Western Air Quality Data Warehouse and Regional Modeling Framework

October 8, 2014

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WESTAR Council

California Desert Air Working Group
Pala, CA

Regional Organizations

- WESTAR = Western States Air Resources Council
  - 15 state air agencies are voting members, ex-officio membership includes FLMs, also open to local air agencies and tribes, EPA active participant but not a member
  - Incorporated non-profit, offices in Seattle, Portland, and Fort Collins
  - www.westar.org

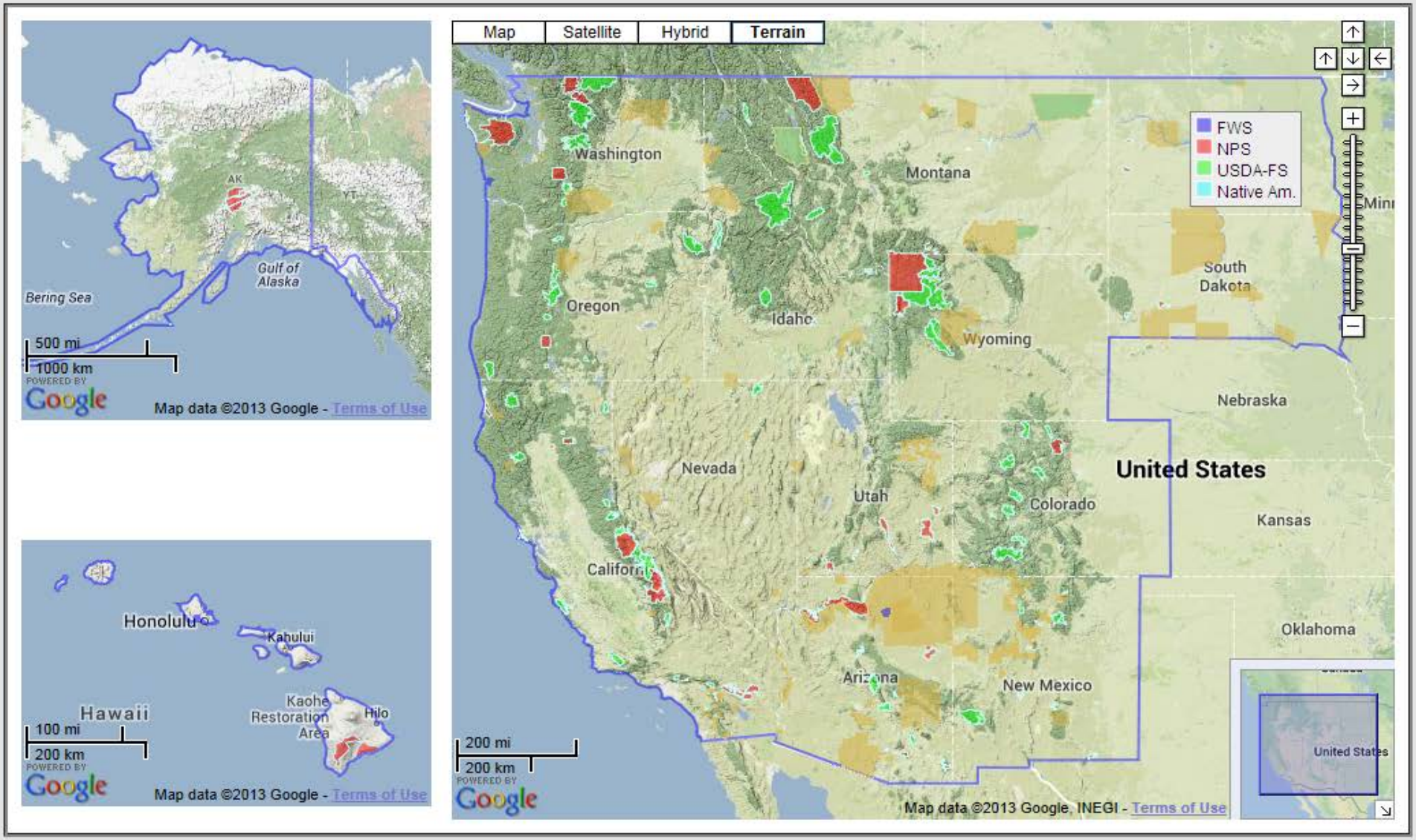
- Purposes:
  - Exchange information related to air pollution control;
  - Develop processes and procedures to meet air quality objectives and to protect the environmental resources;
  - Discuss air quality issues and report on the status of efforts undertaken to achieve air quality objectives;
  - Establish work groups, task forces, as needed; and
  - Adopt resolutions and policy statements for implementation by Council members.

WESTAR / WRAP geographic region

Organizations, continued

- WRAP = Western Regional Air Partnership
  - www.wrapair2.org
  - Same 15-state region as WESTAR
  - Virtual organization, not incorporated
  - 60+ 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 State and Tribal co-chairs, with representatives across states, tribes, federal, and local agencies.
  - Formed in 1997 to implement Grand Canyon Visibility Transport Commission recommendations
    - Led Regional Haze planning effort 1997-2009 for the West
    - 75 % of Class I areas in the WRAP region

WRAP Region Areas and Points of Interest



- 15 states, federal land managers and EPA, tribes, and local air districts
- Regional analyses for Western sources and air quality impacts

WRAP, continued

- Since 2010, WRAP working as regional technical center to support and coordinate Regional Analysis and Planning
- Develop and facilitate use of improved, consistent, comparable, transparent, and reproducible western air quality data
  - Interconnected series of regional technical projects
  - Management of ongoing emissions and modeling studies
    - Reviewed / coordinated with federal agencies, states, locals, tribes
    - External review by, and outreach to, industry and environmental groups
- Staff work for WESTAR - report to WRAP and WESTAR Boards, and WESTAR Executive Director

