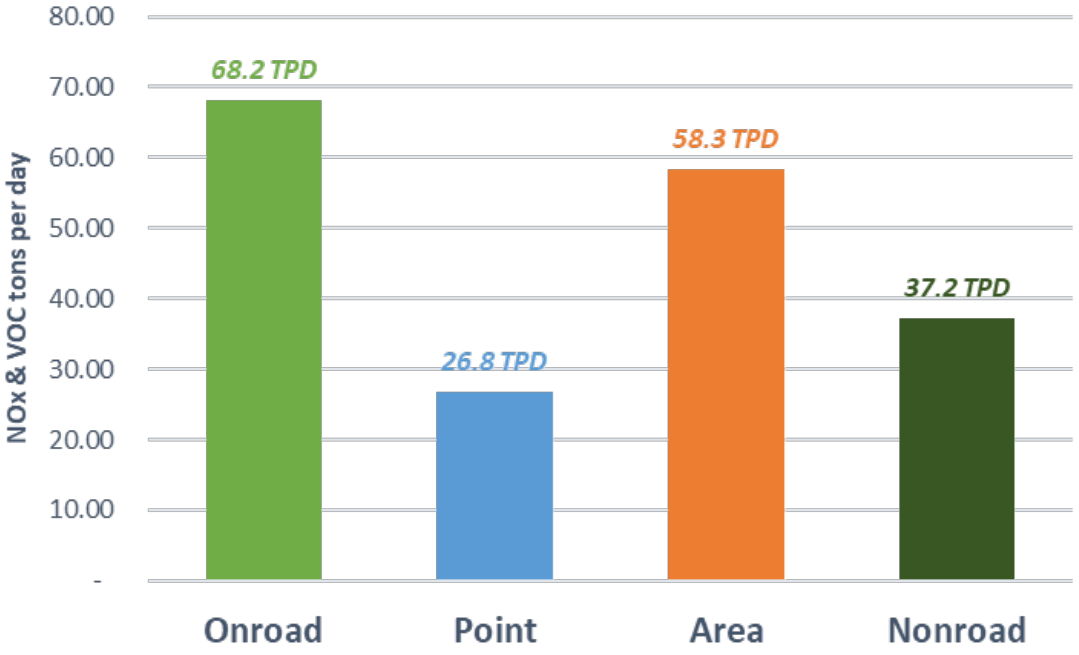


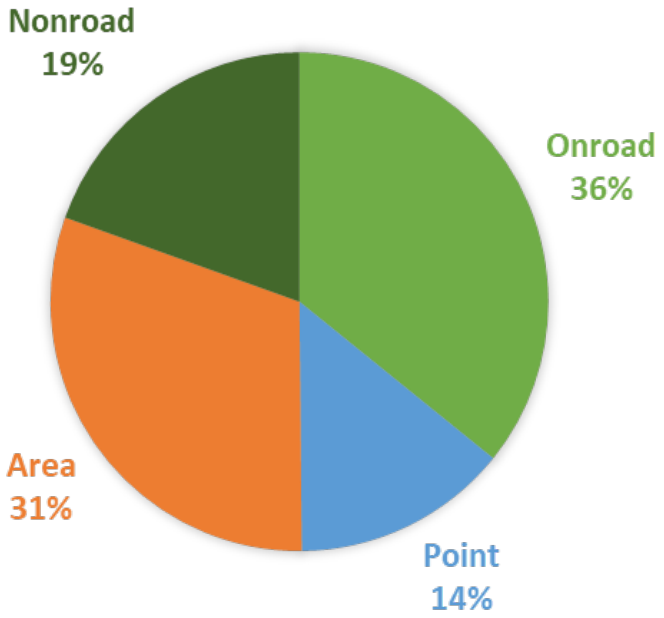
Ozone Daily AQI Values, 2000 to 2024

Salt Lake City, UT



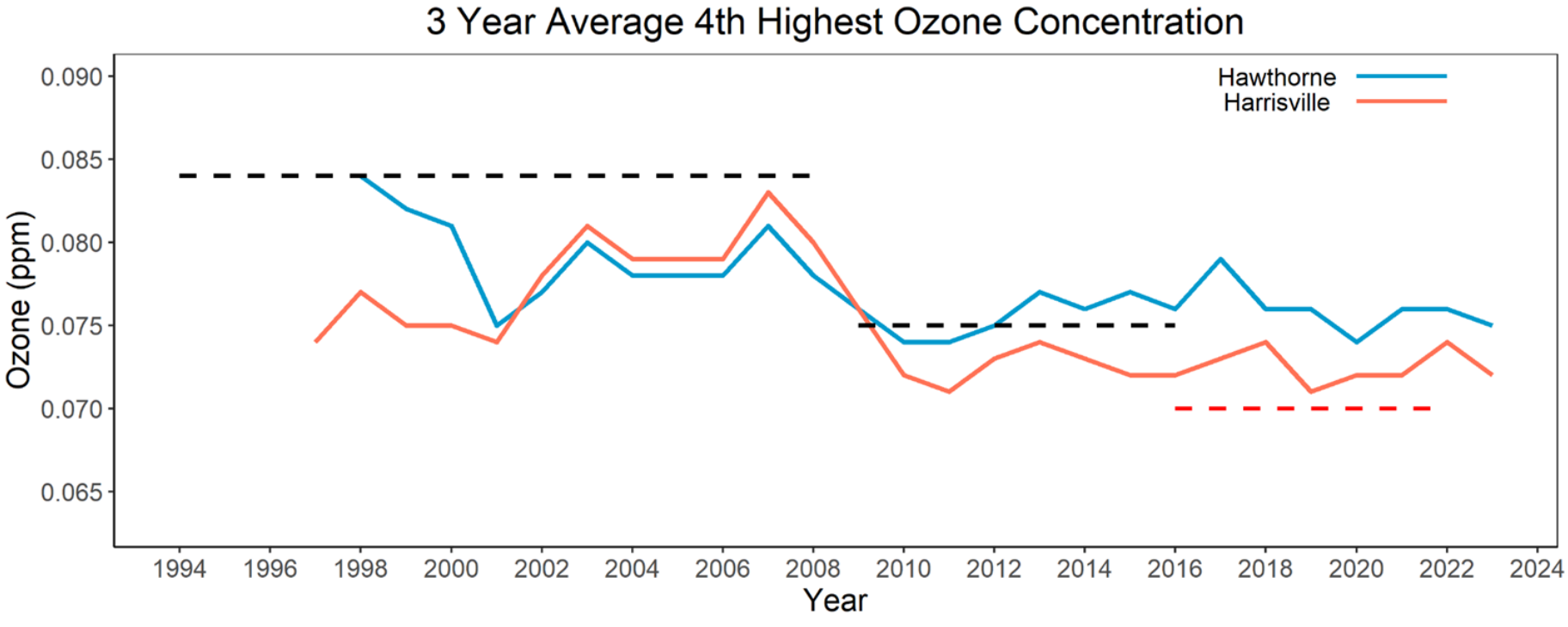
Anthropogenic NOx and VOC Emissions Northern Wasatch Front on an ozone season day



