Dimensions, Uncertainties, and Impacts of Emissions in the Western U.S.

April 14, 2015

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WESTAR Council

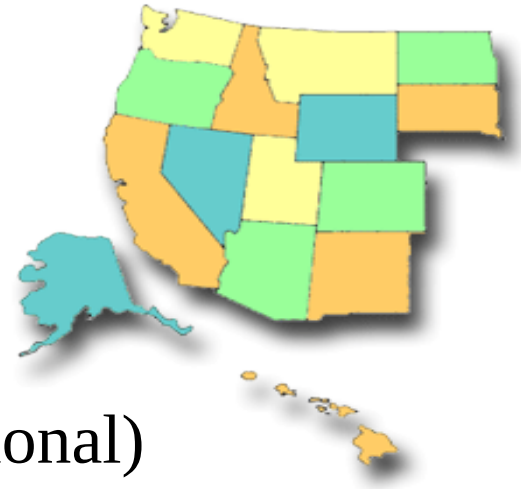
EPA 2015 International Emission Inventory Conference
"Air Quality Challenges: Tackling the Changing Face of Emissions"

Topics

- Overview of the WESTAR/WRAP organization
- Key issues and areas of focus
- Selected results from projects and studies related to this Conference

Overview of WESTAR and WRAP

- Purpose
  - Service organizations
  - Assist members in achieving their air quality management goals
- WESTAR
  - Training
  - Provide a forum for discussion
  - Inform policy-related discussions
  - www.westar.org

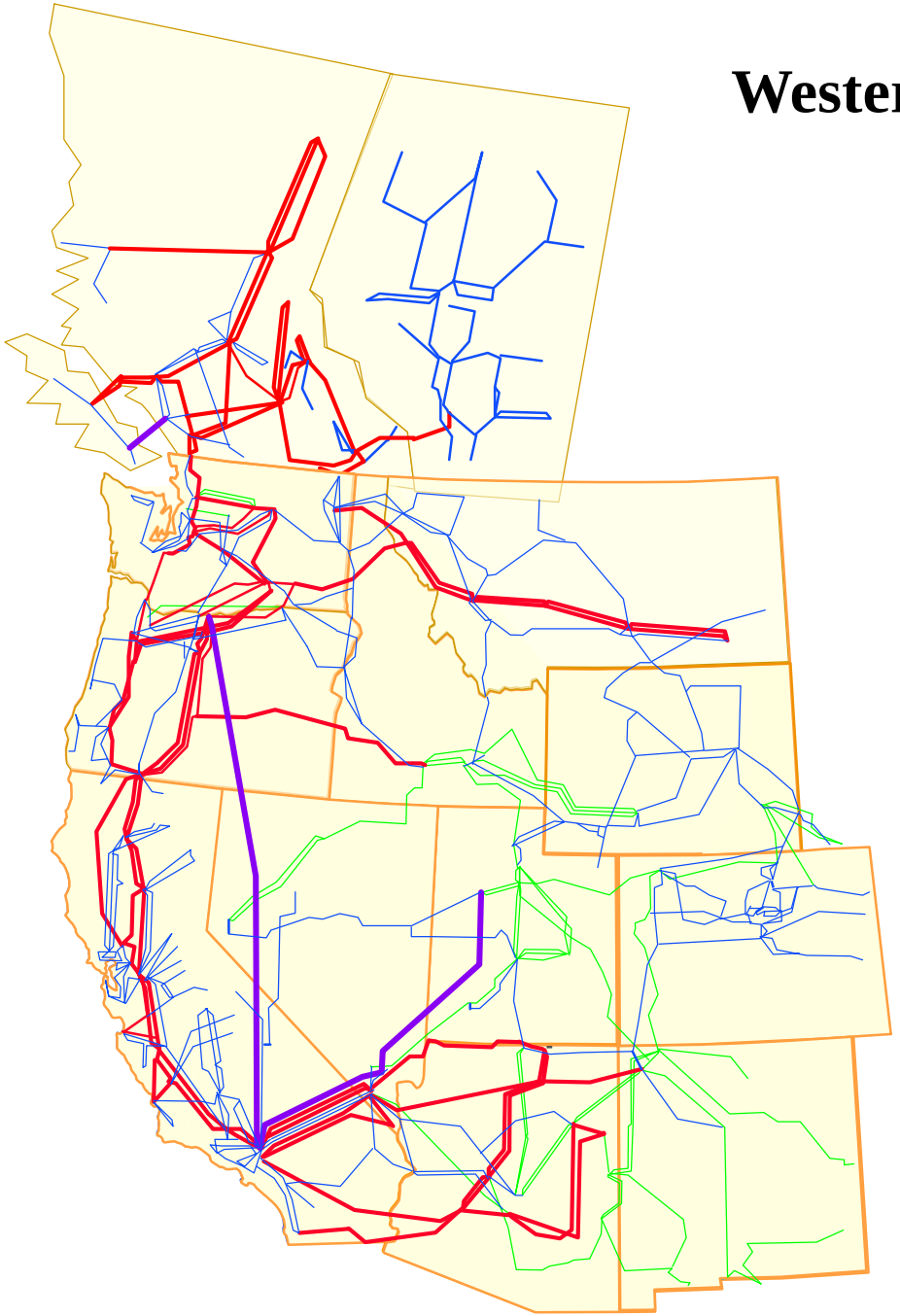


- WRAP - provides technical support (esp. regional)
  - Virtual organization, not incorporated
  - 65+ member agencies include 15 state air agencies, NPS, FWS, BLM, USFS, EPA, and interested tribes and local air agencies/districts in the WRAP region
  - Board has representatives across states, tribes, federal, and local agencies
  - www.wrapair2.org

WRAP current projects and priorities

- precursors to Ozone, Particulates, and Regional Haze - key western sources
  - **Power plants**
  - Mobile sources
  - **Fire activity and effects**
  - Biogenics (natural) emissions
  - **Oil and gas exploration and production**
  - All sources studied in comprehensive regional modeling analyses
    - West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS)
    - Western Air Quality Data Warehouse (WAQDW)

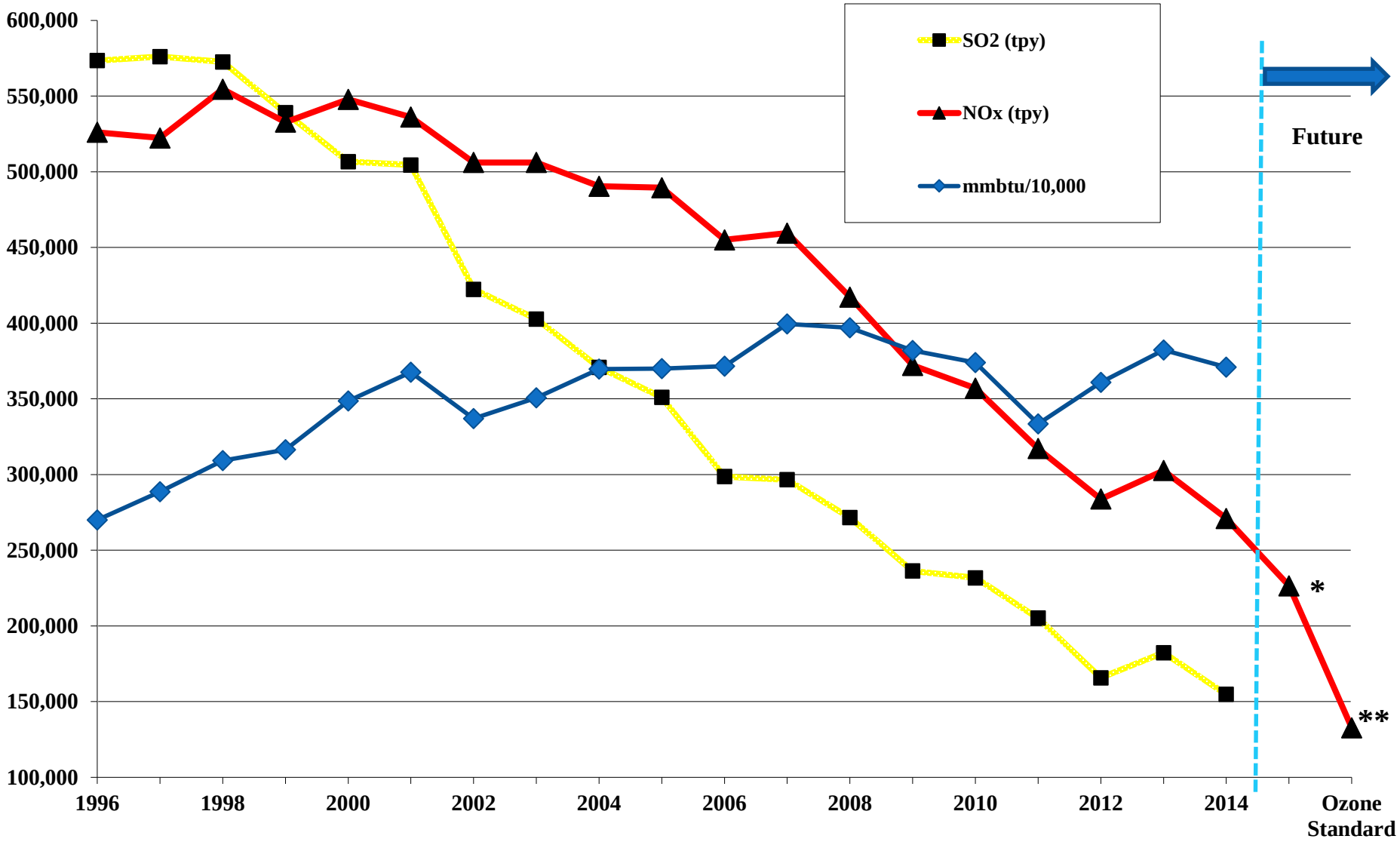
Western Electrical Interconnect



WECC
Existing Transmission System

	230 kV HVAC
	345 kV HVAC
	500 kV HVAC
	± 500 kV HVDC

Western Interconnect Fossil Fuel Power Plant Emissions



1996 through 2014 data from EPA data for fossil fuel-fired electrical generating units in the 11-state Western Interconnect