WRAP regional technical support

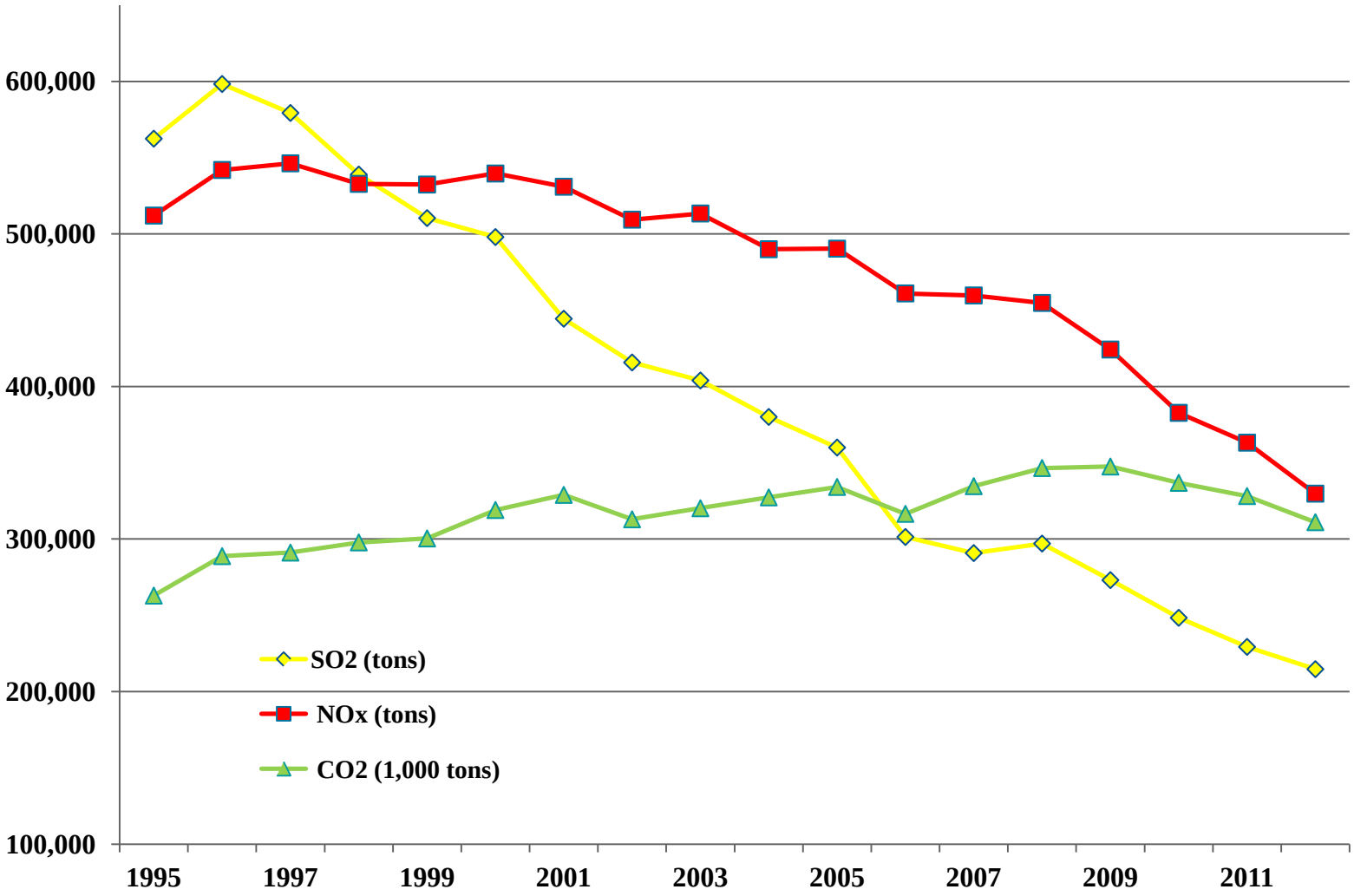
- NAAQS Implementation and Maintenance
  - Data for future infrastructure and transport SIPs
- Exceptional Events
  - Develop technical support data and analysis protocols
- Implementation of Regional Haze SIPs
  - Identify and execute technical work needed for 2018 plans
- Needs of sub-regional groups of states
  - Currently oil and gas, fire
  - Similar efforts in past – dust, other topics

Western ozone and PM precursors - key emissions sources

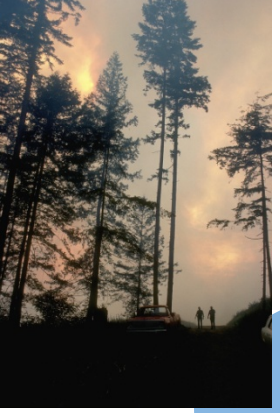
- Power plants decreasing markedly
- Mobile sources controlled and emission rates decreasing markedly through federal rules and state testing programs
- Fire activity and effects are huge, receiving intensive study
  - Smoke's Contribution to Ozone (DEASCO$_3$)
  - Prescribed and Other Fire Emission Contribution to Particulate Matter (PMDETAIL)
  - Others….
- Improved Biogenics Emissions across the West (PDF)
- Oil and gas (WRAP emissions inventories)
  - Emissions Inventories for Intermountain Basins with significant production
  - Coordination for 3-State Air Quality Study

- All sources studied in comprehensive regional modeling analysis
  - 2008 base year - West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS)

Power Plant Emissions Trends – Western Interconnect



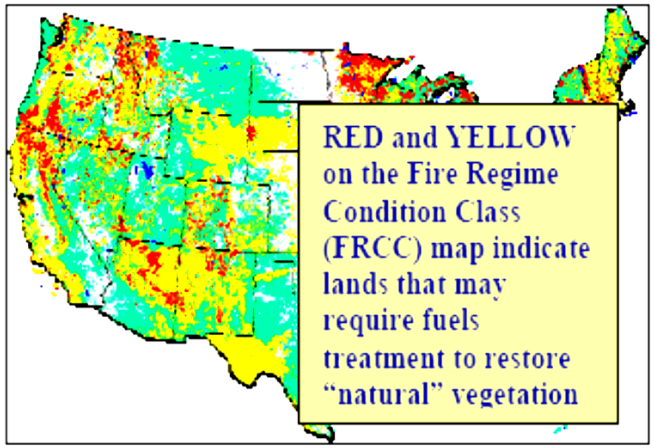
Data Source: EPA Clean Air Markets Division