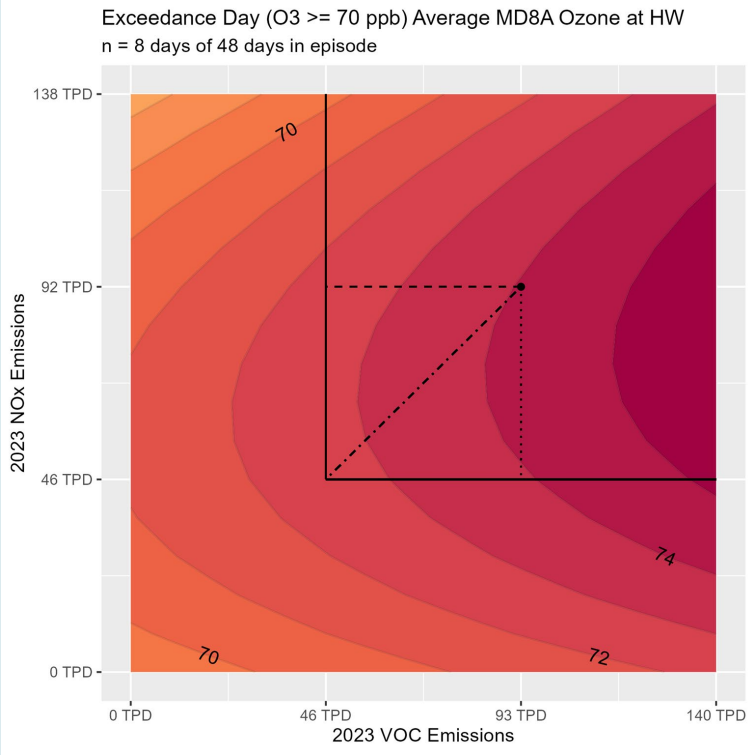


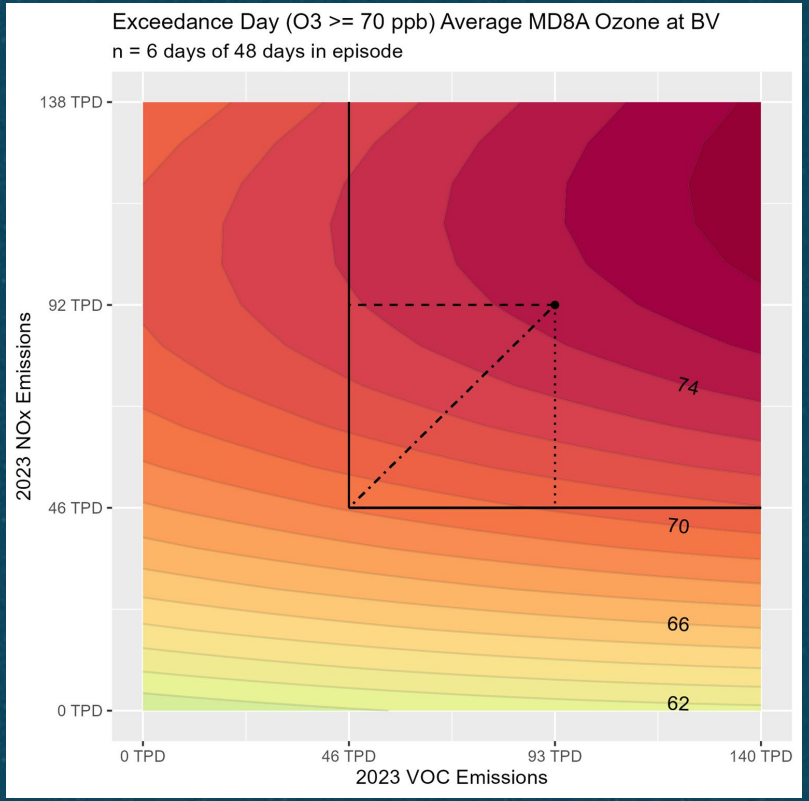
More than half of anthropogenic emissions driving local ozone formation are very difficult to regulate at the state level

Historic NWF Ozone Concentrations



Pathway to Attain





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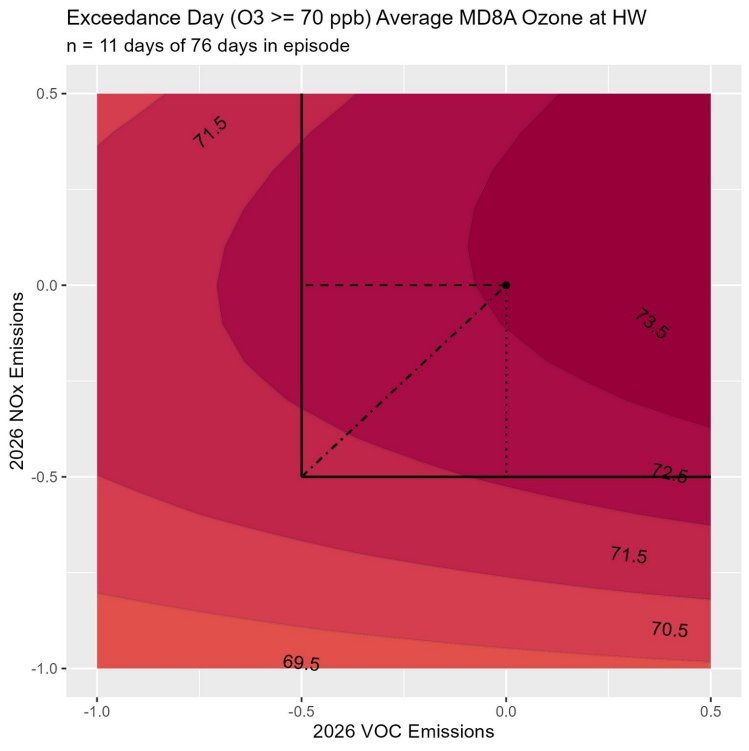

