Western Regional Technical Analysis for Ozone Standard Planning

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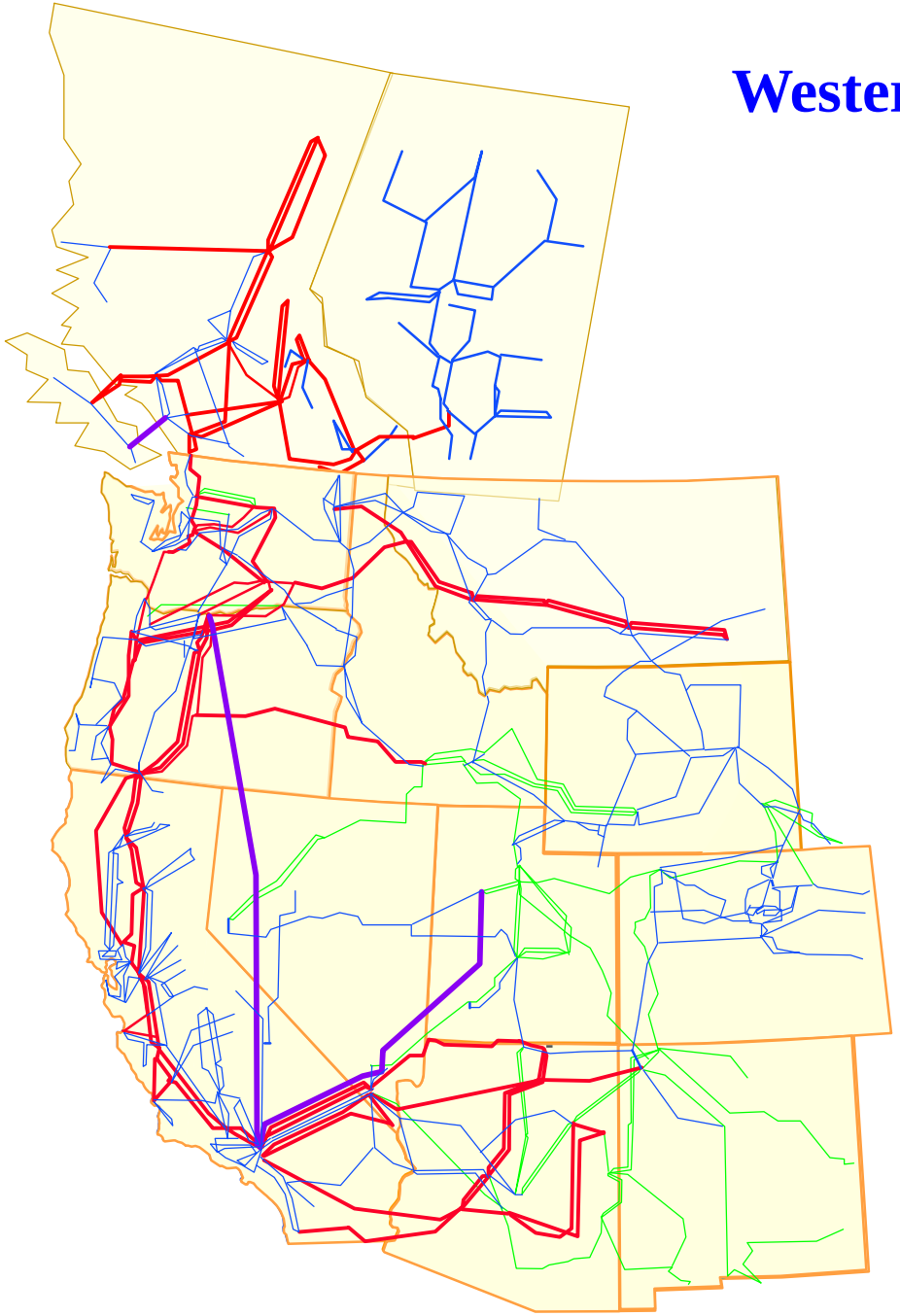
WESTERN REGIONAL AIR PARTNERSHIP

WESTAR
Western States Air Resources Council

Topics

- selected Western sources
- what the monitoring data are telling us
- interpreting modeling results for ozone planning analysis