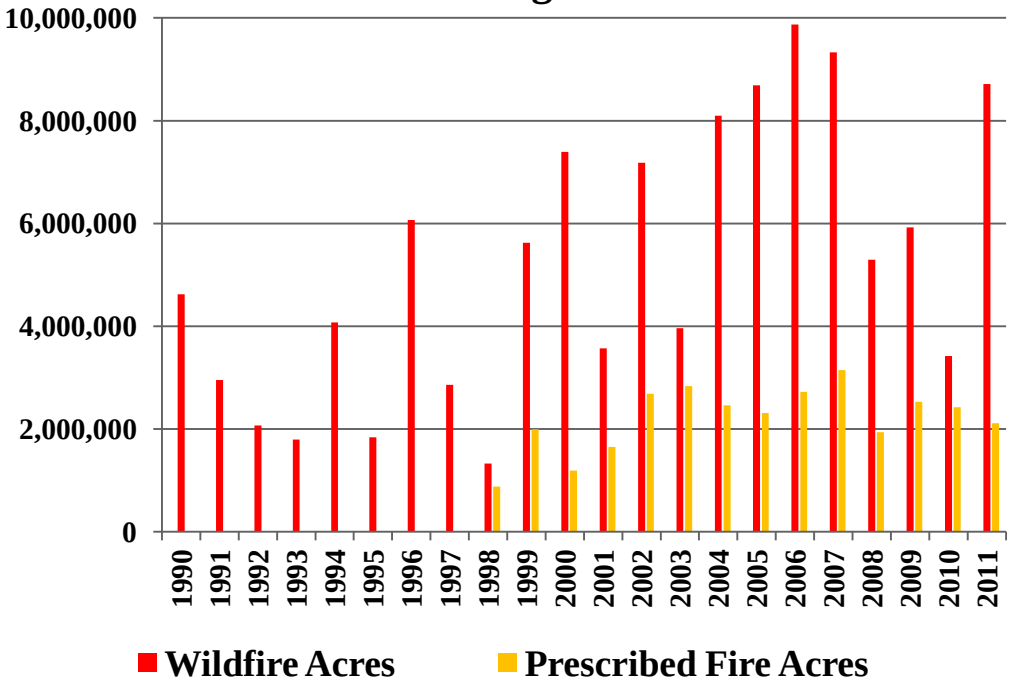
Fire

The Big Picture

The quantity of forest fuels and composition of vegetation in the wildlands of the Western U. S. motivate the land managers to increase the application of prescribed fire to the landscape (from 650.000 acres in 2002 to a projection of up to 3.6 MM acres in 2018).