* Additional NOx reductions estimate - BART controls from Regional Haze baseline planning

** Further NOx reductions from applying maximum post-combustion controls to all remaining units

Fire

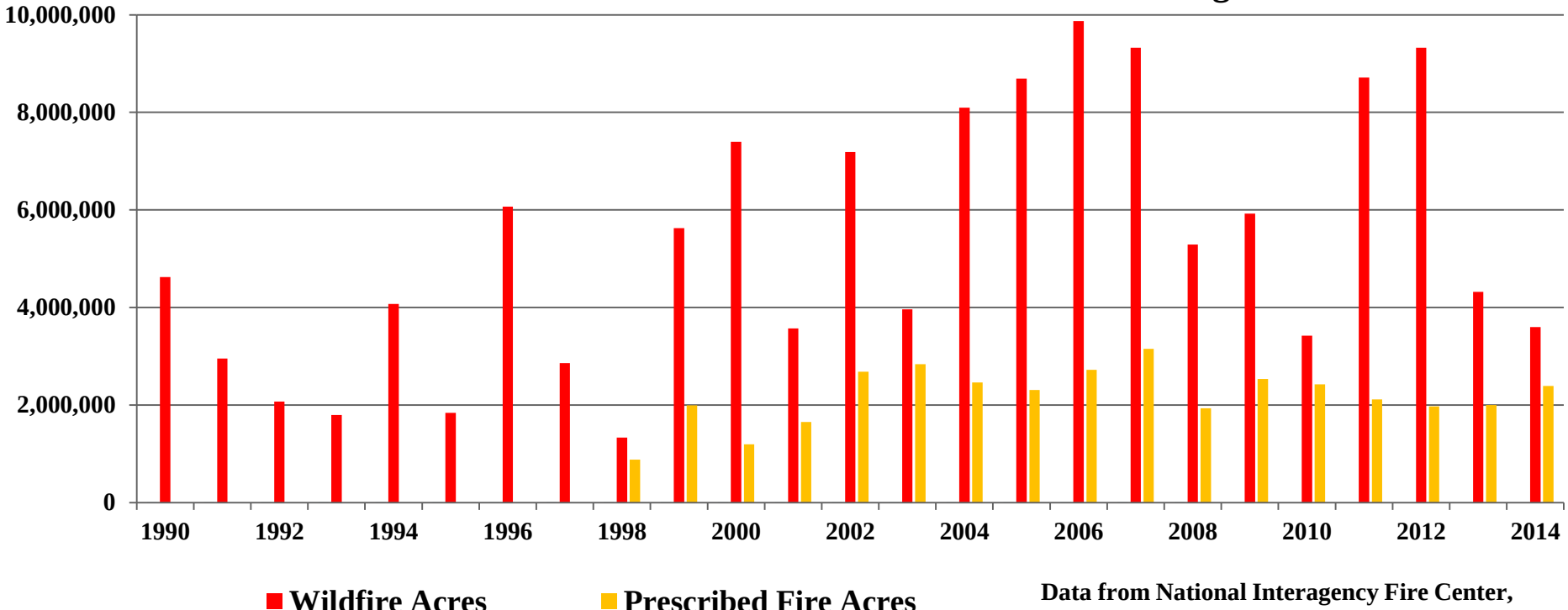
The Big Picture

Smoke/Fire & the Ozone and PM NAAQS, Regional Haze Rule

Technical Products for air quality planning & management as required by the Clean Air Act

Future emissions, efforts to avert emissions & health/visibility impacts, & adapt to a changing/varying climate