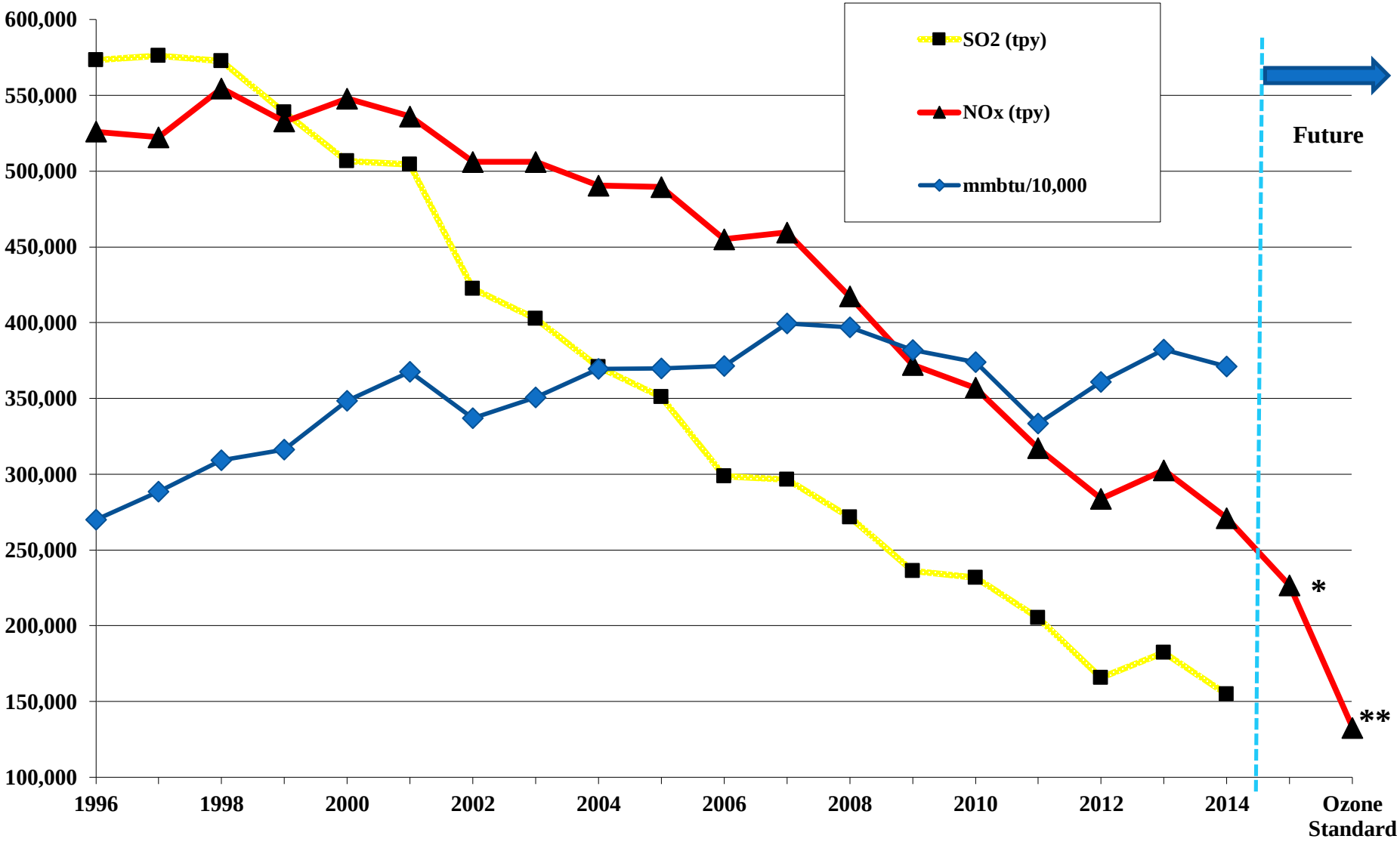
Western Electrical Interconnect



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

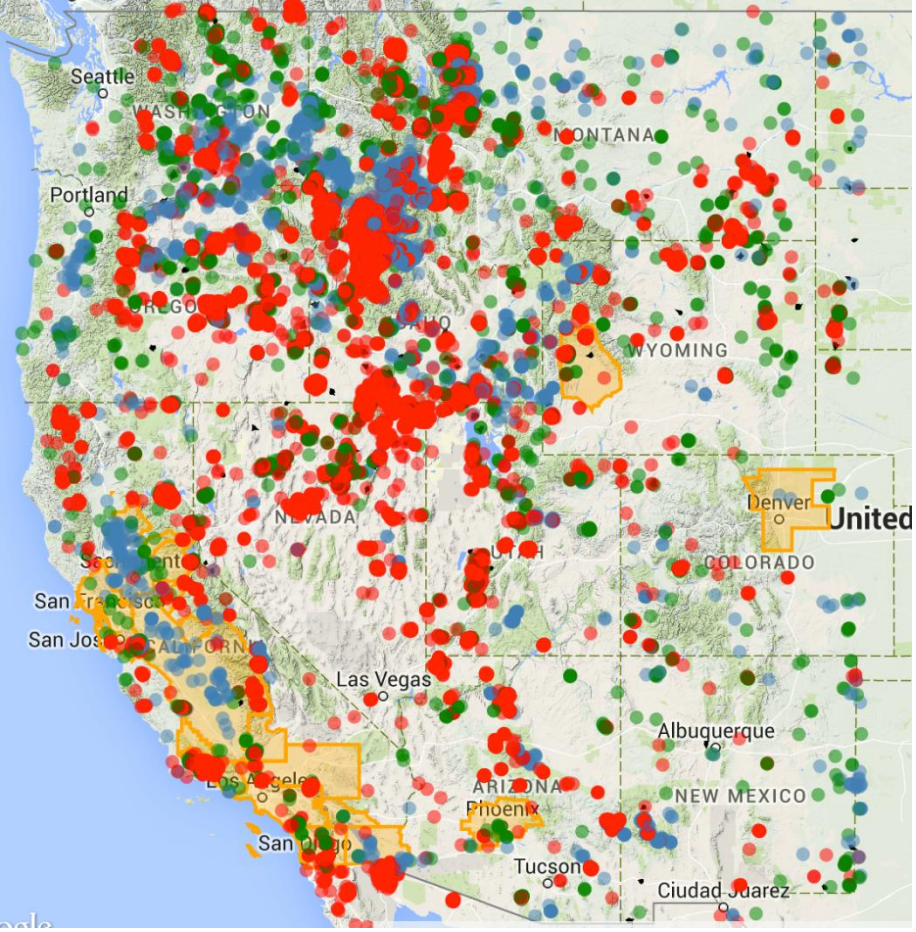
* Additional NOx reductions estimate - BART controls from Regional Haze baseline planning