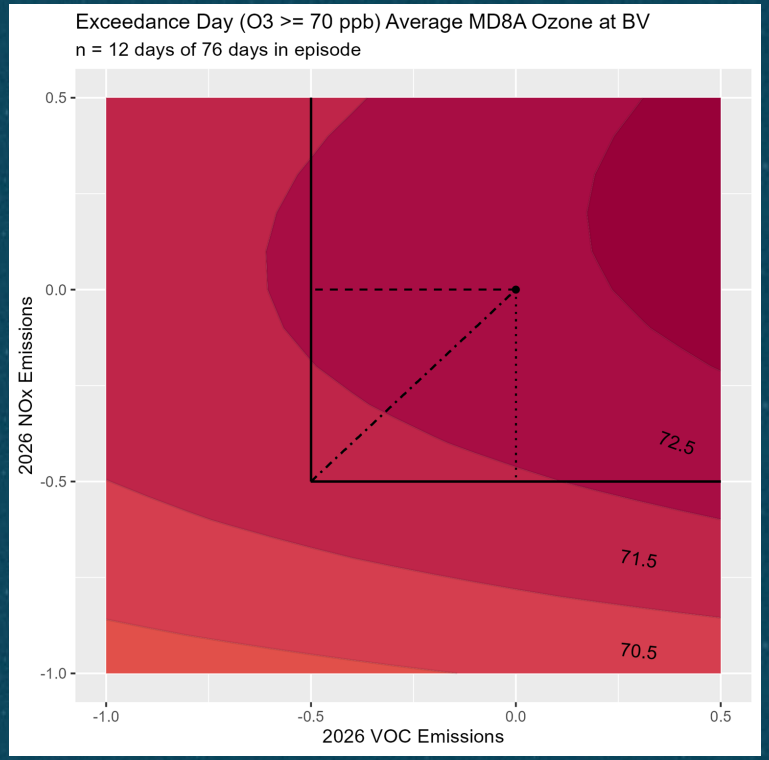

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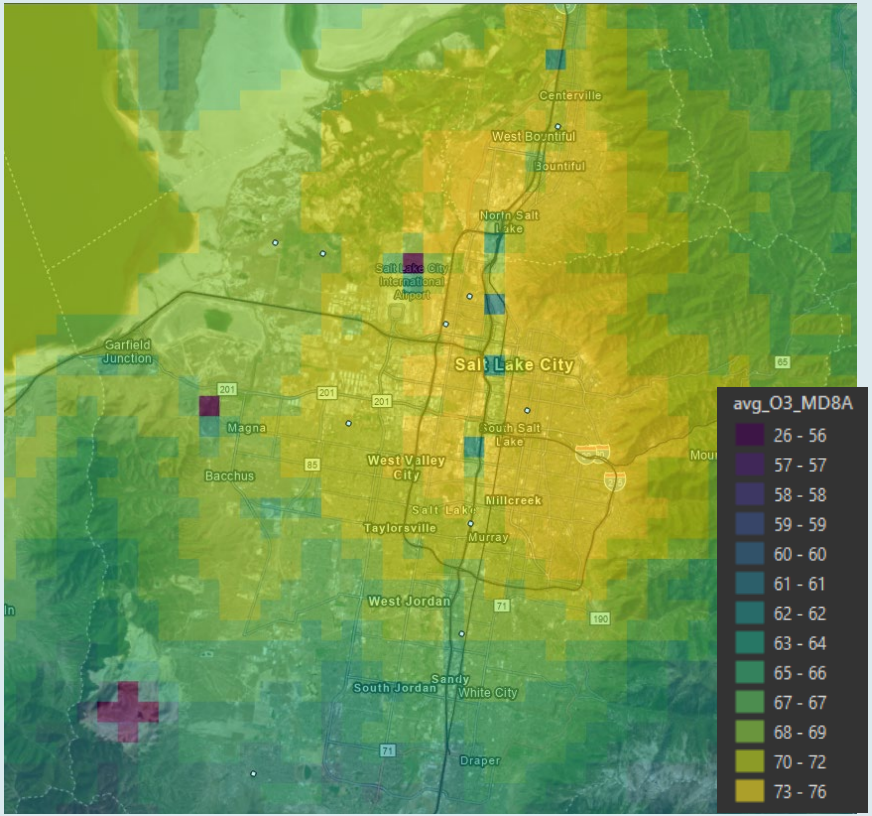

8-hour ozone grid cells represented as the average MD8A ozone value over exceedance days (highest value each day). Maxima may not occur at exactly the same time period.