U.S. Wildfire and Prescribed Fires Acres Burned - 1990 through 2014

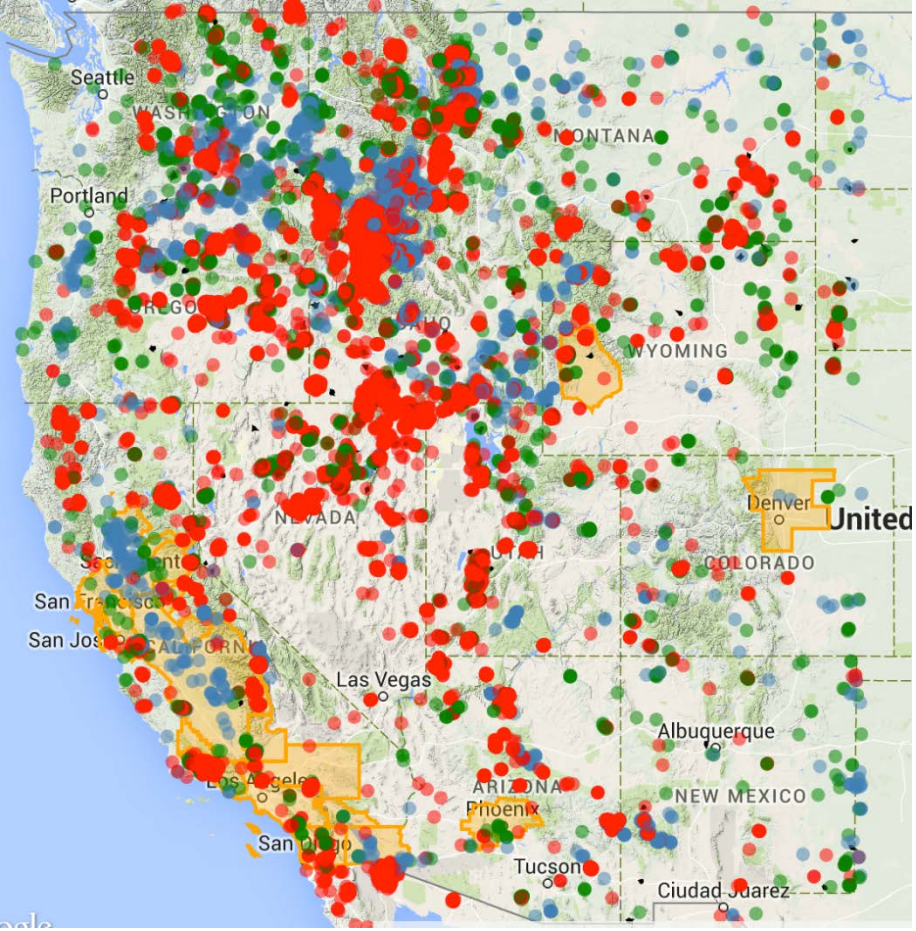


Data from National Interagency Fire Center, no prescribed fire data before 1998

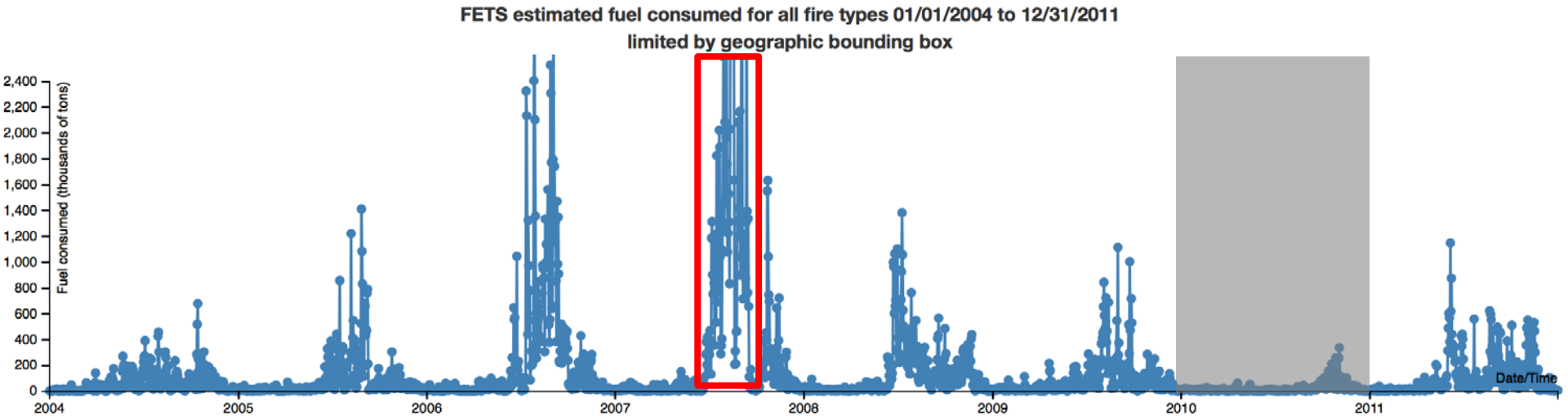
2007

6/21 – 9/21
Limited by bounding box

Source: WRAP Fire Tools



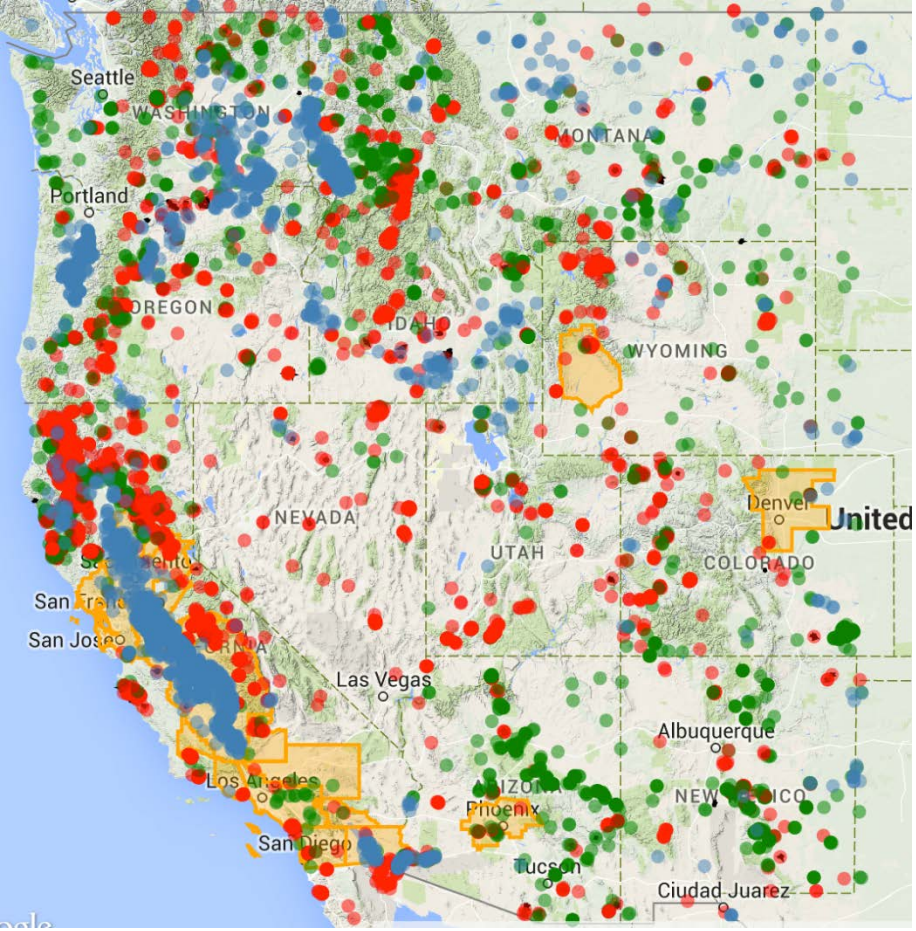
Agriculture
Prescribed
Wildfires



2008

6/21 – 9/21
Limited by bounding box

Source: WRAP Fire Tools



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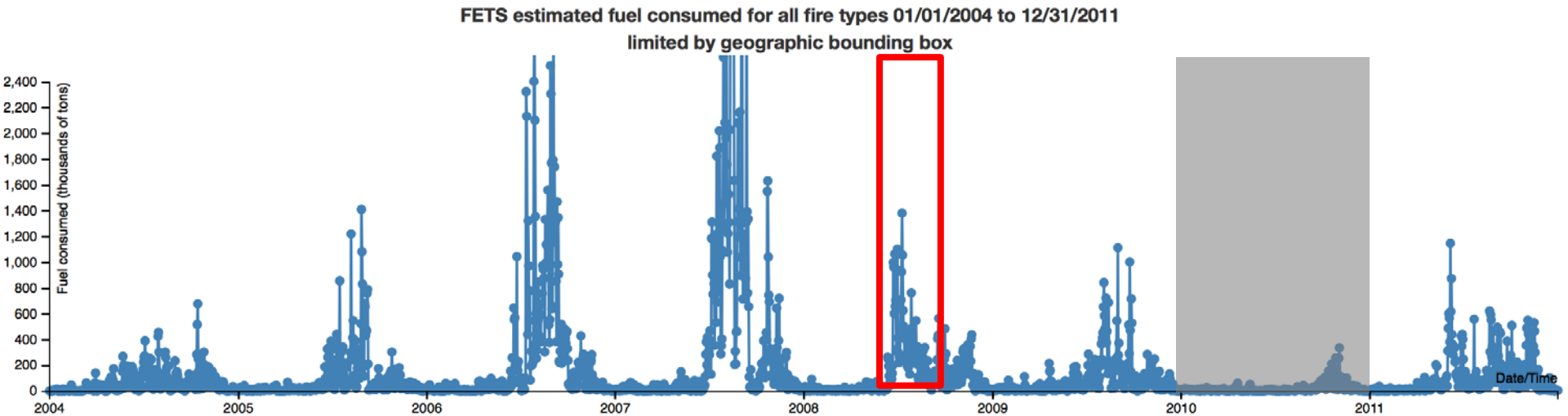
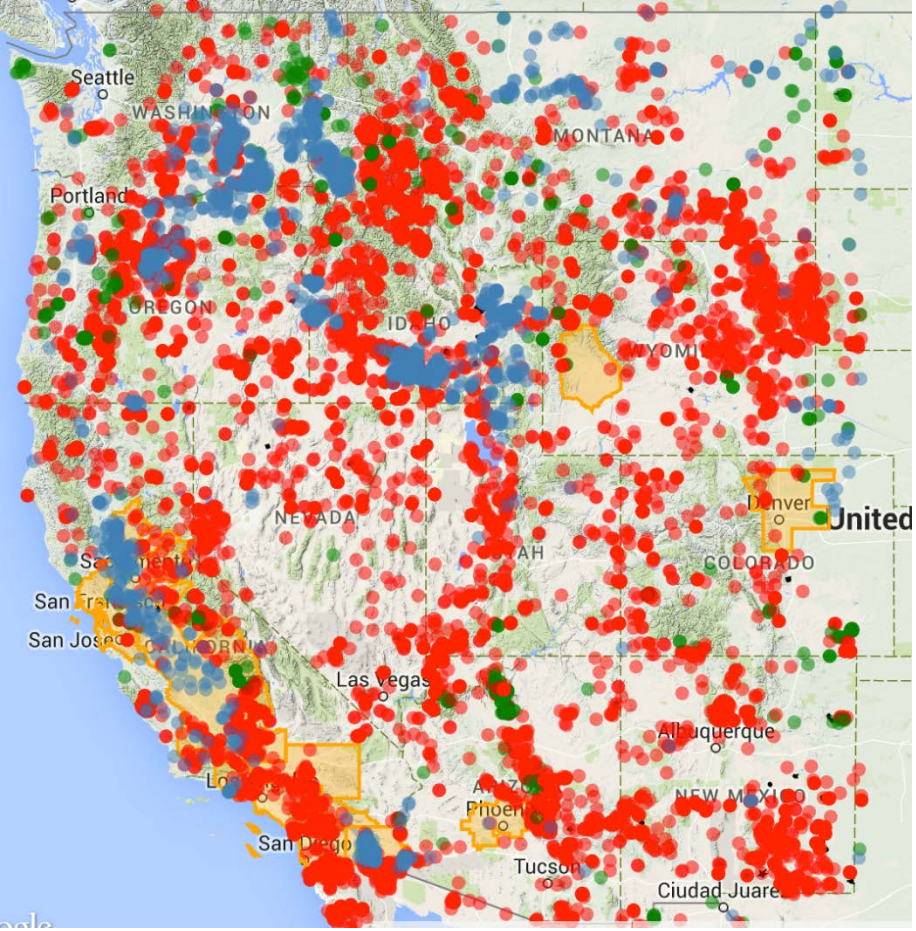