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

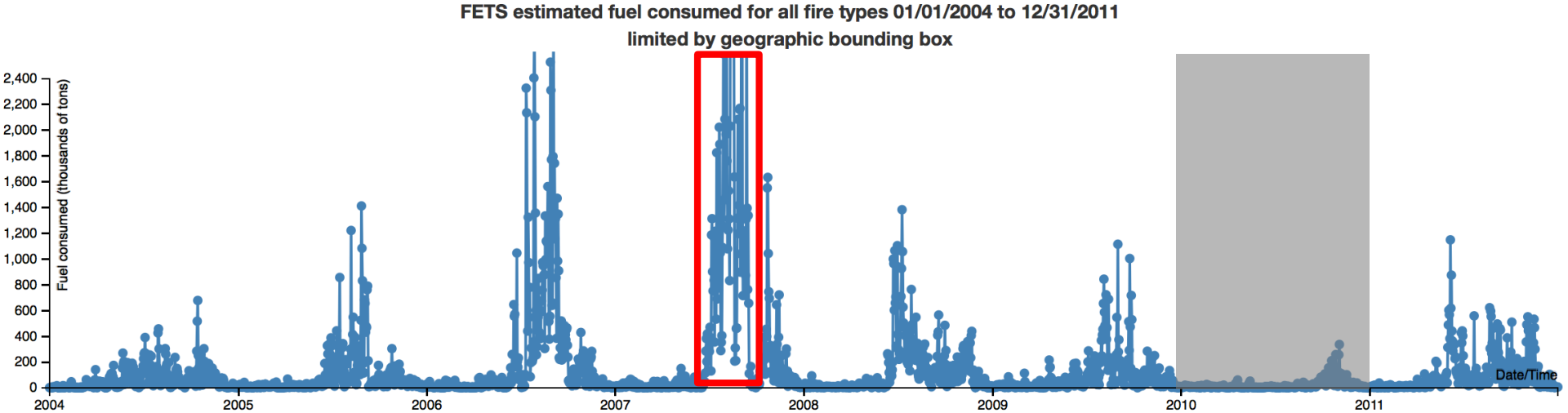
2007

6/21 – 9/21
Limited by bounding box

Source: WRAP Fire Tools



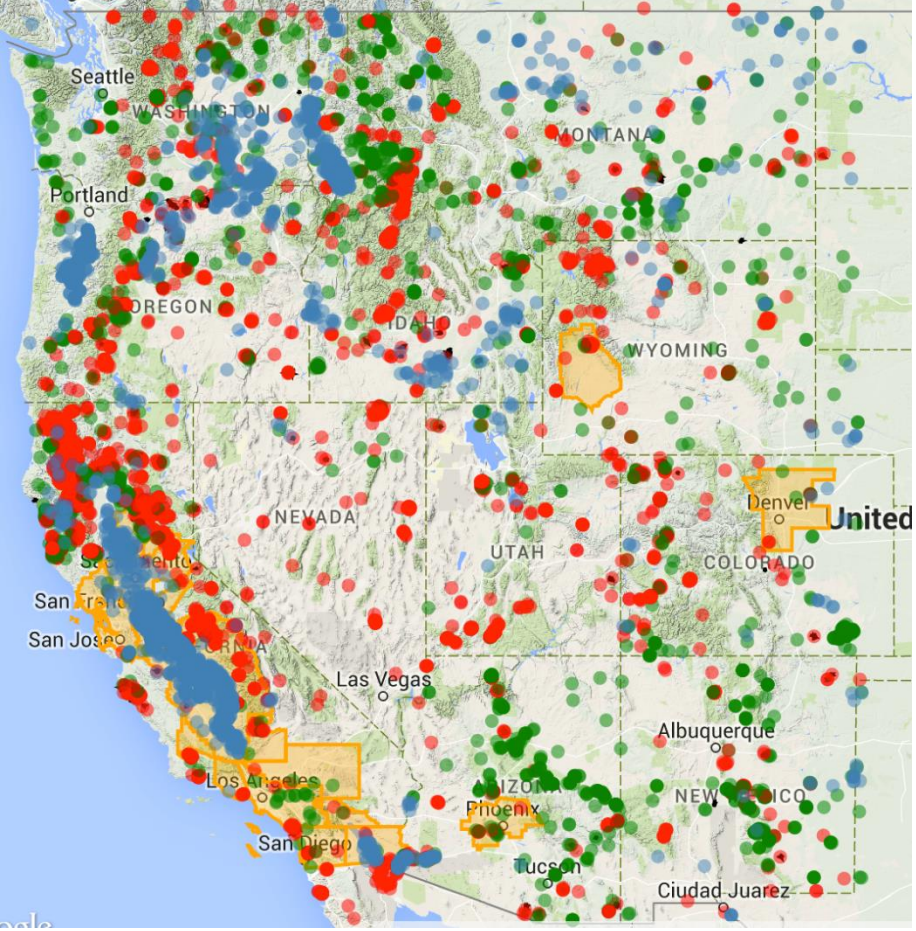
Agriculture
Prescribed
Wildfires



2008

6/21 – 9/21
Limited by bounding box

Source: WRAP Fire Tools



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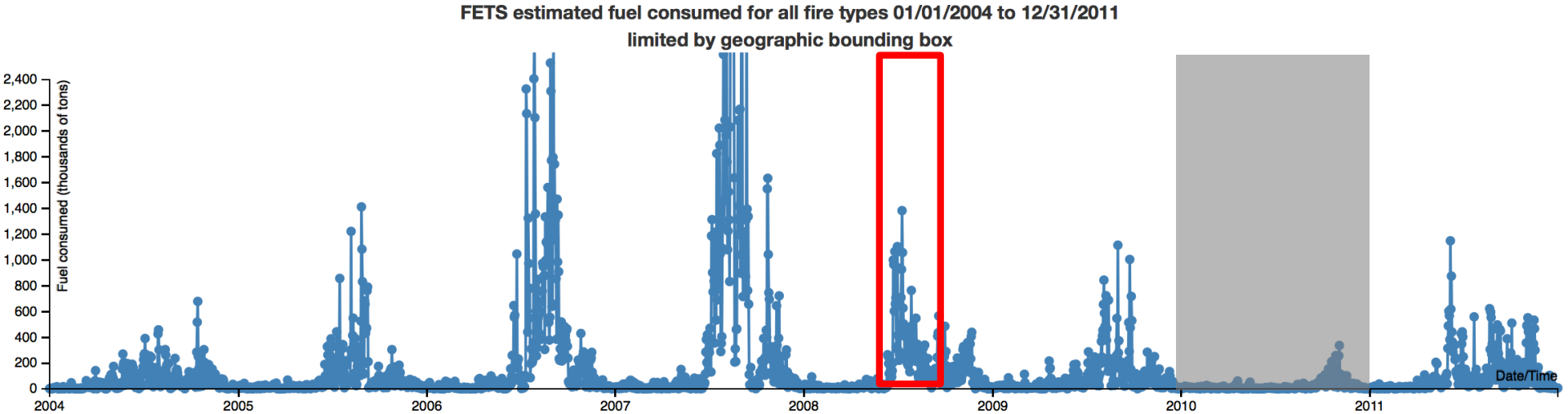
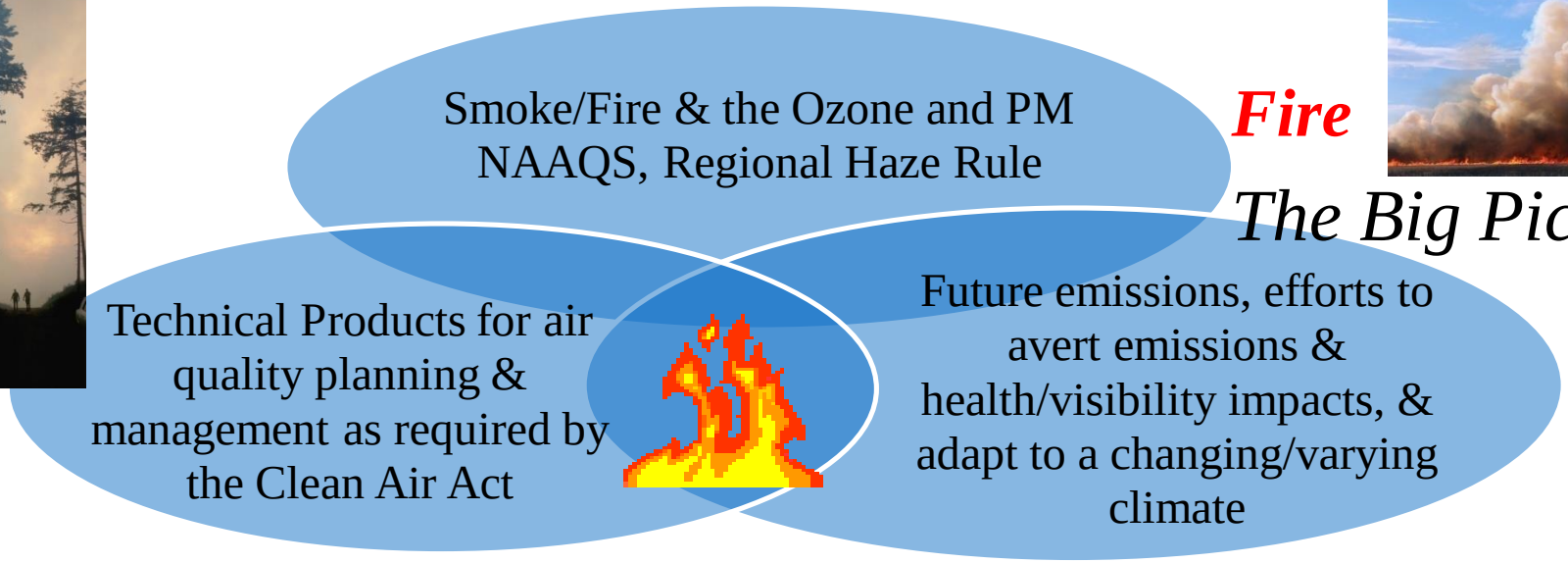
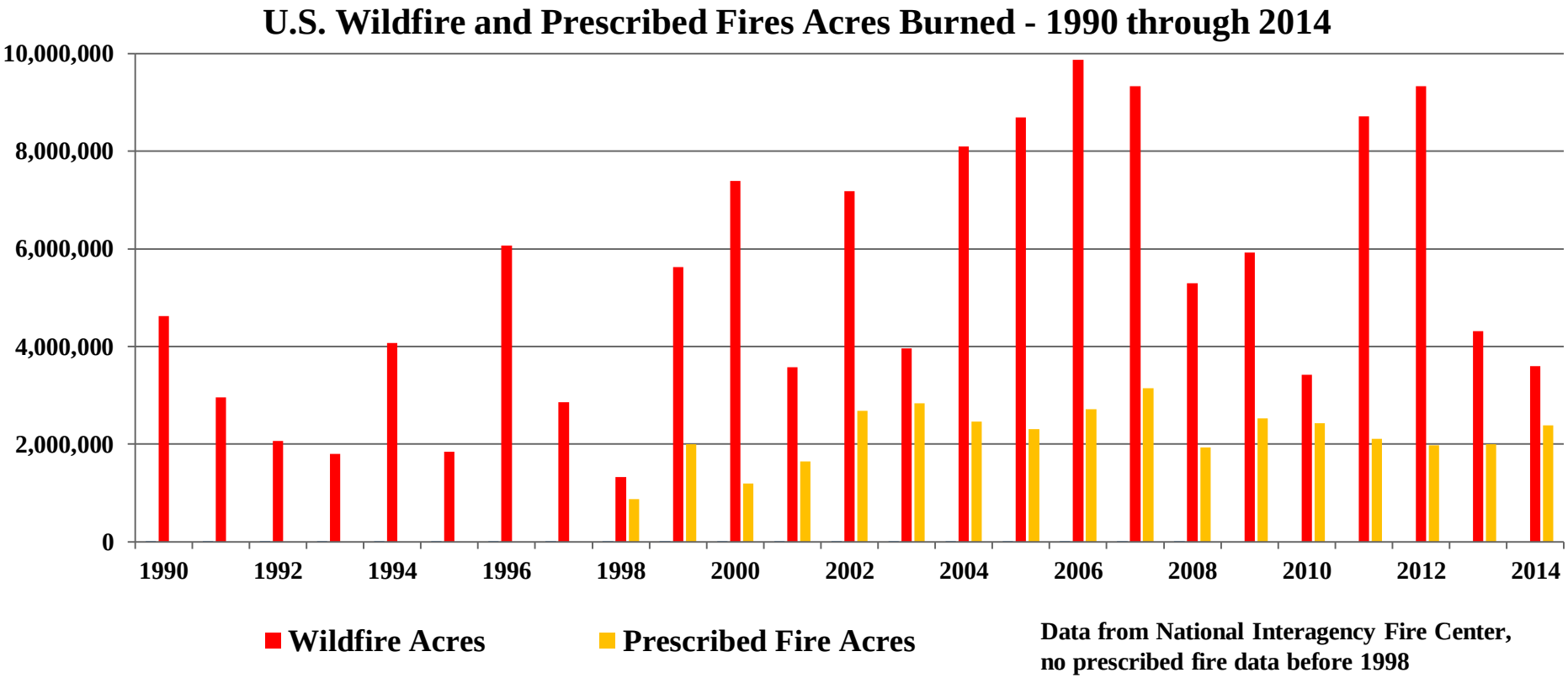