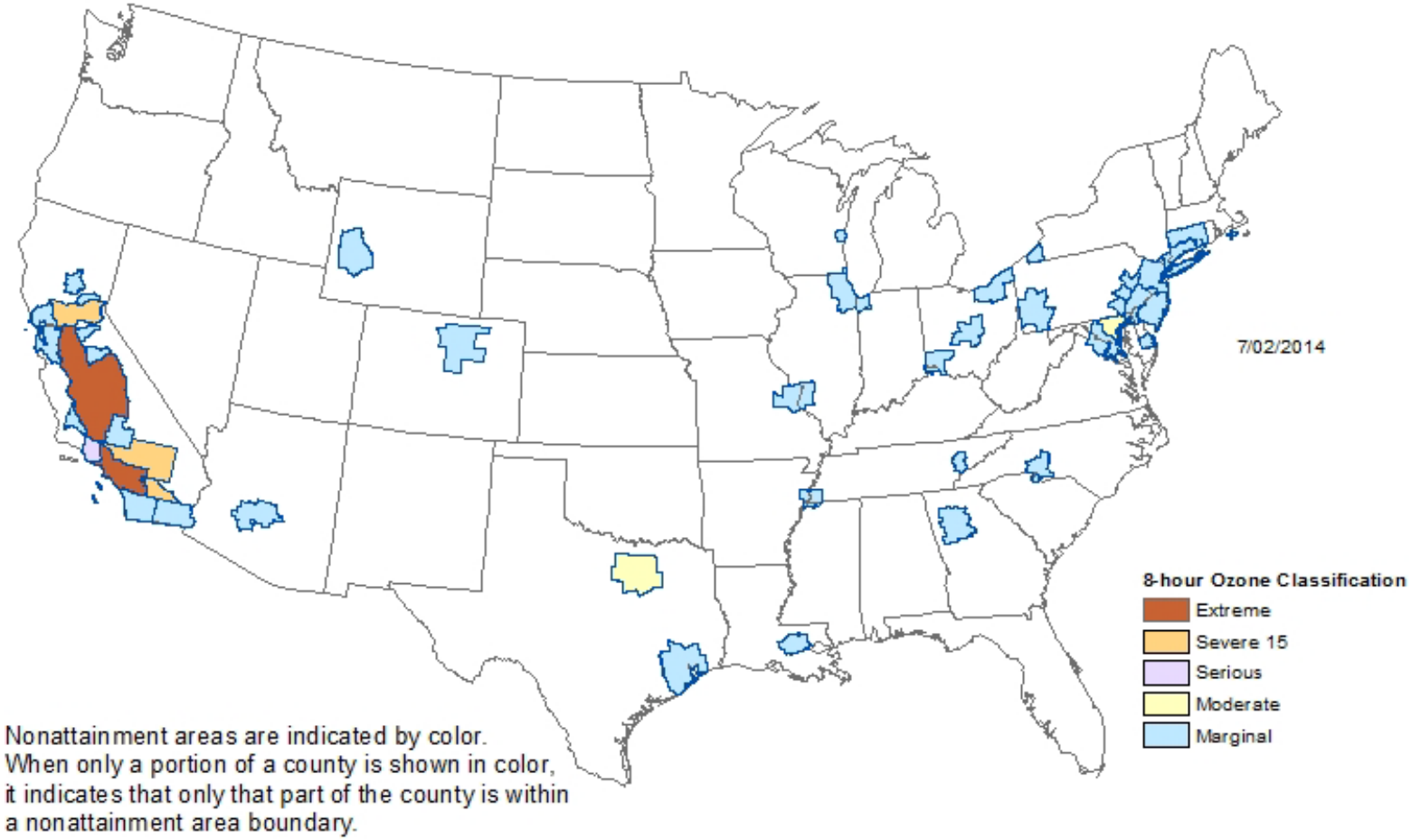


U.S. Wildfire and Prescribed Fires Acres Burned - 1990 through 2011



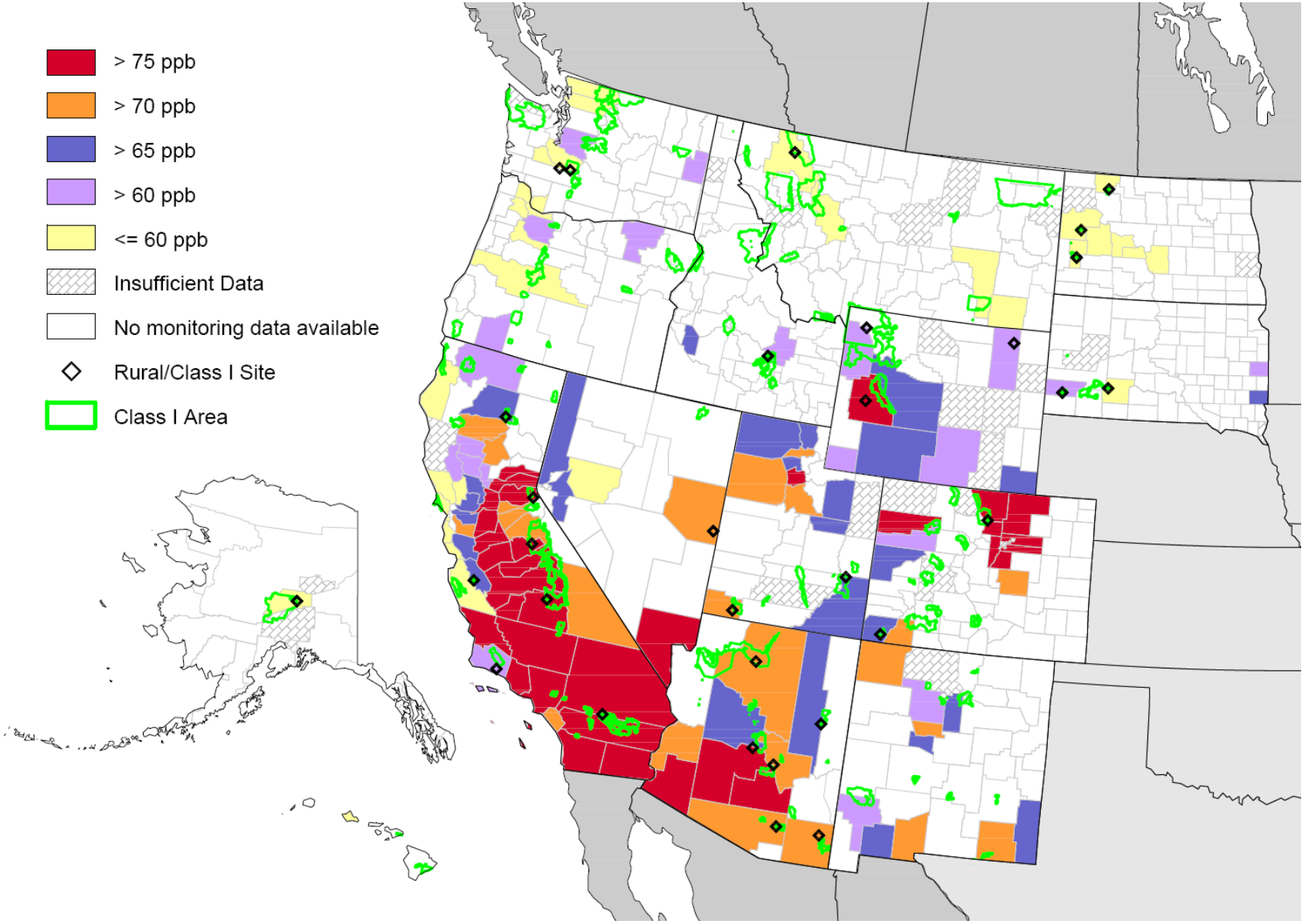
Counties with Monitors Violating Primary 8-Hour Ground-Level Ozone Standard (0.075 ppb)

(Based on 2011-2013 Air Quality Data)



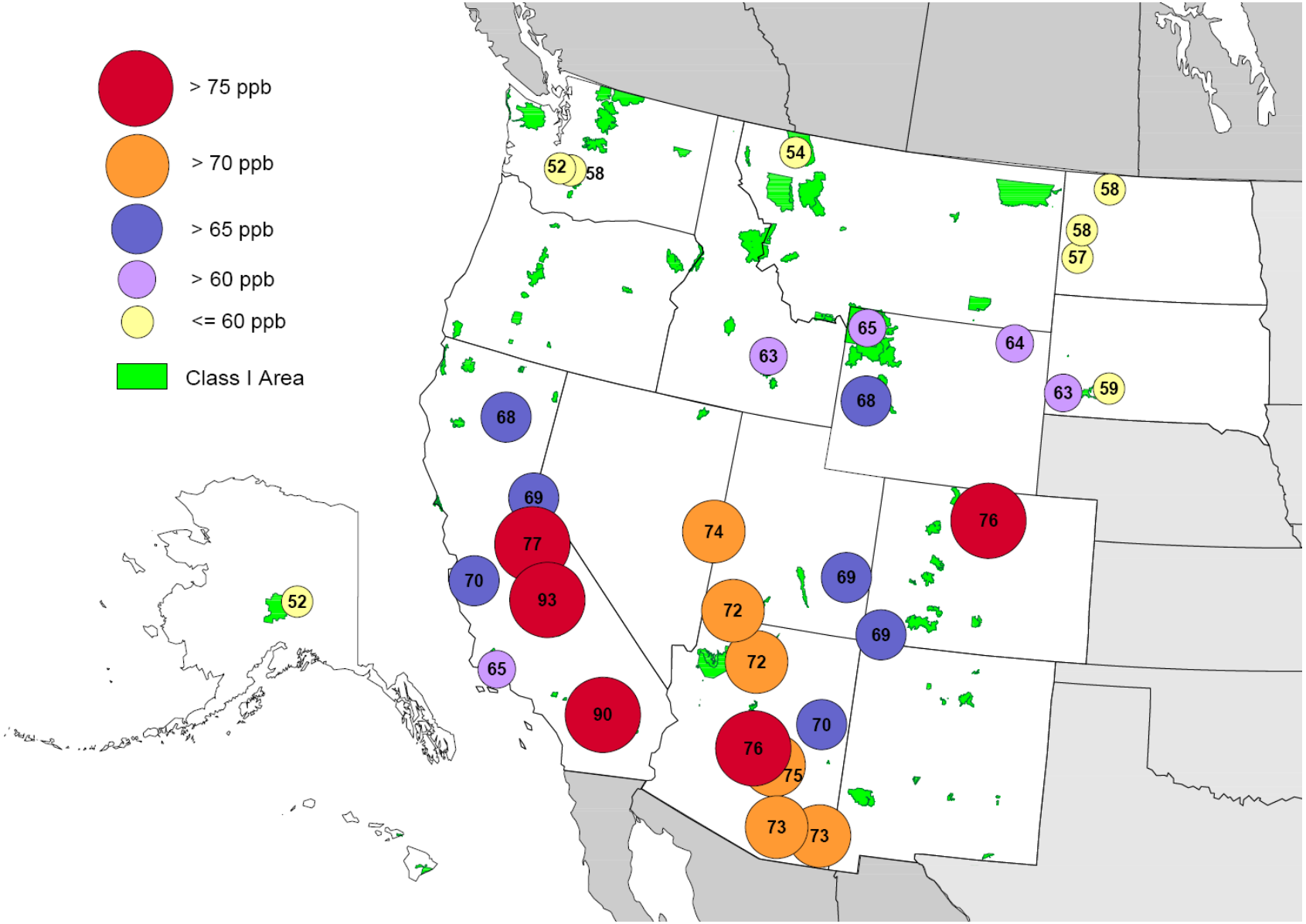
http://www.epa.gov/airquality/greenbook/map8hr_2008.html