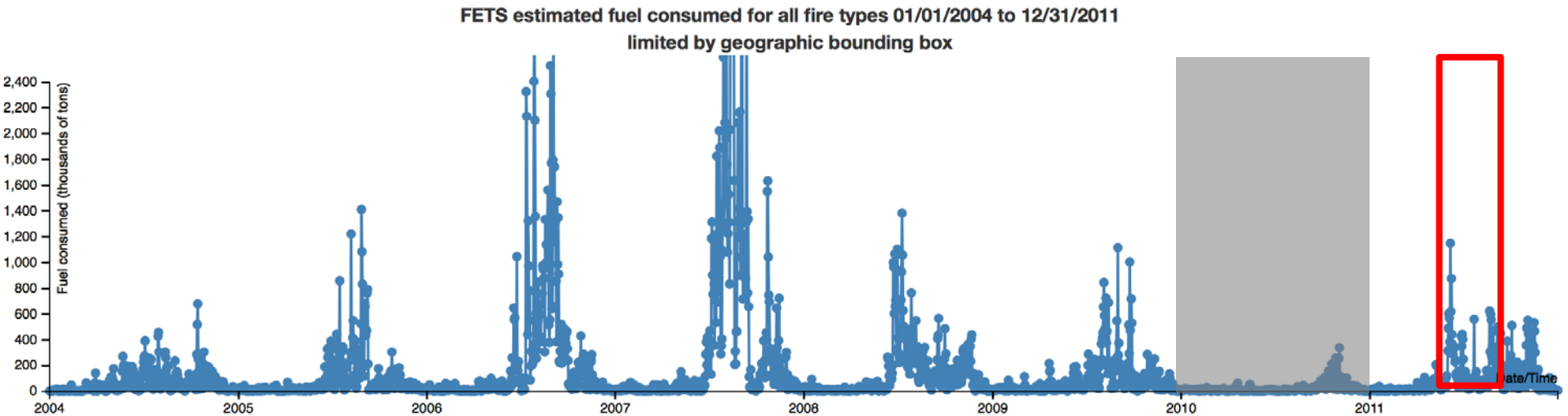
2011

6/21 – 9/21
Limited by bounding box

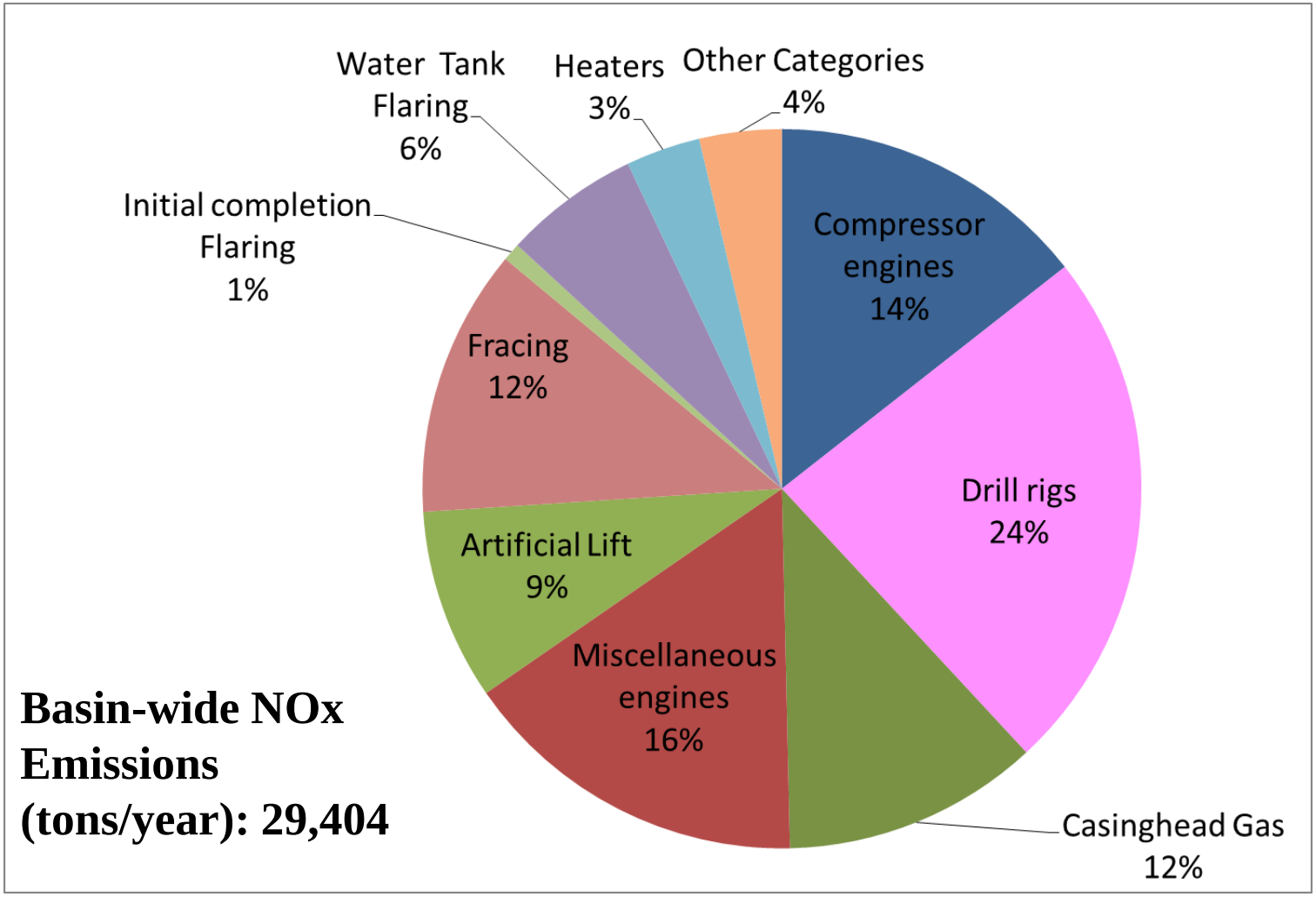
*Obtained additional small wildfire data for this inventory

Source: WRAP Fire Tools

Agriculture
Prescribed
Wildfires

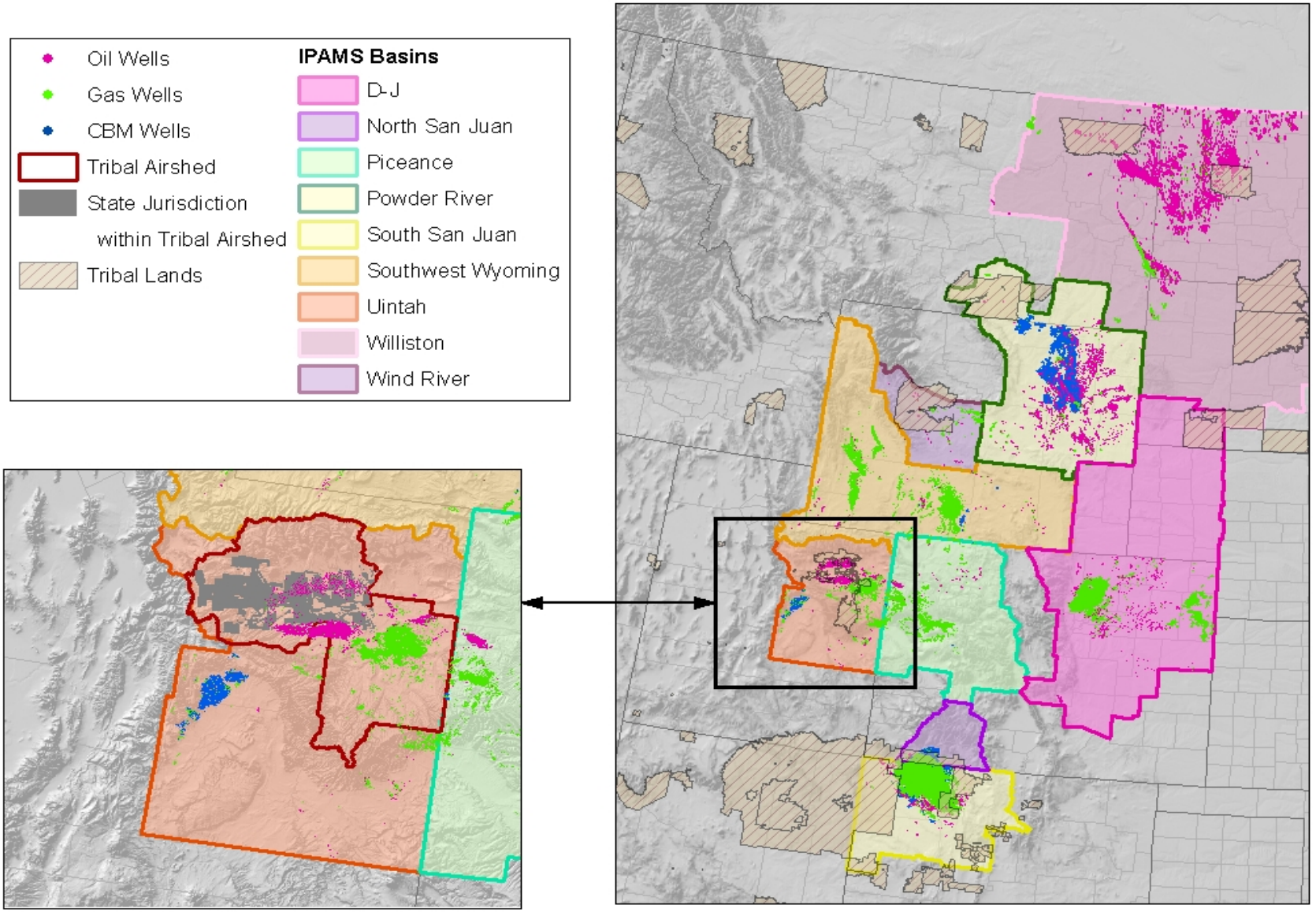


Example Oil & Gas Study: Williston Basin 2011 Baseline Results NOx Emissions By Source Category