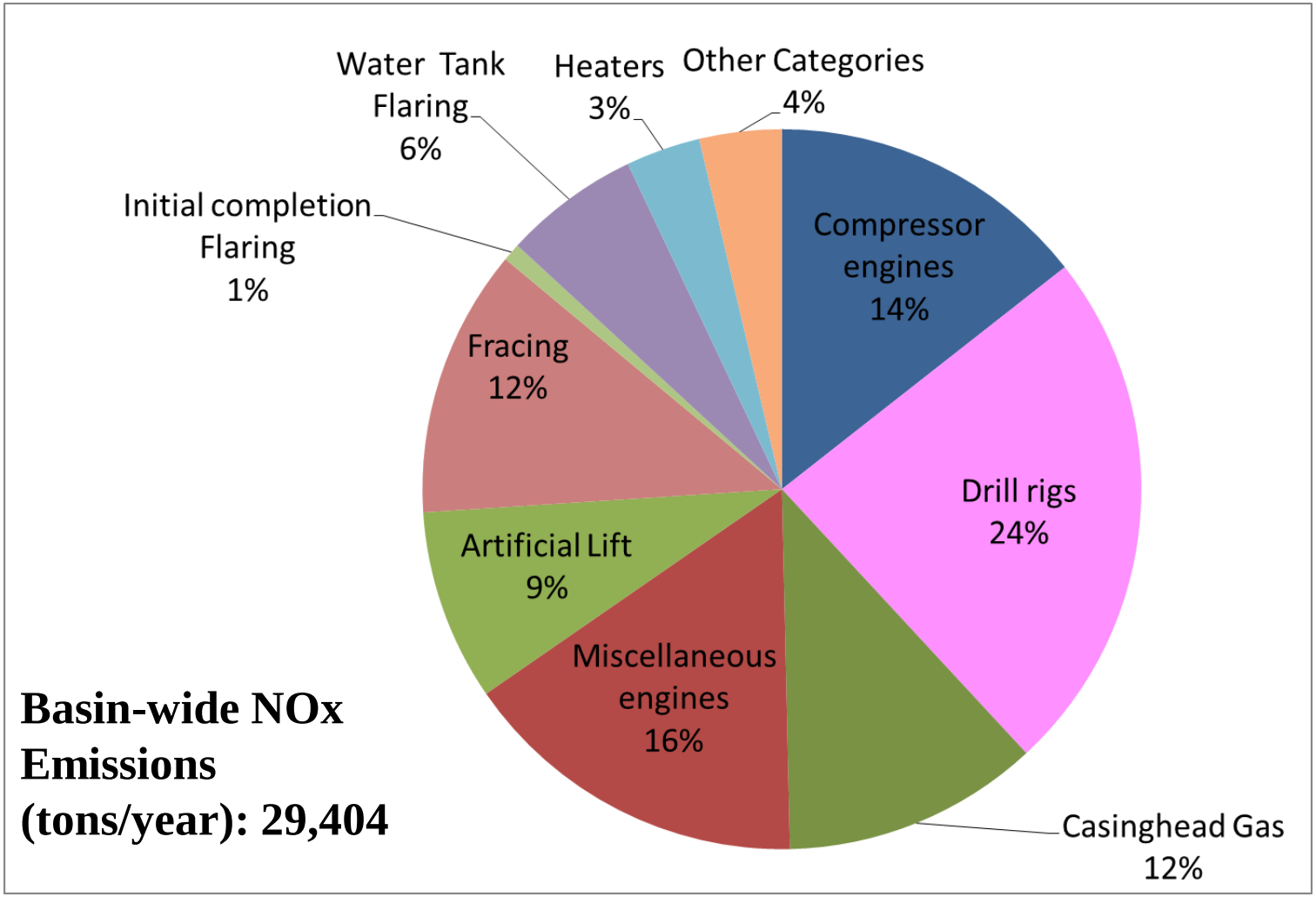
Fire

The Big Picture





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



Source: BLM/WRAP Oil and Gas Inventory project

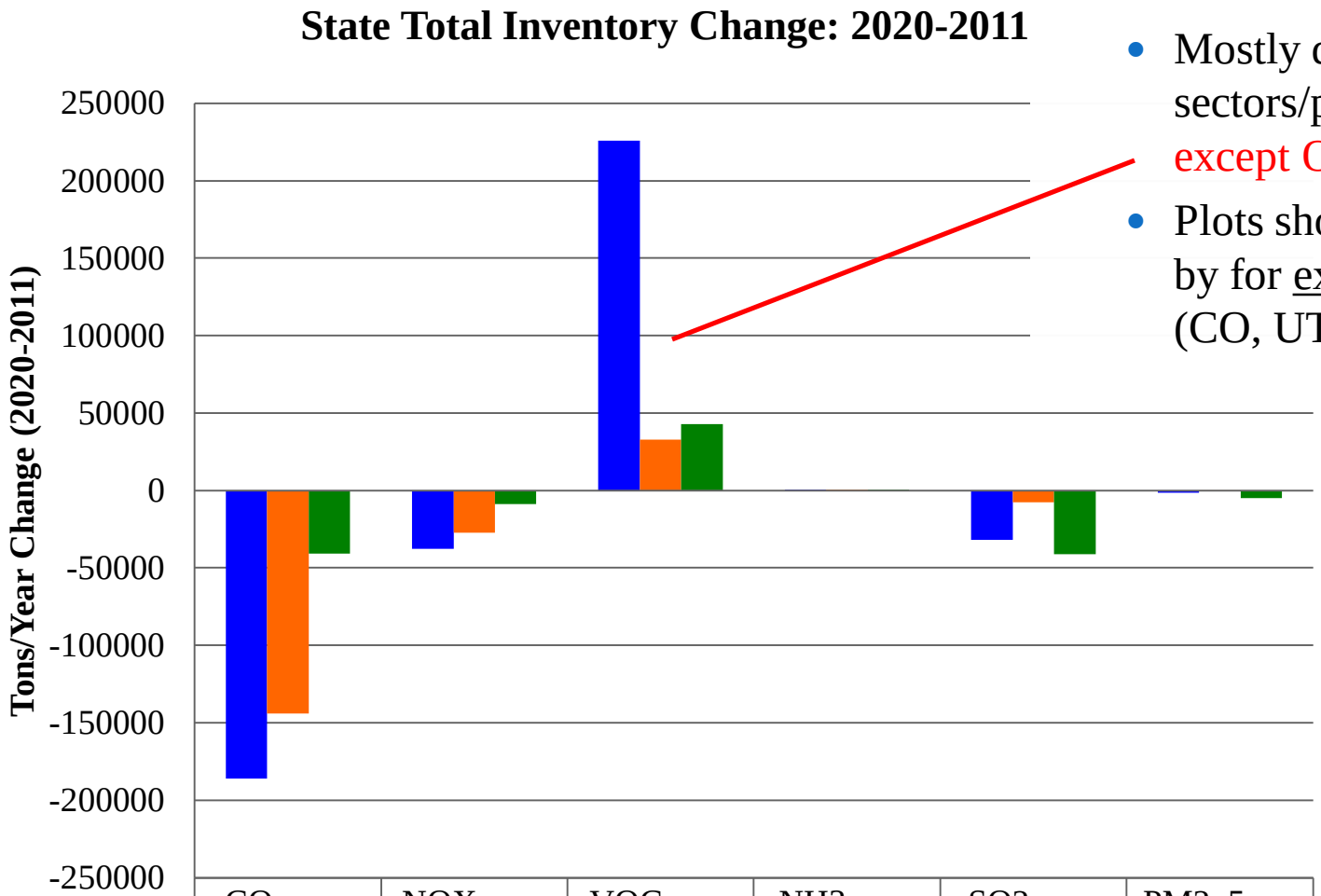
Oil & Gas Projections - Methodology

- 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

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

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 by for example states (CO, UT, WY)

Source: Western Air Quality Data Warehouse

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

Some are further controllable

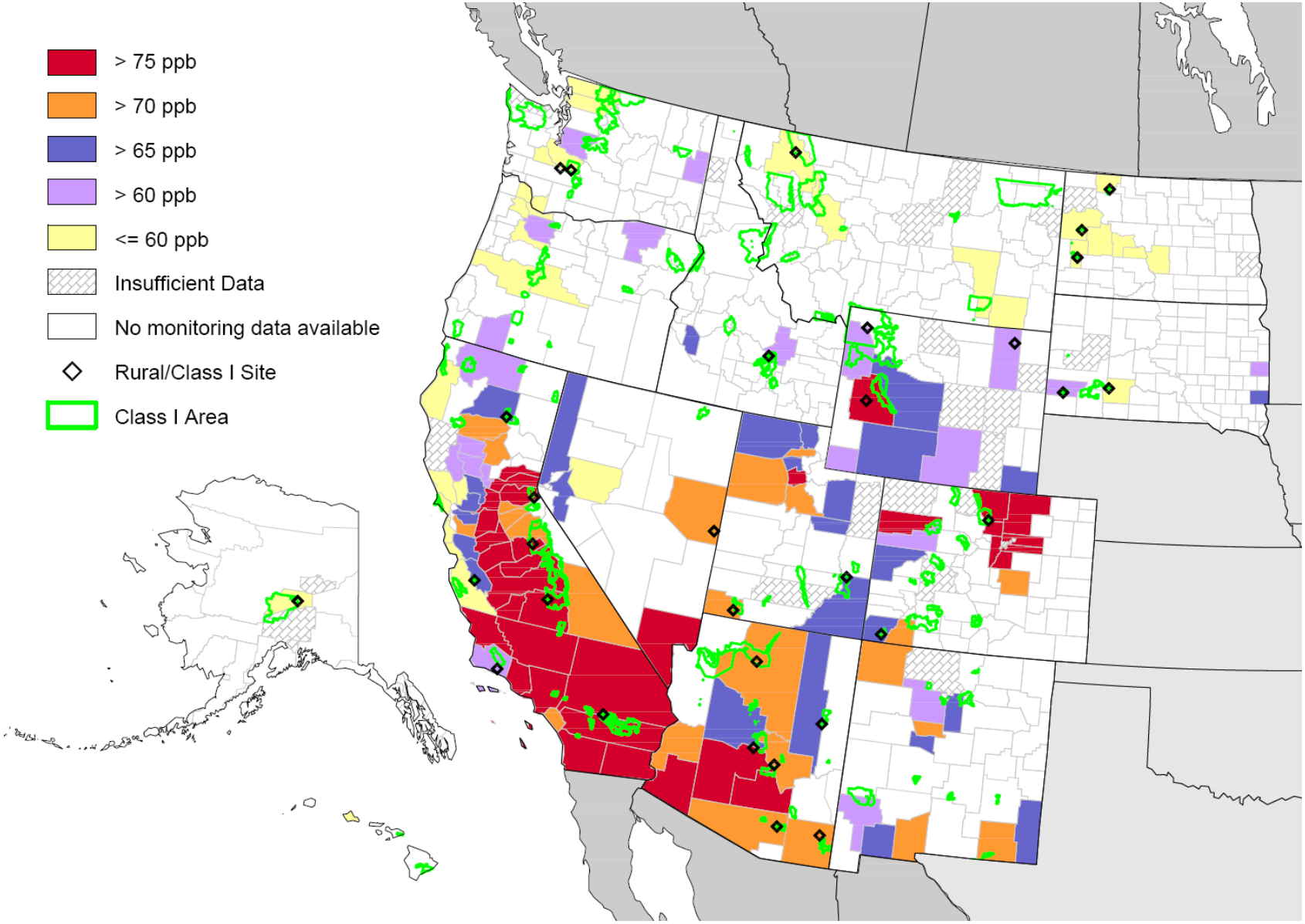
Others are less controllable, quasi-natural, and/or less well-understood - these may grow and/or vary significantly within the CAA planning timeframes