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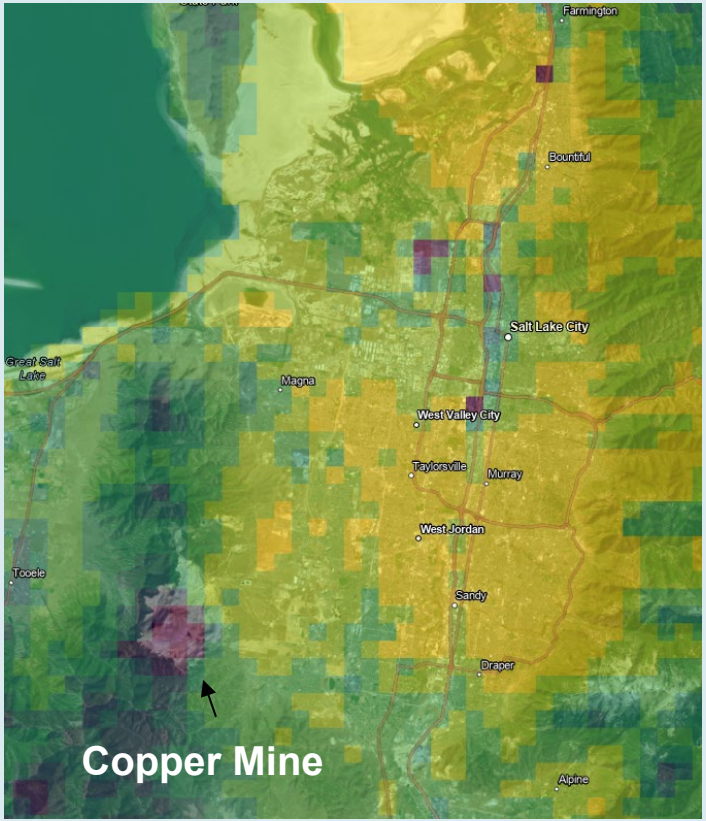