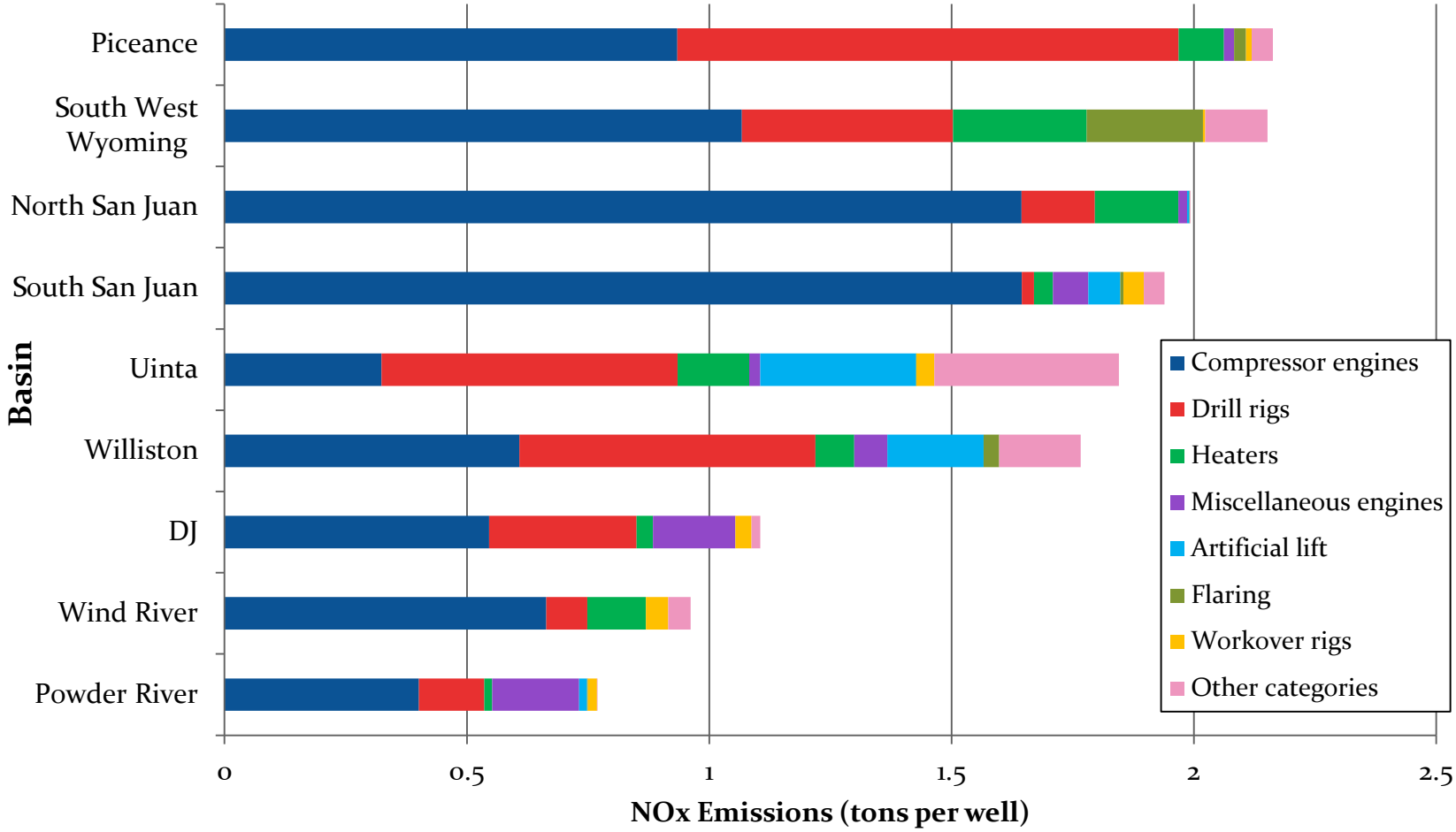


Source: BLM/WRAP Oil and Gas Inventory project

Geographic Extent

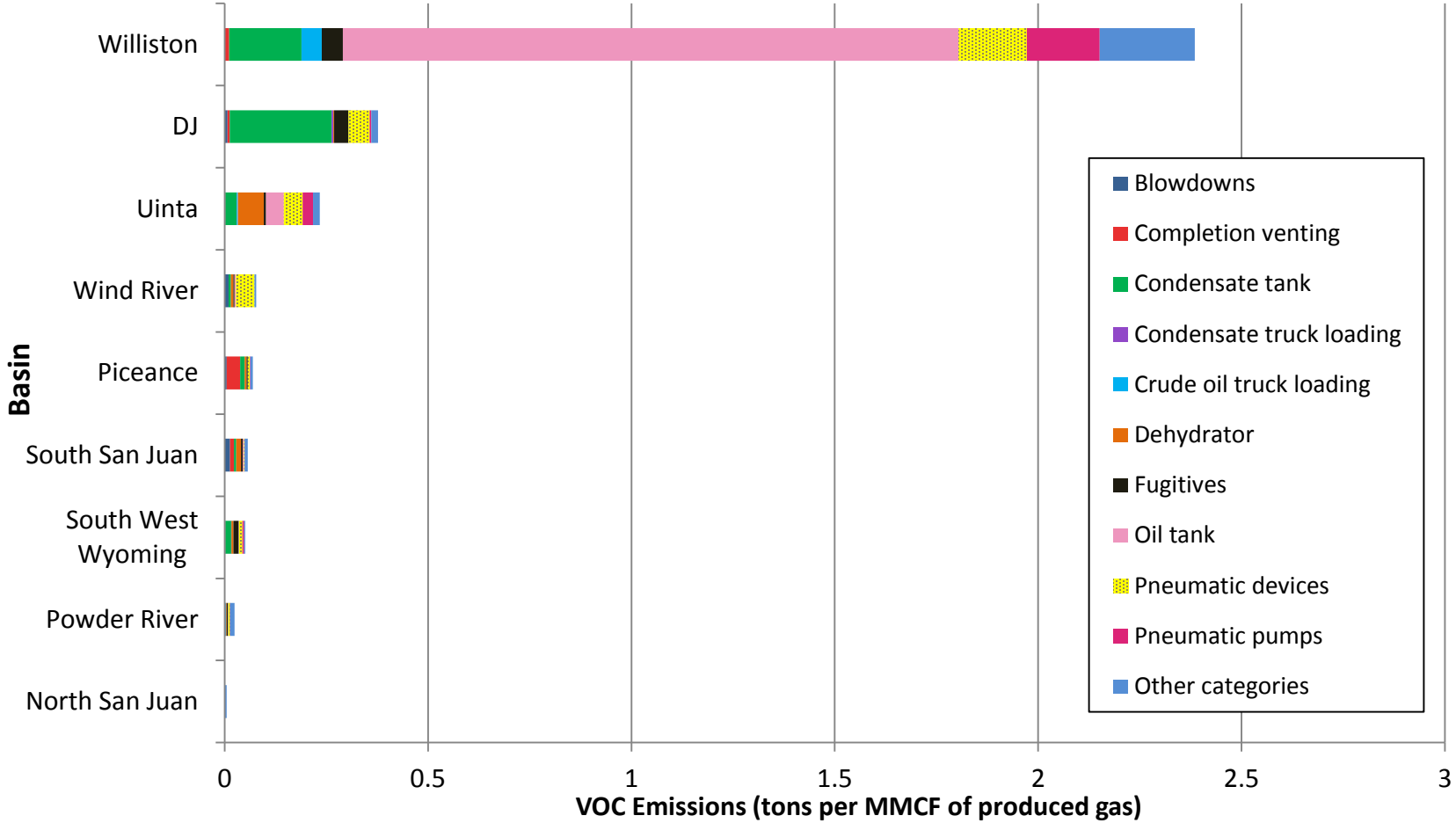


Cross-Basin – Per-Well NOx Emissions



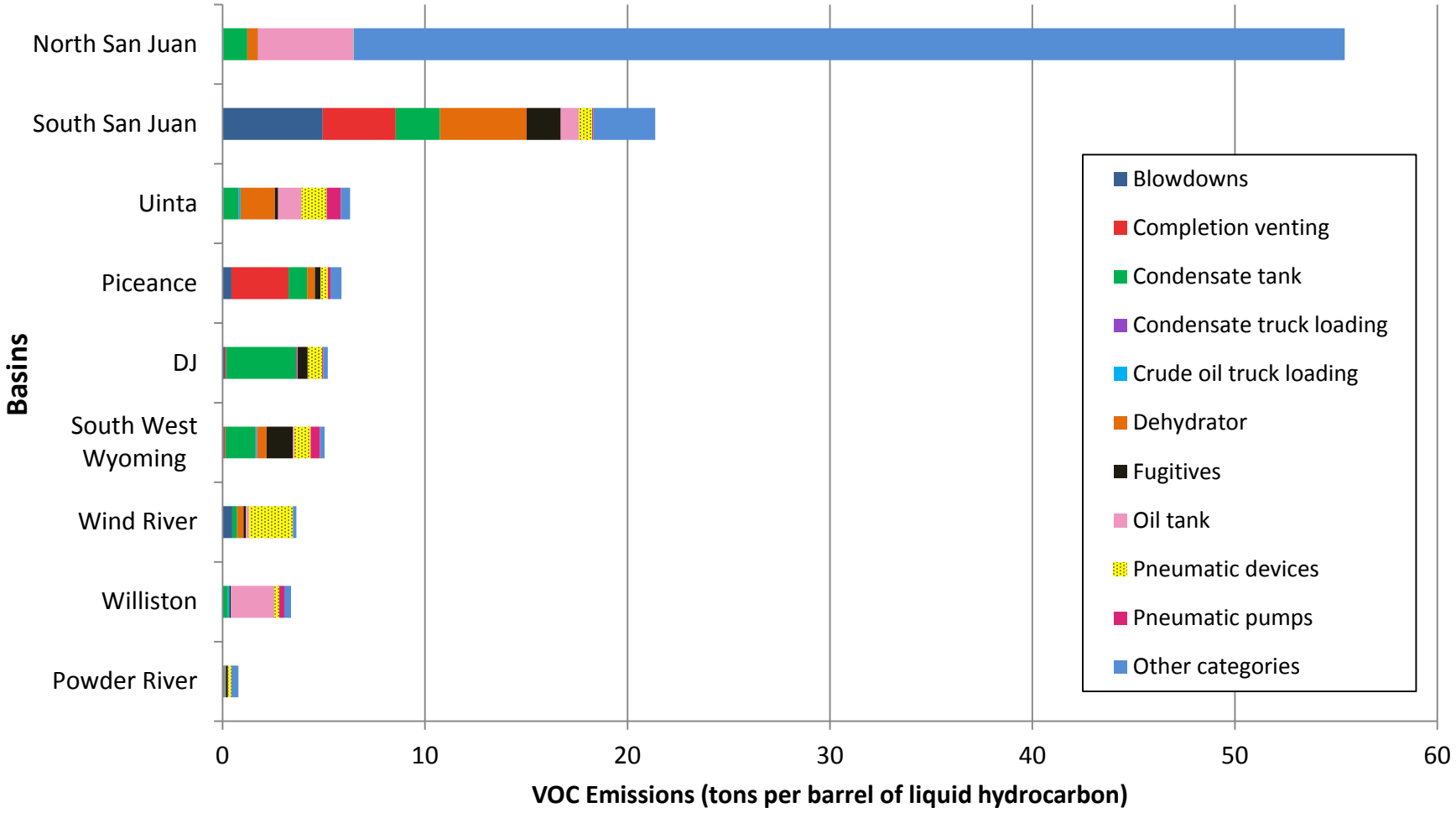
Per well NOx emissions relatively consistent across basins – differences mainly due to usage of compression and centralized vs. wellhead compression

Cross-Basin – Per-Unit-Gas-Production VOC Emissions



Per unit gas production VOC emissions vary widely across basins – differences due to levels of liquid hydrocarbon production (oil and condensate) and VOC content of produced gas