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

(Based on 2011-2013 Air Quality Data)

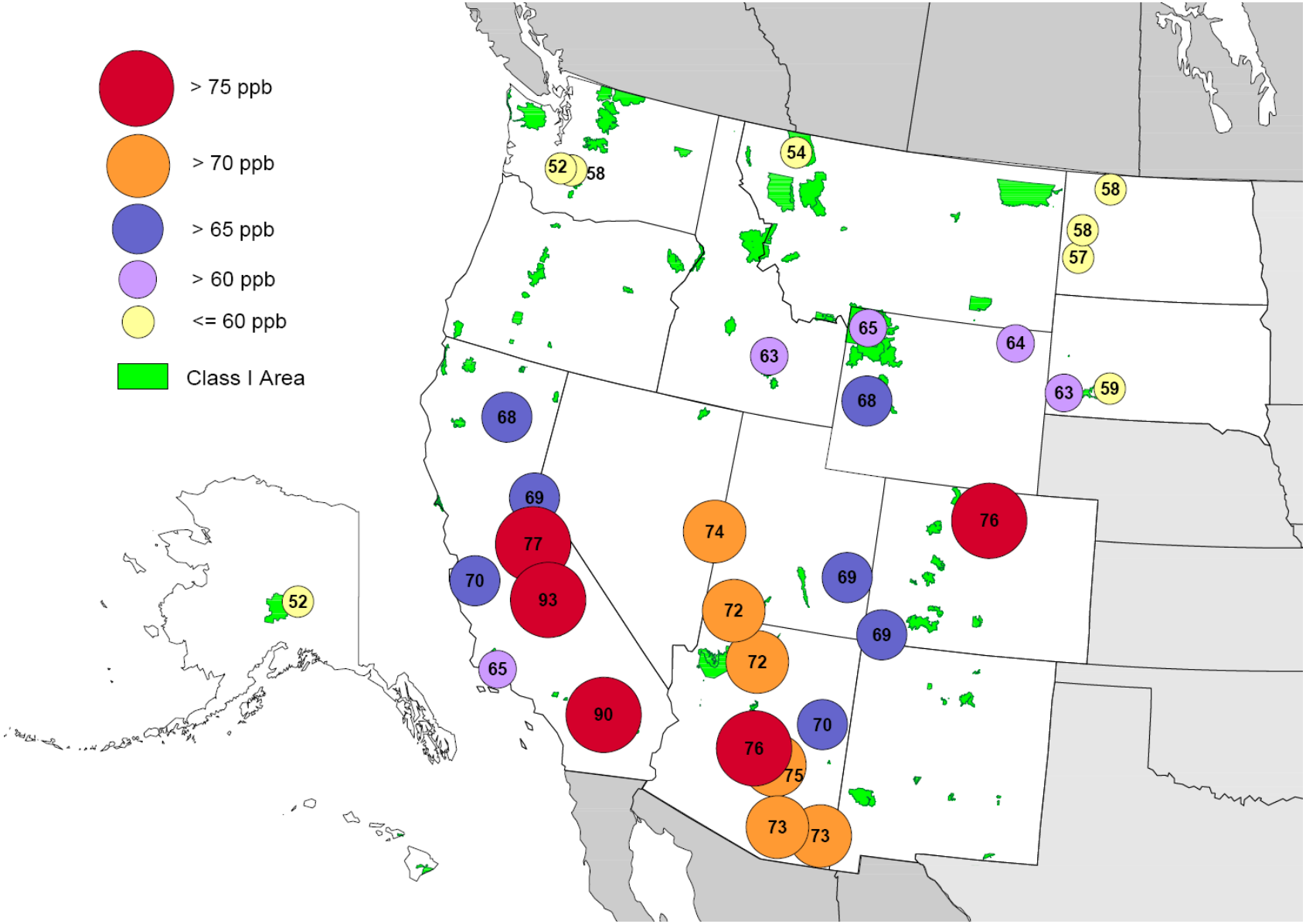
http://www.epa.gov/airquality/greenbook/map8hr_2008.html

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

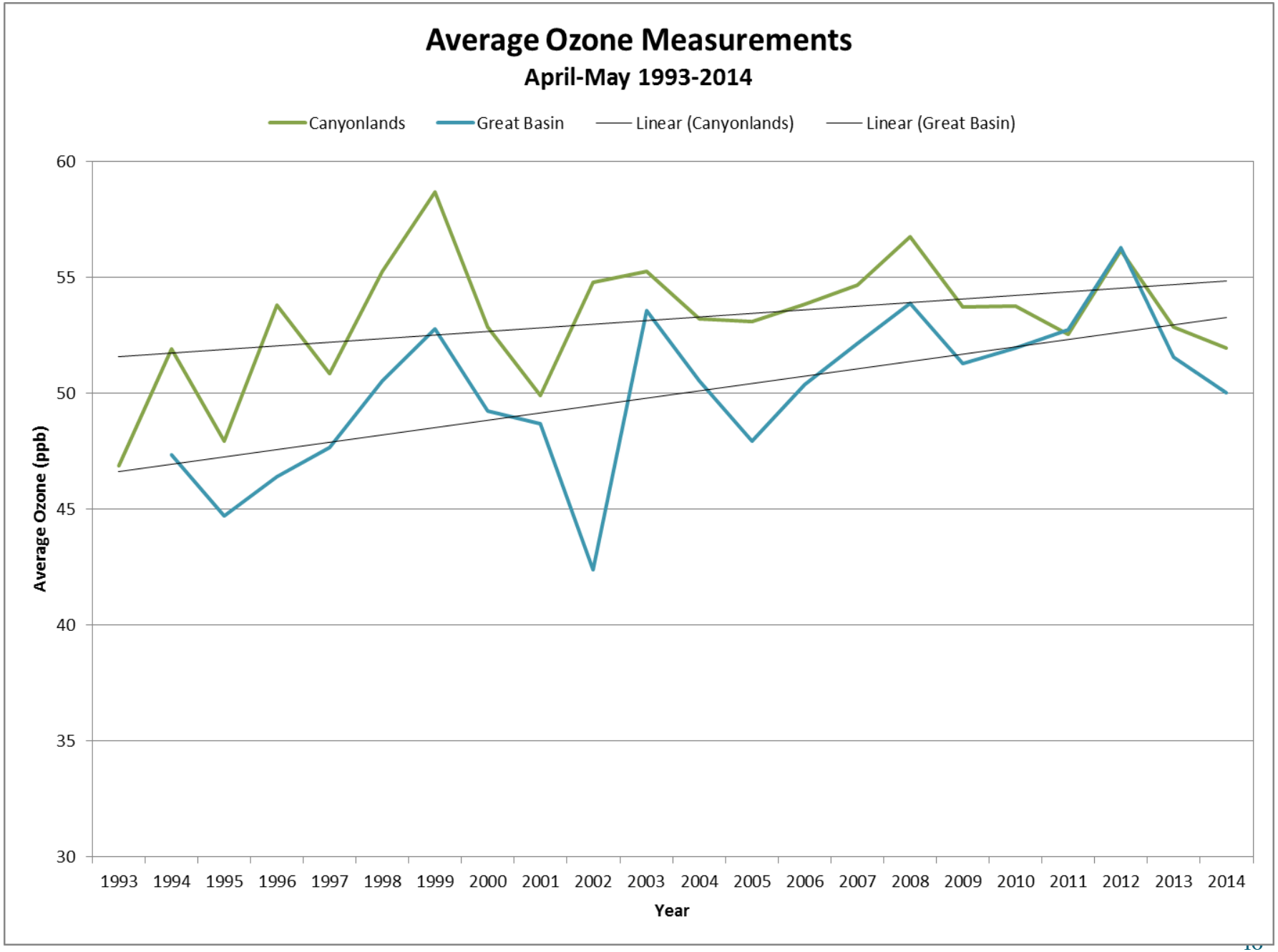


AQS Federal Reference Method data from the monitoring site in each County with the highest Ozone values