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



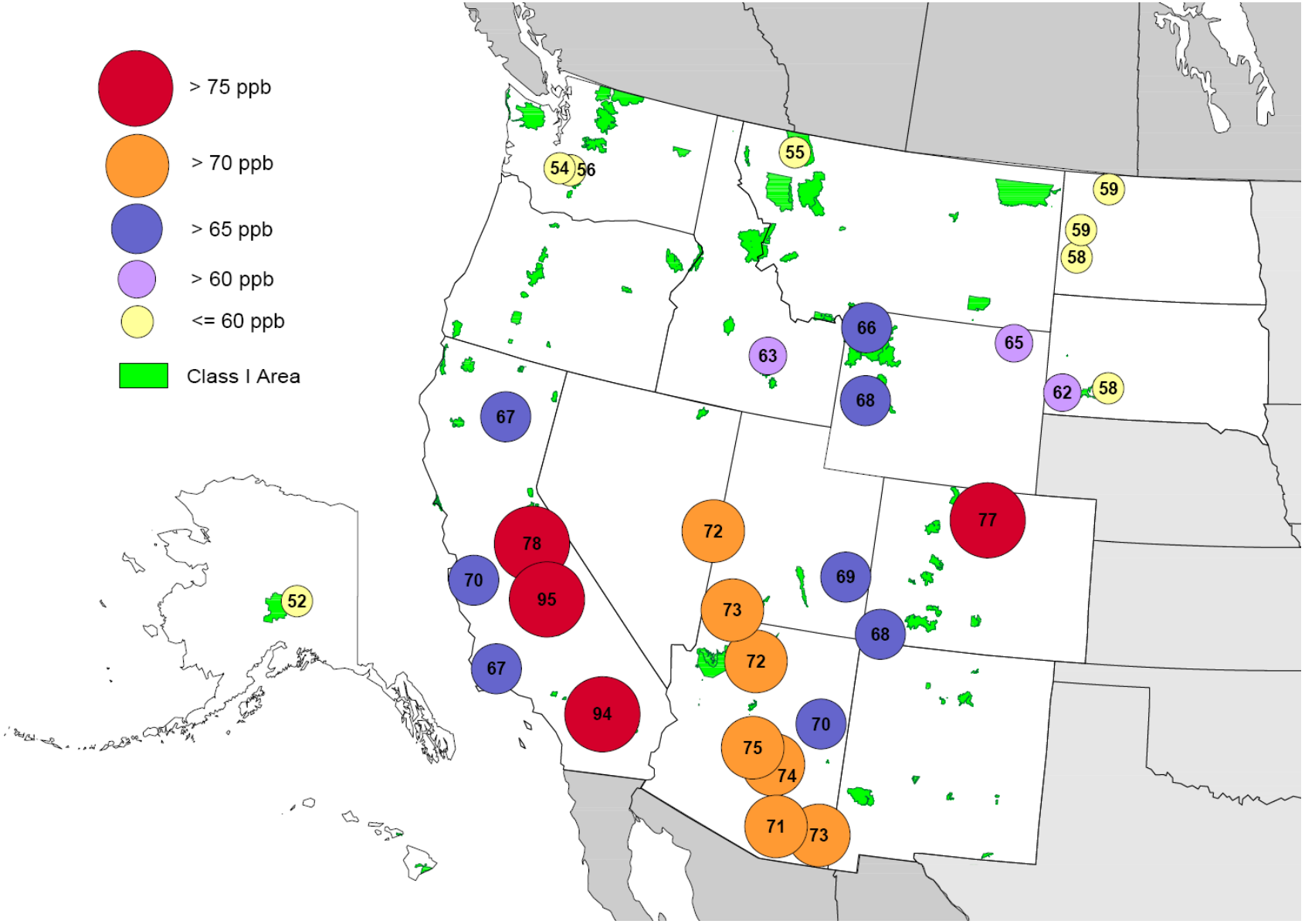
AQS Federal Reference Method data from the monitoring site in each County with the highest Ozone values