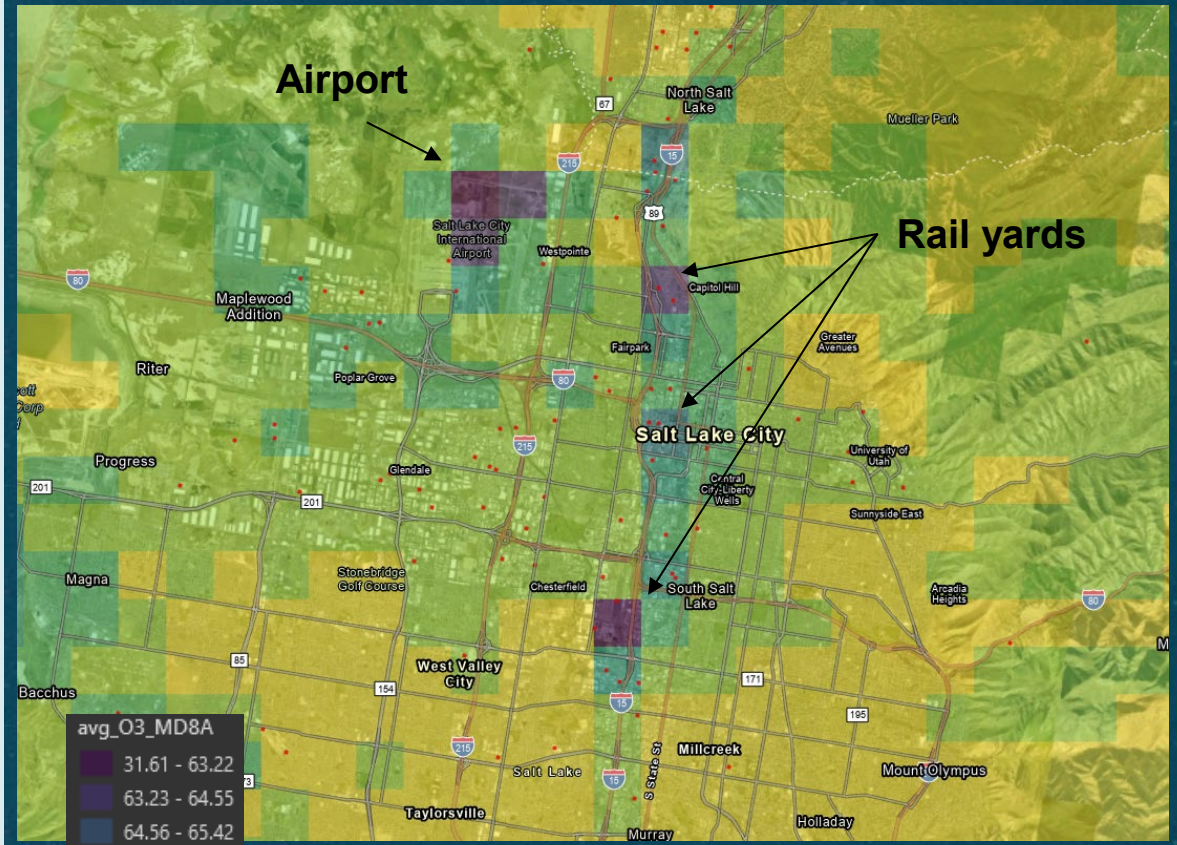

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