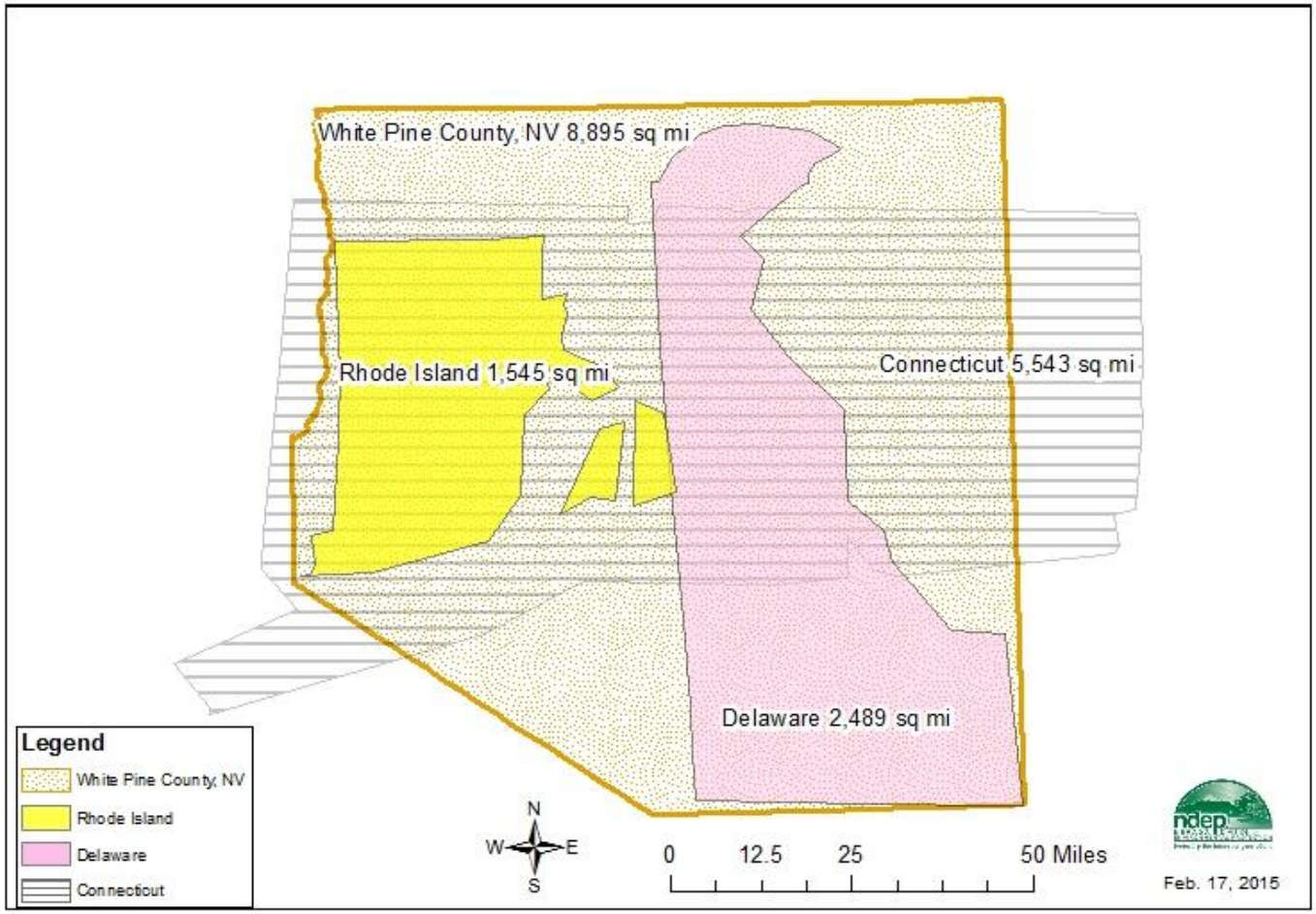
3-year Average 4th Highest 8-Hour Ozone value for Rural/Class I Sites 2011-2013



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


Average Ozone Measurements
April-May 1993-2014
Canyonlands
Great Basin
Linear (Canyonlands)
Linear (Great Basin)
Average Ozone (ppb)
60
55
50
45
40
35
30
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

White Pine County, NV - population ~10,000



Design Values						
2018 Average (ppb)	**2018 Max (ppb)**	**Other (ppb)**	**Biogenic (ppb)**	**Boundary Conditions (ppb)**	**Total Background (ppb)**	**Background % of Avg Design Value**
68.6	70.5	4.9	2.2	52.6	59.7	87%

EPA Guidance on Ozone Projections Procedures for 2008 Standard

- Start with a current year observed Design Value (DVC)
  - EPA recommends average of three Design Values (DVs) centered on modeling year (example of 2008) (5-Year DV)
    - DVC averaged of DVs from 2006-2008, 2007-2009 and 2008-2010
- Use relative changes in 2018 & 2008 modeling results to scale DVC to obtain future year Design Value (DVF)
  - Relative Response Factors (RRFs) based on ratio of 2018 to 2008 modeling results

$$DVF = DVC \times RRF$$

- Compare DVF with March 2008 0.075 ppm ozone NAAQS
  - Slight update in 2014 draft EPA guidance to these procedures – will apply to new ozone standard when it is determined in late 2015

Five Ozone Planning Needs related to modeling

1. **Ozone NAAQS planning** – requires photochemical modeling for SIP attainment demonstrations for nonattainment areas.
2. **Ozone transport SIPs** –photochemical source apportionment modeling can be used to quantify U.S. Ozone transport between states and jurisdictions.
3. **Identification of Ozone exceptional events** caused by stratospheric intrusion and wildfires – requires observations & data analysis, supplemented with global/regional scale photochemical models and regression models.
4. **Identification of international transport of Ozone for §179B** demonstrations: requires nested global and regional scale photochemical modeling to evaluate international transport of Ozone.
5. **Identification of §182 Rural Transport Areas** – combination of data analysis and photochemical modeling.

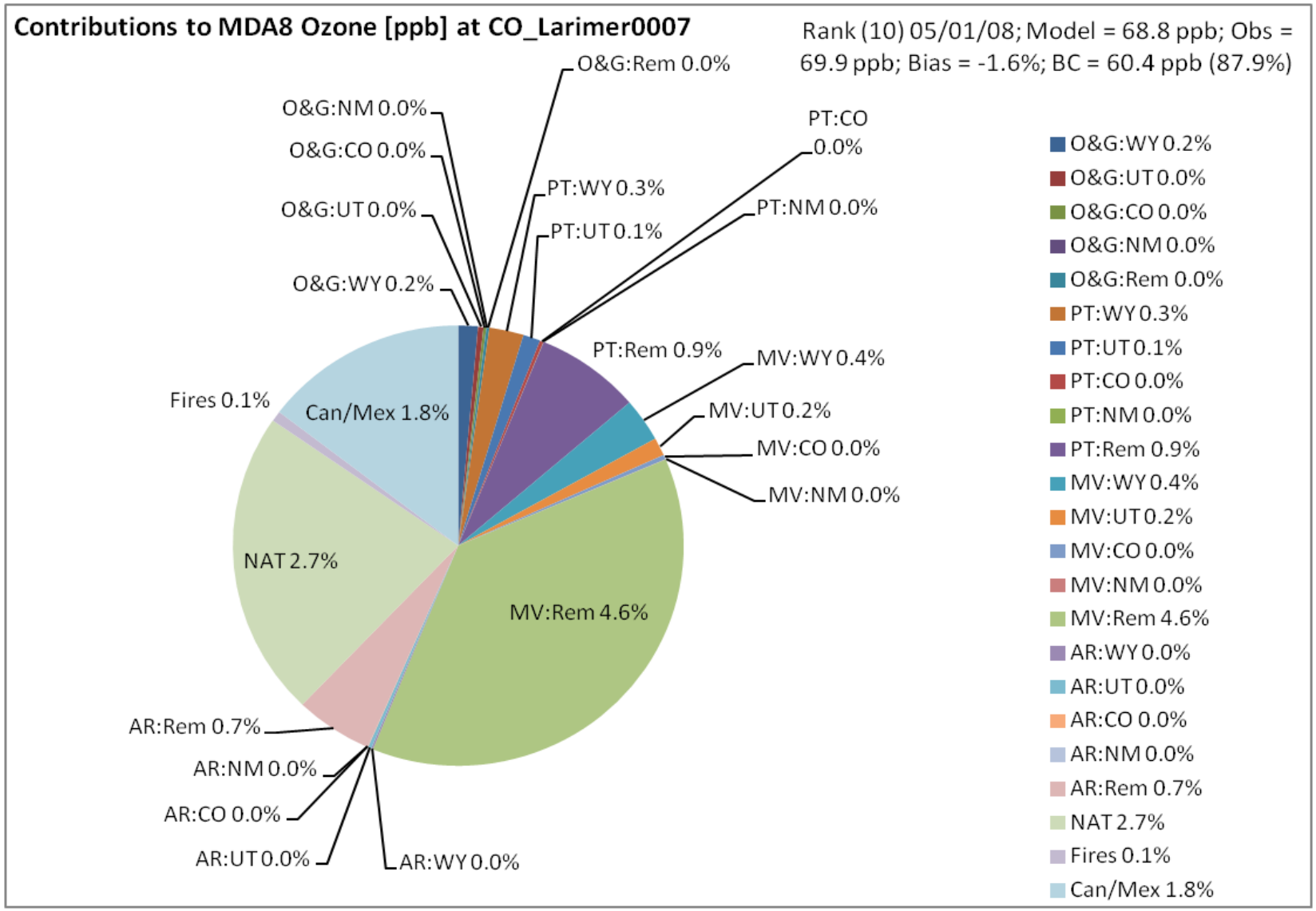
In the West under CAA, whom to do which ?