Cross-Basin – Per-Unit-Liquid-Production VOC Emissions

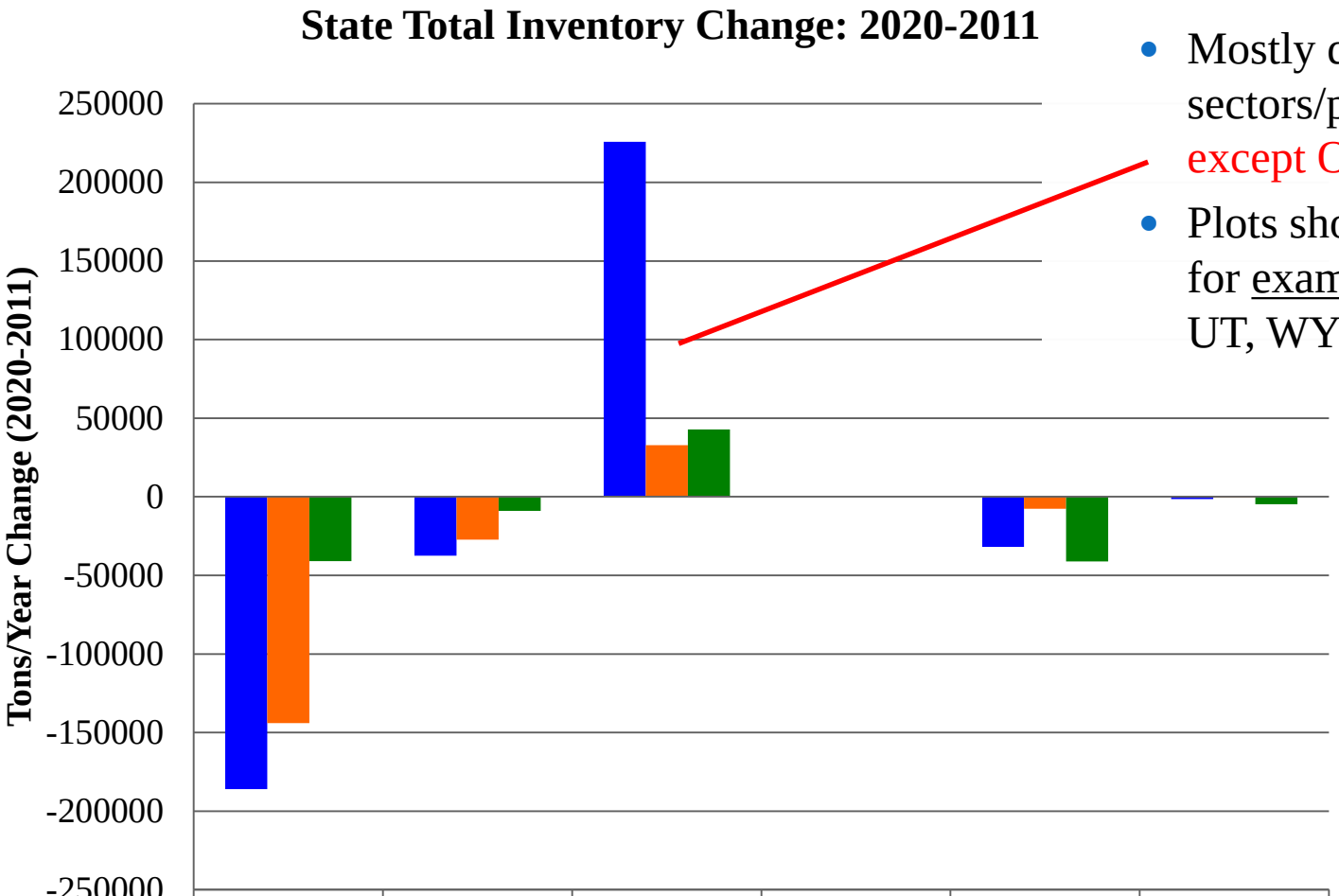


Per unit gas production VOC emissions vary widely across basins – differences due to levels of liquid hydrocarbon production (oil and condensate) and VOC content of produced gas

Oil & Gas Projections - Methodology

- No standardized methodology for conducting projections
  - Each inventory study has used different approaches (EPA methods, Resource Management Plans, NEPA air quality projects, Western States Air Quality Modeling Study regional inventories)
- WRAP O&G inventories have used a three-step approach:
  1. Activity scaling factors
  2. “Uncontrolled” projections
  3. State and federal regulatory control requirements
- Activity scaling requires input from operators on planned activities, and/or analyzes trends, and/or relies on industry studies
- State and federal regulatory control requirements complex and continuing to evolve
  - National rules focused on new sources

Trends in projected emissions - example



	CO	NOX	VOC	NH3	SO2	PM2_5
Colorado	-185992	-37563	225853	51	-31871	-1379
Utah	-144069	-27324	32826	312	-7625	-313
Wyoming	-40936	-8922	42778	443	-41052	-4820

- Mostly decreases for all sectors/pollutants/states except O&G VOCs
- Plots show differences for example states (CO, UT, WY)

Source: Western Air Quality Data Warehouse

What are (some of) the sources and control issues in the West related to a new Ozone standard?

- Urban and rural reactivity
- Transport and formation – how much / how important?
- Public lands with large biogenic emissions and fire activity
  - How to characterize for effects of drought and climate variation ?
- Federal and state mobile fuel and tailpipe controls
- Upstream Gas NSPS rules in place in 2015
  - Industry practices changing rapidly, e.g., green completions
- Point sources (dominated by EGUs for SO_2, NO_x)
  - Significant NO_x BART by ~2018
  - Less coal-fired electricity supply due to Clean Power Plan?
  - 17+ million acres of public lands leased in last 5 years for O&G exploration and production

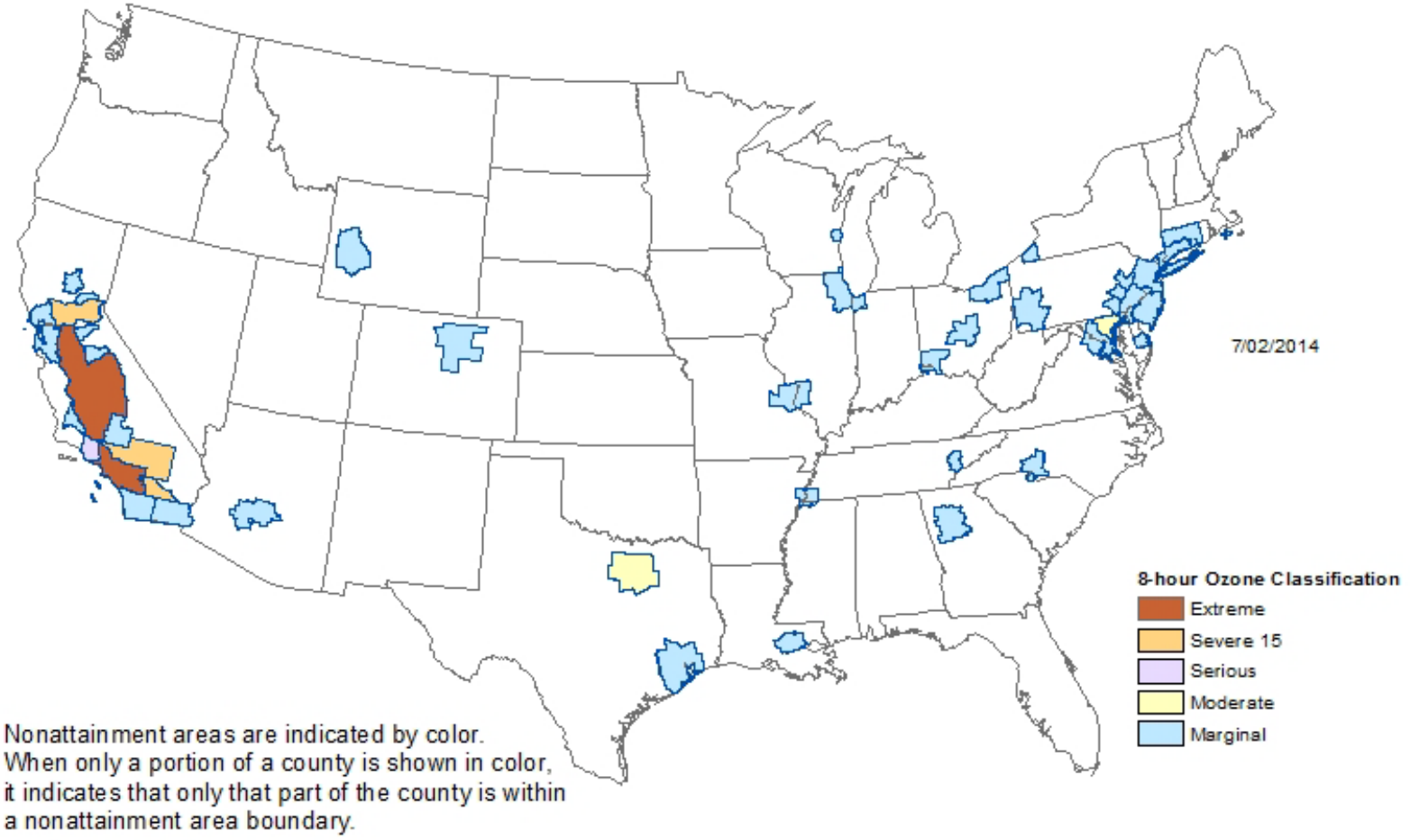
Numerous sources within and outside the U.S. will continue to contribute to air quality impacts across the West

Some are further controllable

Others are less controllable, quasi-natural, and/or less well-understood - these may grow and/or vary significantly within the CAA planning timeframes

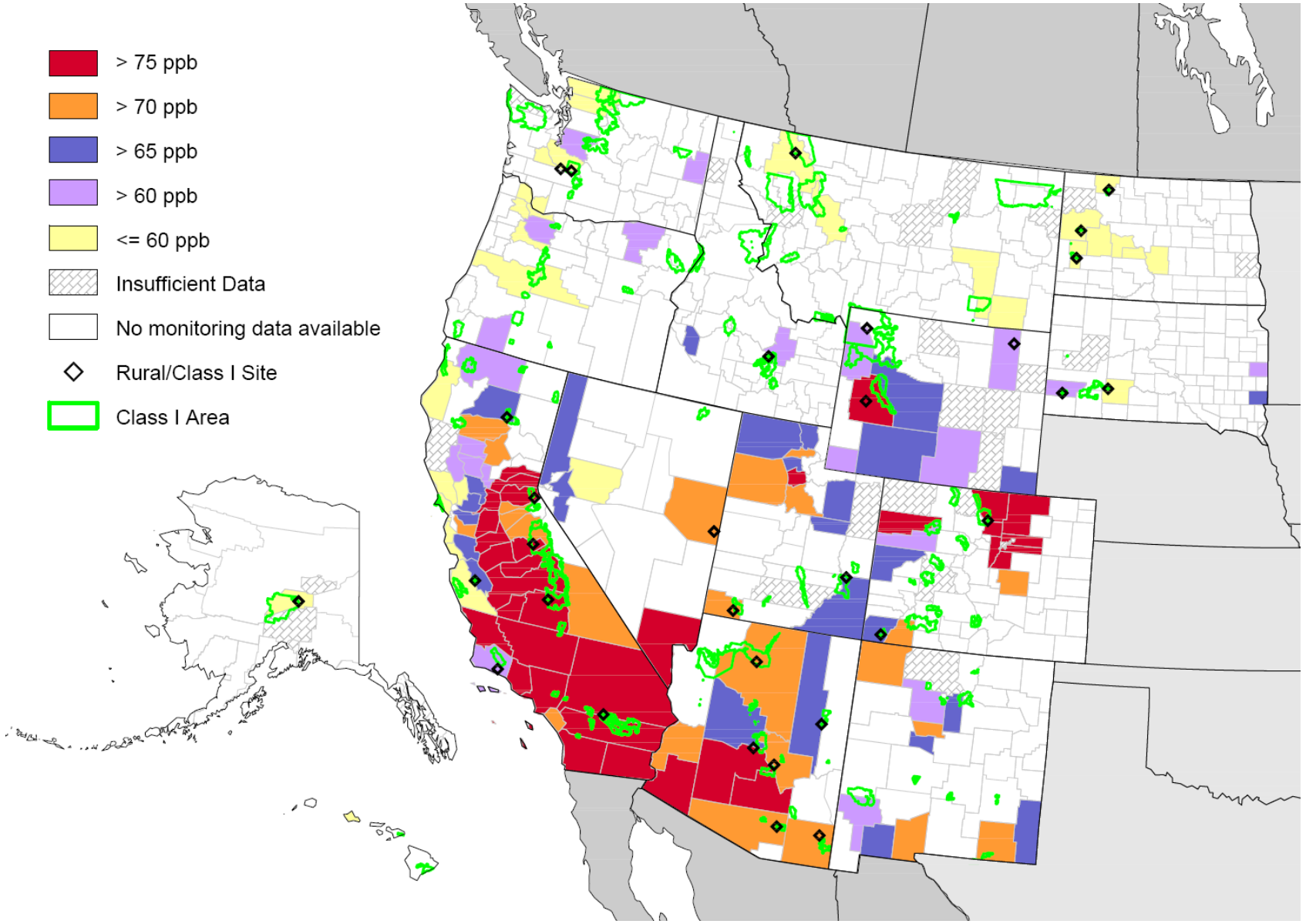
Counties with Monitors Violating Primary 8-Hour Ground-Level Ozone Standard (0.075 ppb)