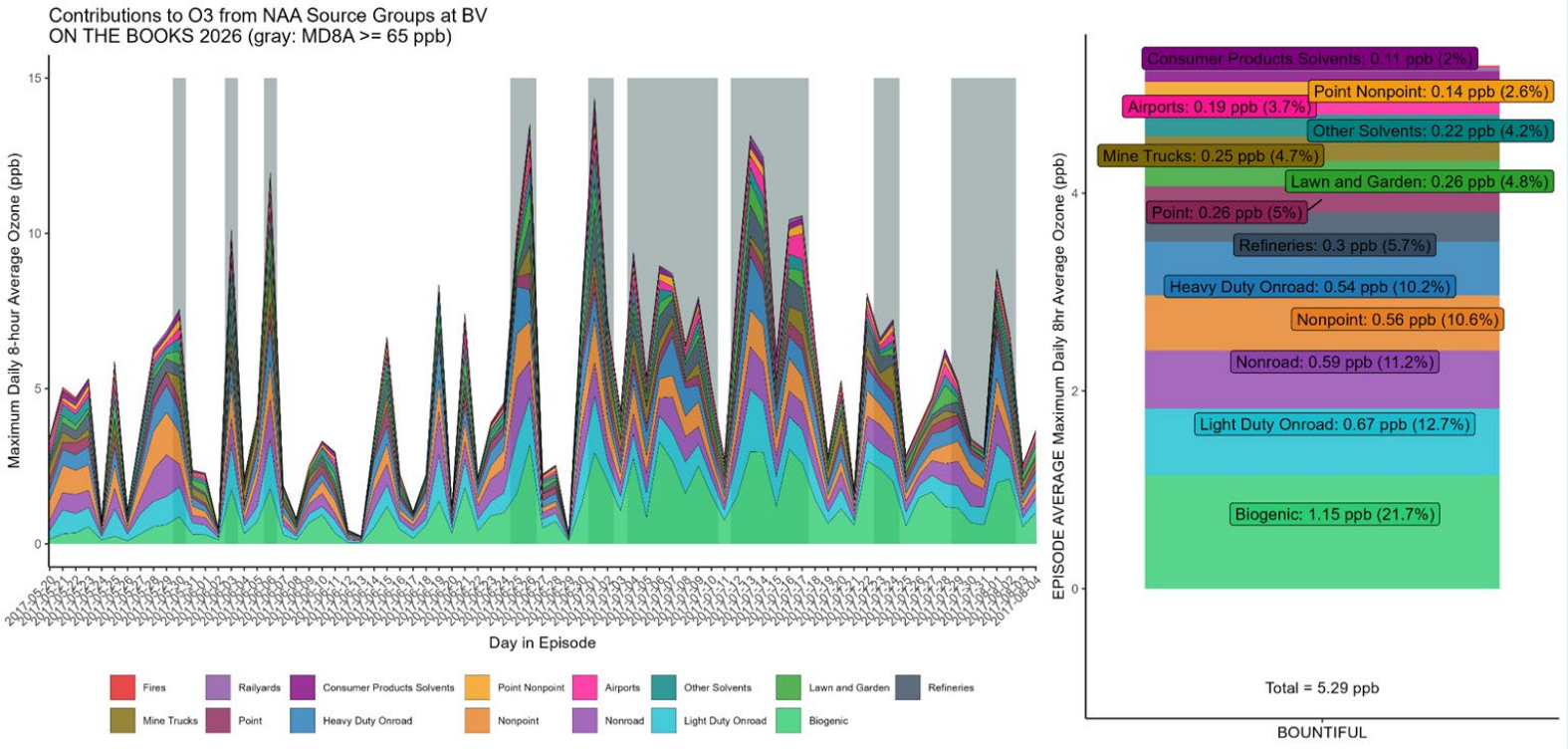
Local Ozone Source Contributions



Ozone Source Contributions