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



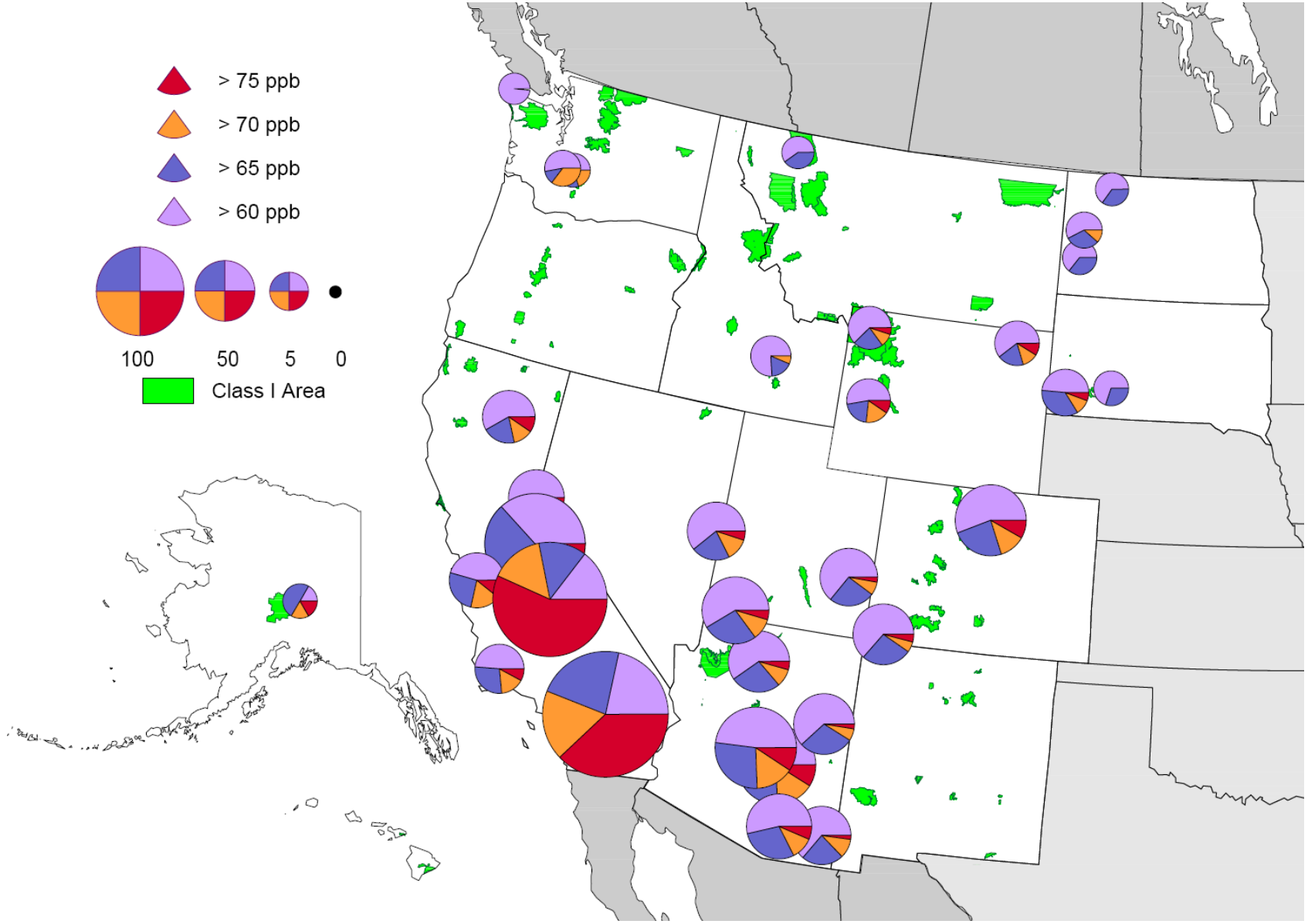
AQS Federal Reference Method data from rural or Class I area monitoring sites

3-year Average 4th Highest 8-Hour Ozone value for Rural/Class I Sites 2010-2012



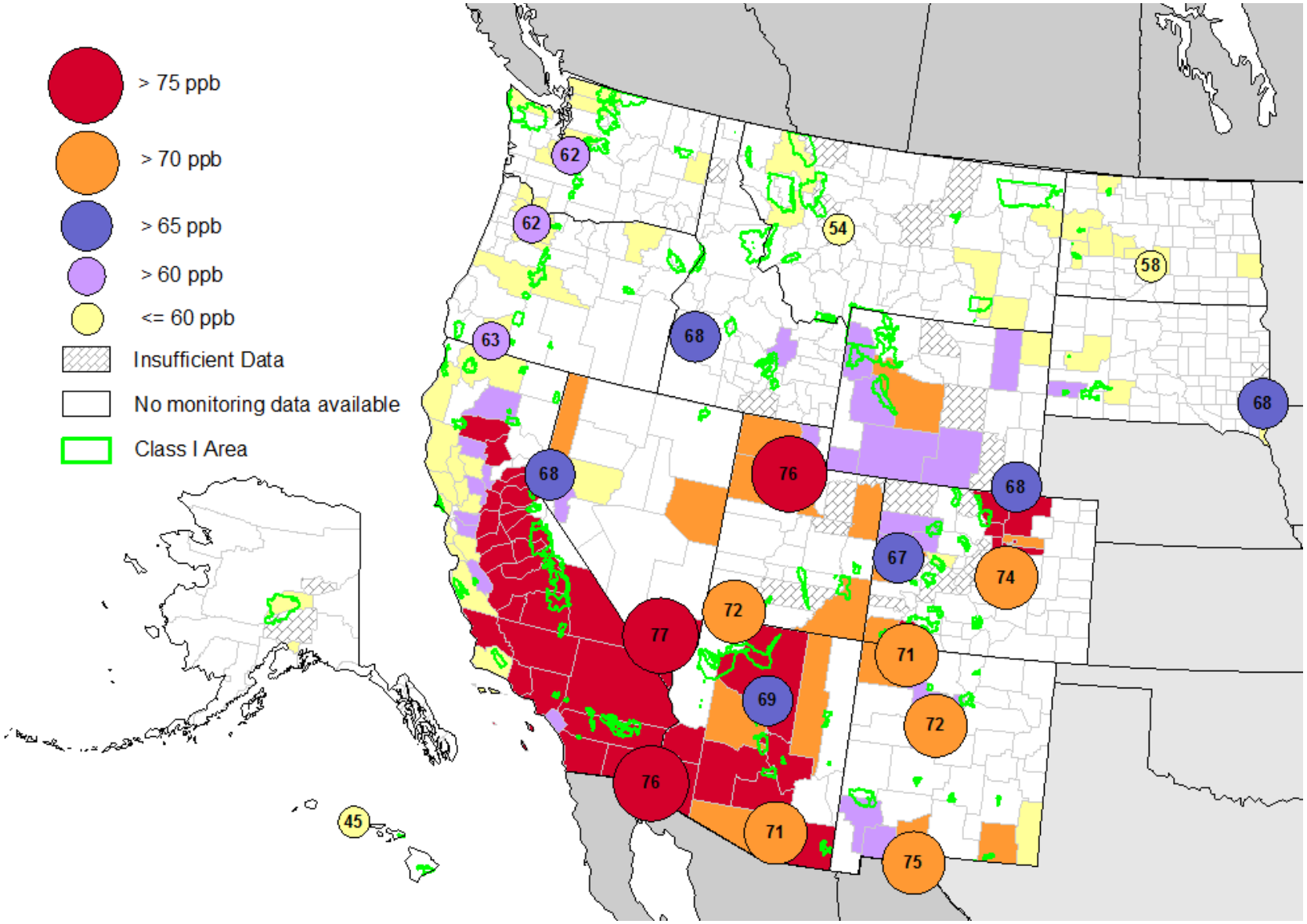
AQS Federal Reference Method data from rural or Class I area monitoring sites