Alone or together ?

- States/Locals
- Regional
- Federal

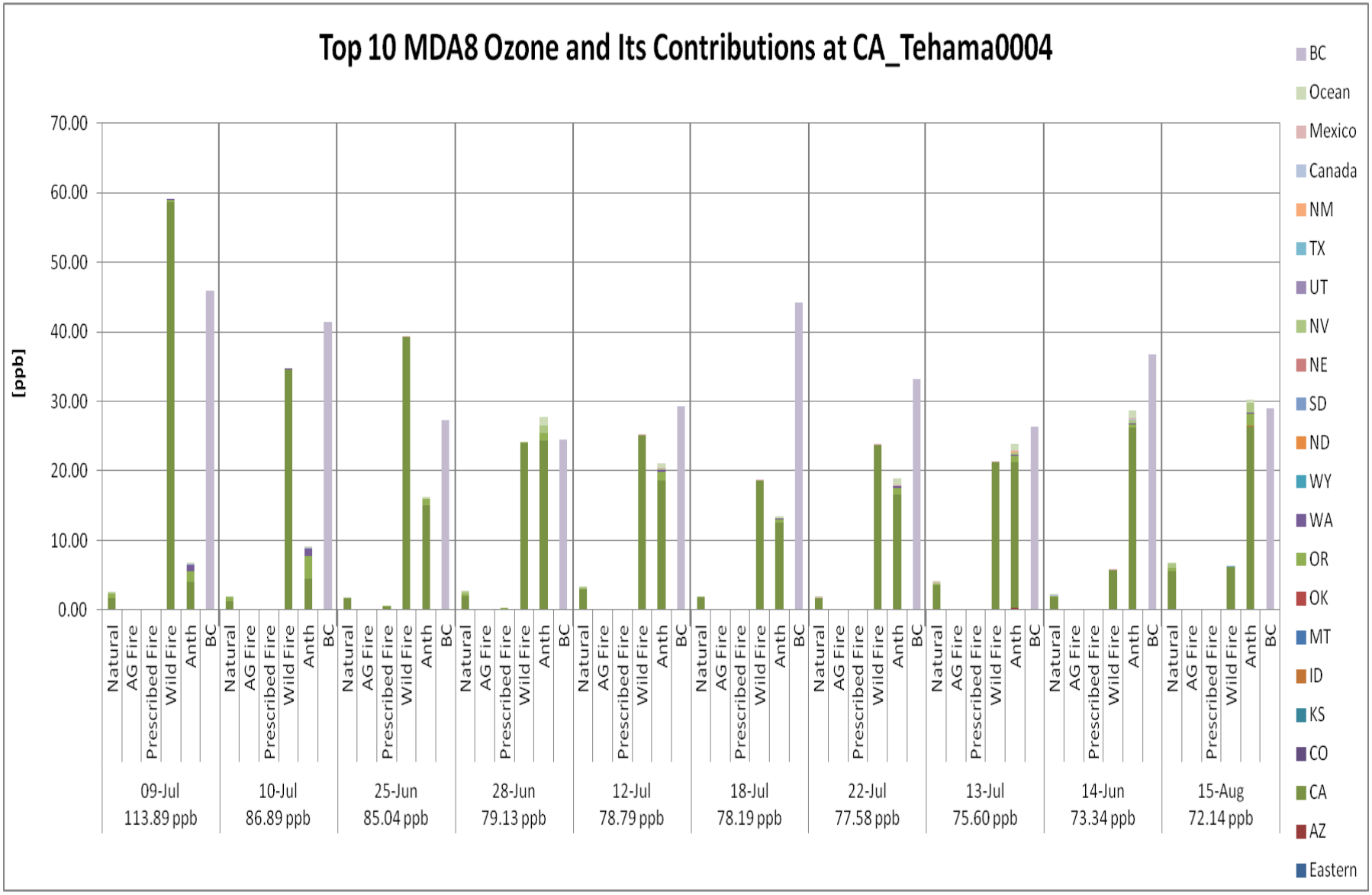
Regional modeling of U.S. sources for air quality planning, to identify sources and assess controls for contributing sources, will be needed within the West

Contributions to 2008 Ozone at Rocky Mountain National Park



Source: WestJumpAQMS

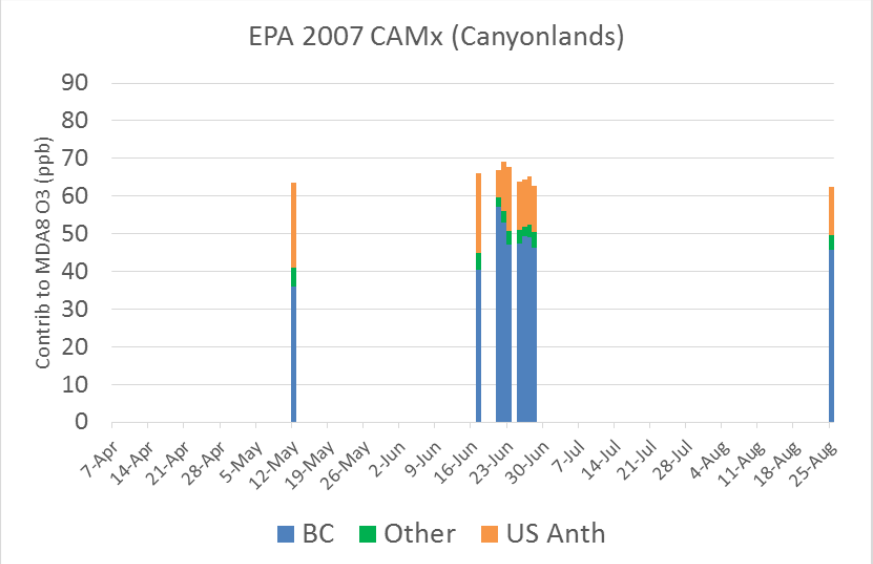
Contributions to 2008 Ozone at Tuscan Buttes, Tehama County, CA