(Based on 2011-2013 Air Quality Data)



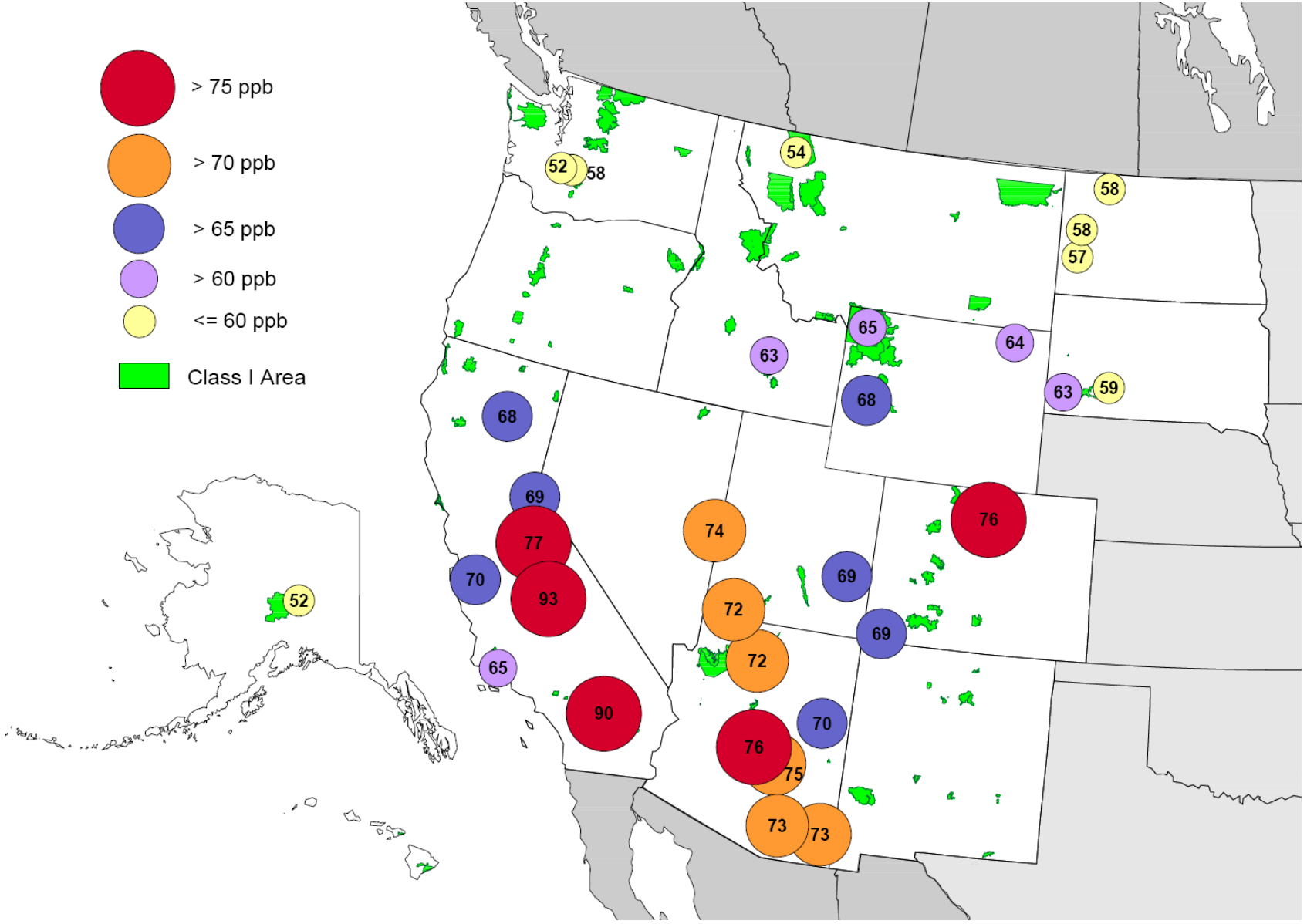
http://www.epa.gov/airquality/greenbook/map8hr_2008.html

3-year Average 4th Highest 8-Hour Ozone value by County 2011-2013



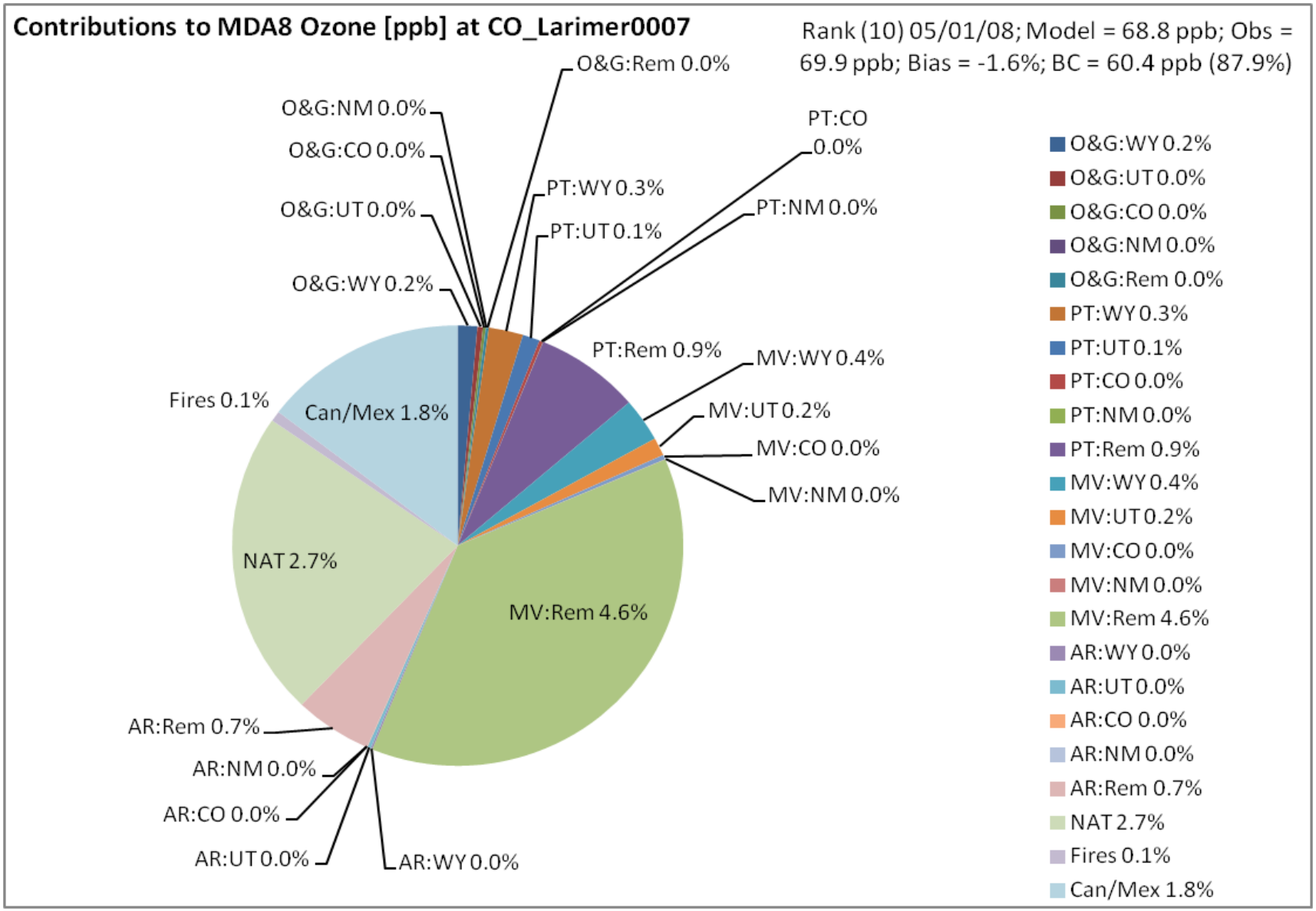
AQS Federal Reference Method data from the monitoring site in each County with the highest Ozone values