Average Annual Count of Days with 8-Hour Ozone Averages >60 ppb for Rural/Class I Monitoring Sites – 2004 through 2013



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

3-year Average 4th Highest 8-Hour Ozone Design Value for Selected Urban Counties currently in Attainment – 2011 through 2013



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

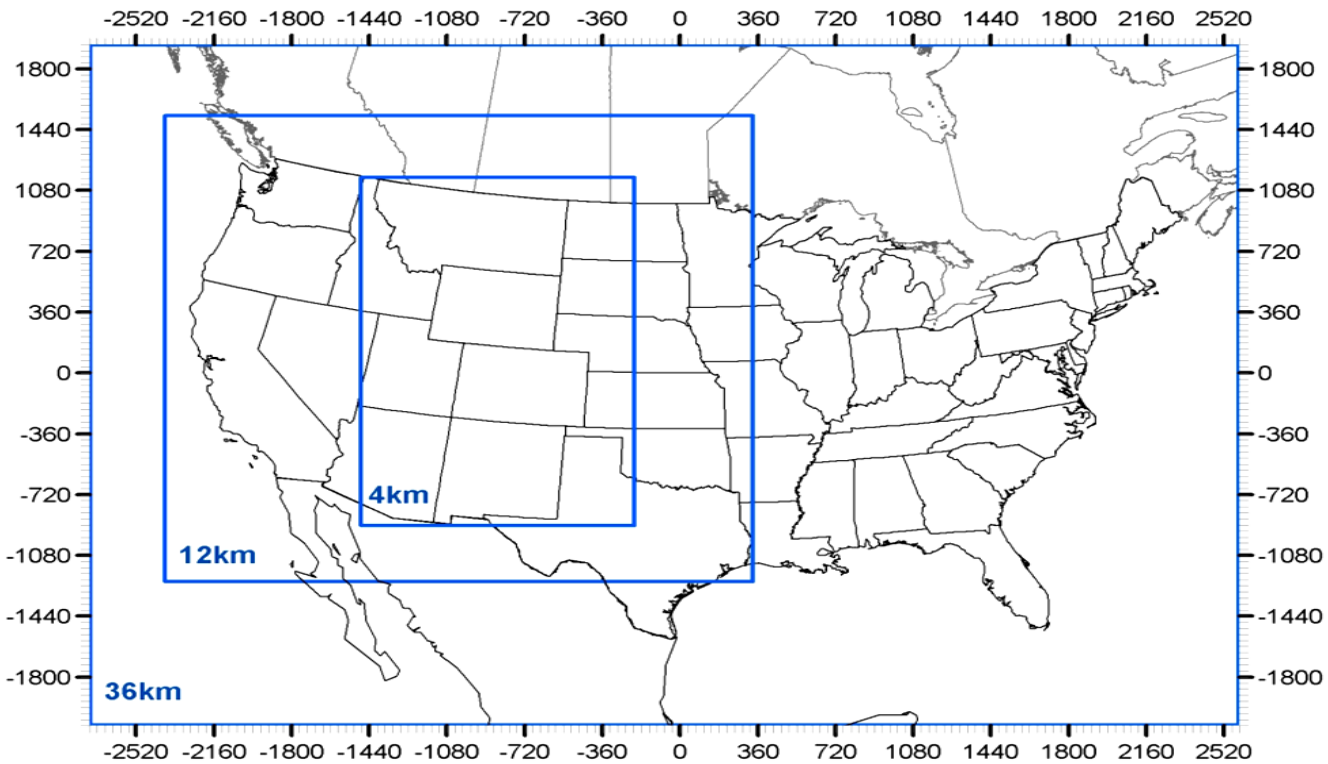
Western Regional Studies and Projects

West-Wide Jumpstart Air Quality Modeling Study

- Regional results provide data and context for state and federal planning
  - Uses most current transport and background studies
  - Meteorological and emissions modeling
    - Regionally consistent, High resolution, Comprehensive
  - Photochemical modeling
    - 2008 base case model performance evaluation with Ozone / PM source apportionment
  - Most up-to-date and complete characterization of Western U.S. air quality available

- Study completed September 2013
  - Emissions and Modeling data foundation of 3-State Data Warehouse
  - All materials at: http://www.wrapair2.org/WestJumpAQMS.aspx
  - Advances goal to provide a regional modeling framework