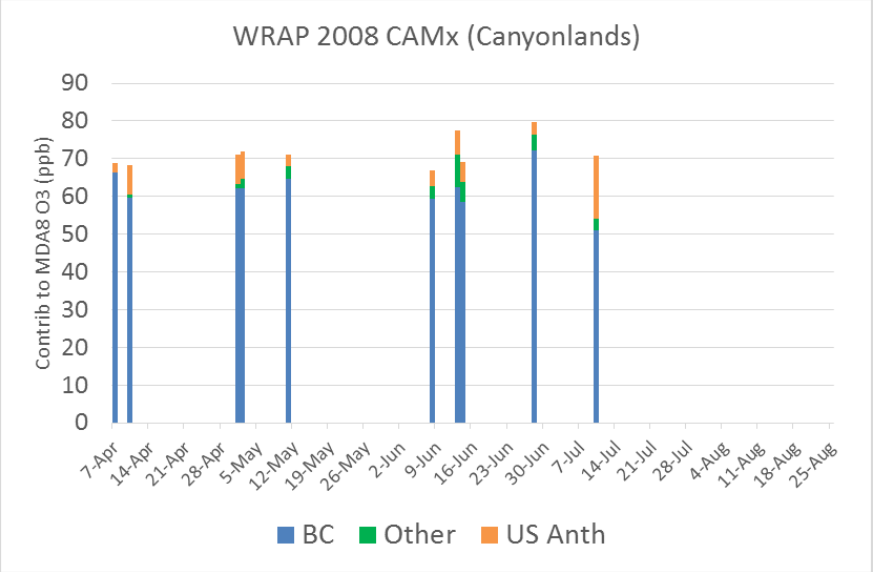


Source: WestJumpAQMS

Uncertainty in model estimates of U.S. Background

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





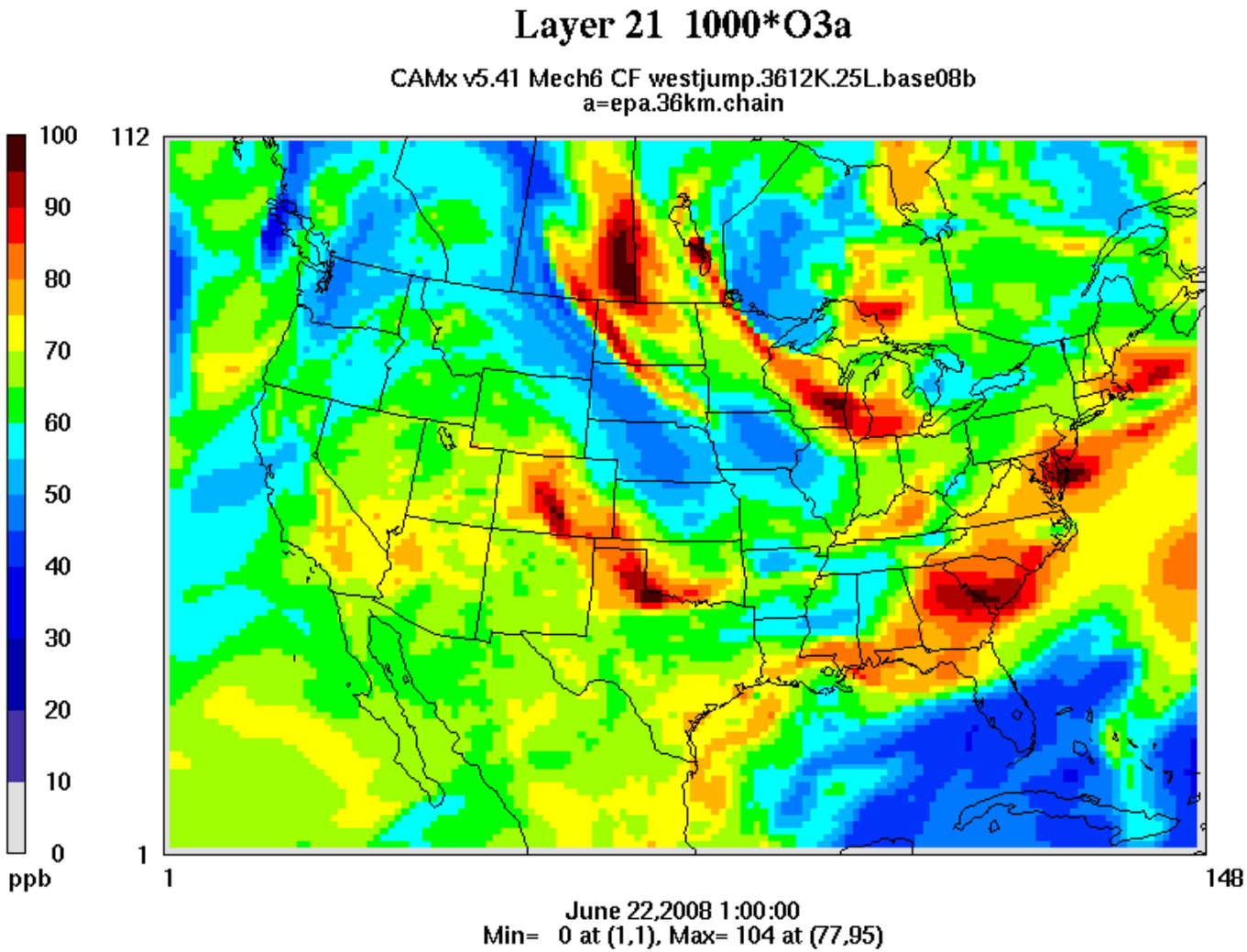
EPA 2007 CAMx model:
BC contributions of 36-57 ppb; still substantial U.S. anthropogenic contribution to O3.

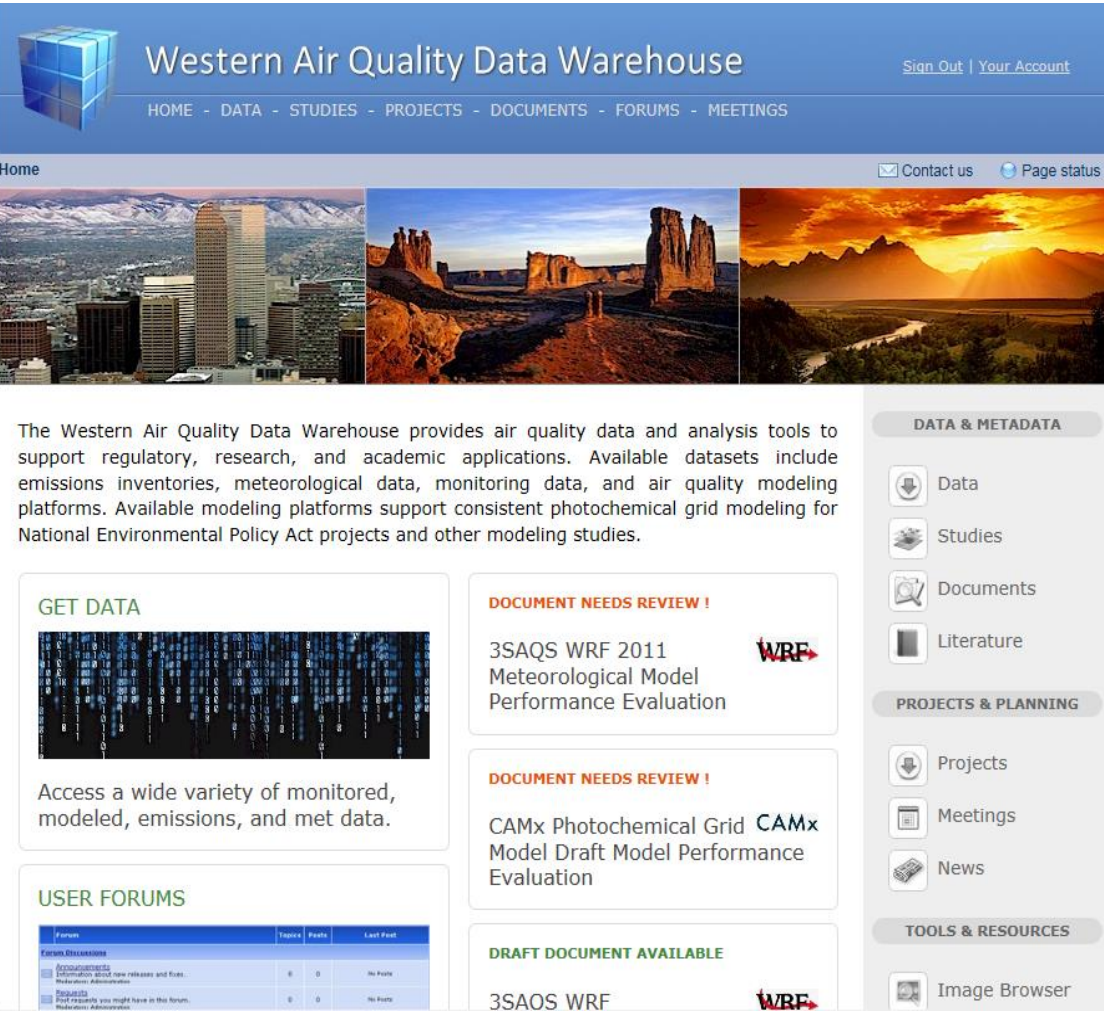
WRAP 2008 CAMx model:
BC contributions of 50-72 ppb, much larger than OAQPS modeling.

Same methodology - reasons for modeled differences are not fully understood

O_3 in upper free troposphere is determined primarily by transport from boundaries

O_3 animation in Layer 21 (6-7 km) June 22 through July 4, 2008





http://views.cira.colostate.edu/tsdw/

Background / Boundary Conditions evaluations:

MOZART
GEOS-Chem
(considering addition of AM3)

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Observations vs. Boundary Condition / Background Monthly Mean MDA8 Ozone

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Animations of Modeled Daily Max Concentrations

Background contribution
Difference plots for background minus U.S. sources

O3, NO_x, CO, $PM_{2.5}$

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Animations of Daily Max Concentrations for O3 and Dust Boundary Tracers

Boundary conditions plots:

O3, Ox (O3+NO+NO2+PAN)
Coarse Dust (CCRS), Fine PM (FPRM+FCRS)

Applications of global model data as regional modeling boundary conditions need to codified between the science and regulatory communities

- Current, clear, and unambiguous scientific findings are needed
- Address uncertainty, assessment methods, and applications of global modeling products:
  - As boundary conditions
  - To help clarify transport within the U.S.
- Resources and usable tools for applying data and knowledge from global models and monitoring research across the West are likely beyond the scope of most/many air regulatory agencies
  - How will that work be done and when, and whom will be responsible for communicating those results?