3-year Average 4th Highest 8-Hour Ozone value for Rural/Class I Sites 2011-2013



AQS Federal Reference Method data from rural or Class I area monitoring sites

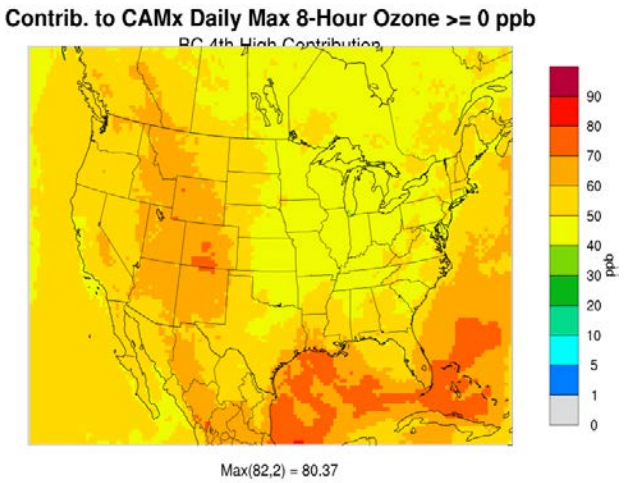
Contributions to Ozone at Rocky Mountain National Park



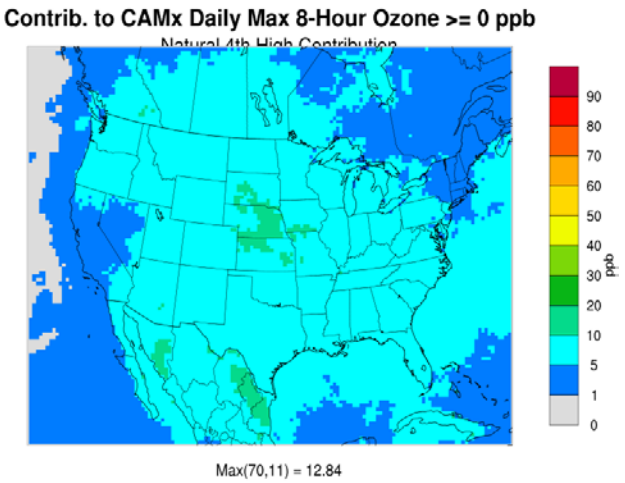
Source: WestJumpAQMS

“Other Sources” Max Contrib. 4th High DMAX8 Ozone

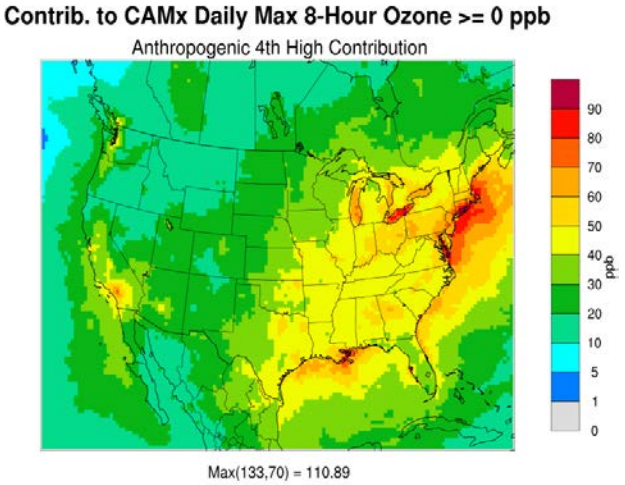
Boundary Conditions

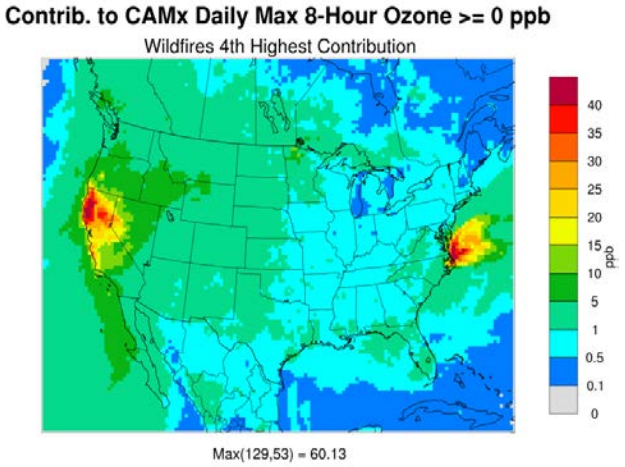


Natural

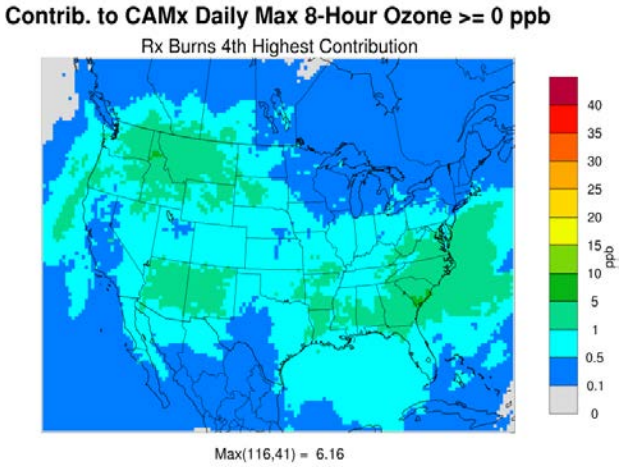


Anthropogenic

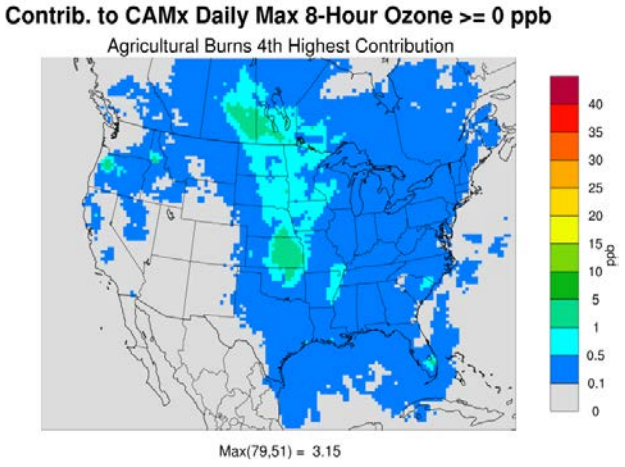




Wildfire



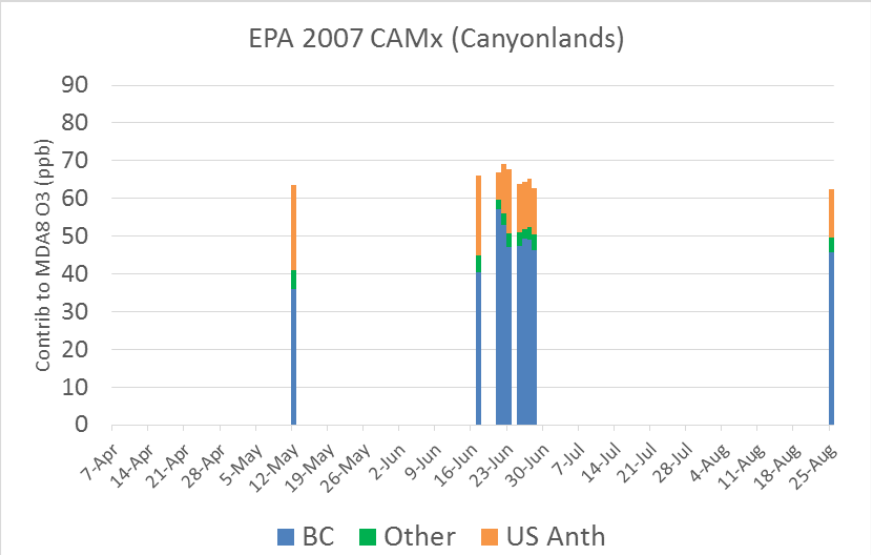
Prescribed Fire

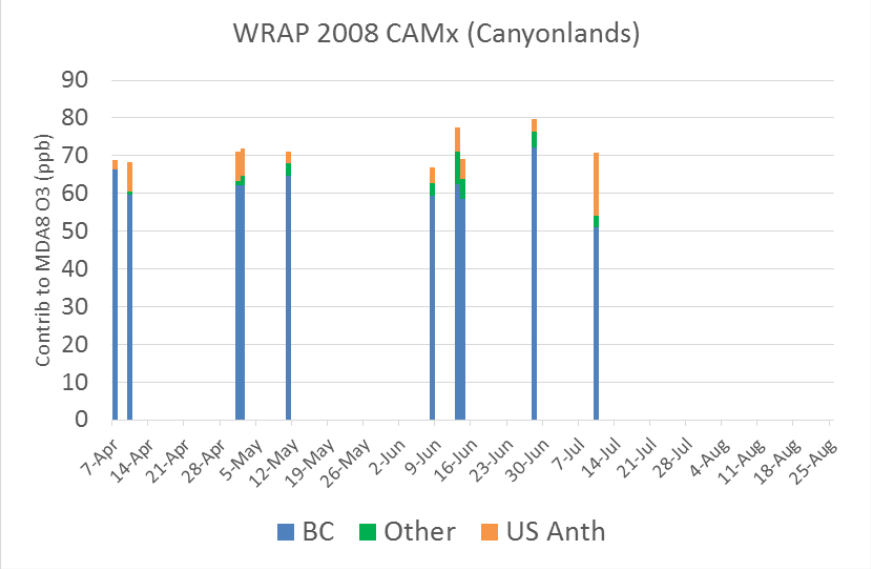


Agricultural Fire

Uncertainty in model estimates of U.S. Background

CAMx simulations for 2007 and 2008 at Canyonlands National Park – Eastern UT





EPA 2007 CAMx model:
BC contributions of 36-57 ppb; still substantial U.S. anthropogenic contribution to O3.

WRAP 2008 CAMx model:
BC contributions of 50-72 ppb, much larger than OAQPS modeling.

Same methodology - reasons for modeled differences are not fully understood

Meetings and Workshops

San Joaquin Valley Unified Air Pollution Control District – *Transboundary Ozone Pollution Conference* – March 31-April 2, Tenaya Lodge, Yosemite National Park

EPA *Emission Inventory Conference* – April 13-16, San Diego

WRAP-EPA *Modeling Air Quality from the Global to Local Scale* Workshop – May 11-15, Boulder, CO

Thanks –

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