WestJumpAQMS Area

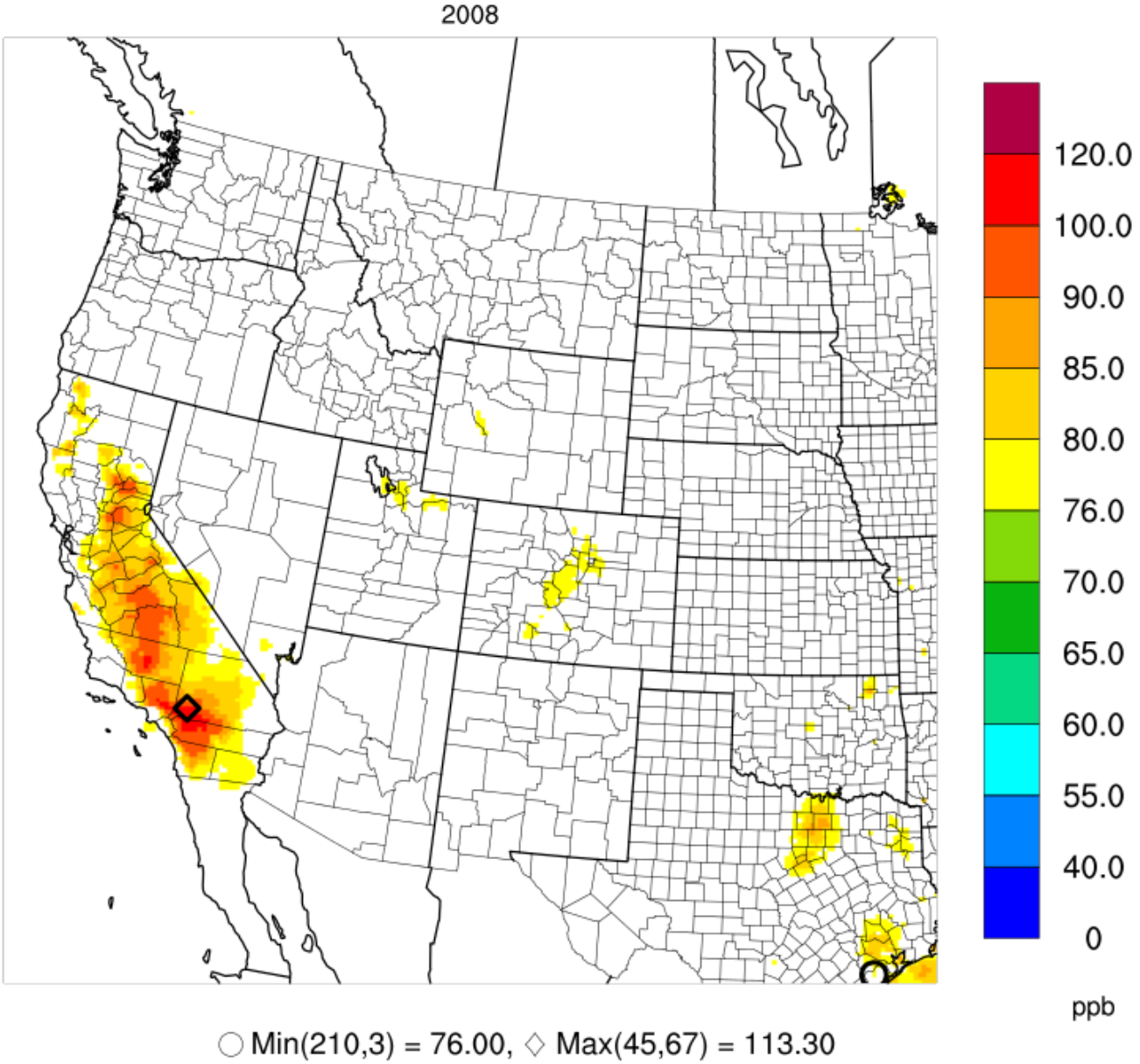


Modeling Domain

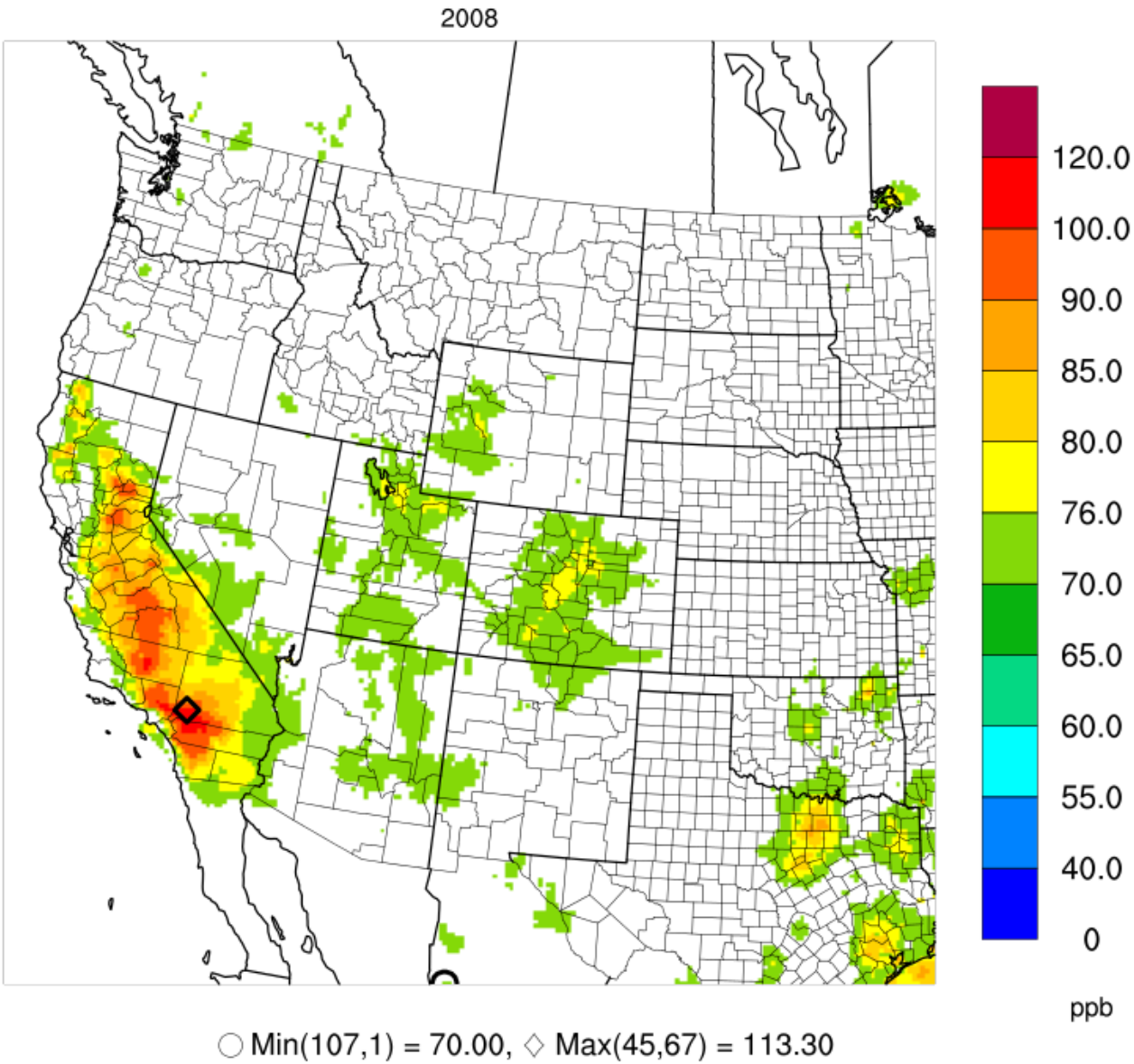
36km: 148 x 112 (-2736, -2088) to (2592, 1944)
12km*: 227 x 230 (-2388, -1236) to (336, 1542)
04km*: 317 x 515 (-1480, -904) to (-212, 1156)

* includes buffer cells

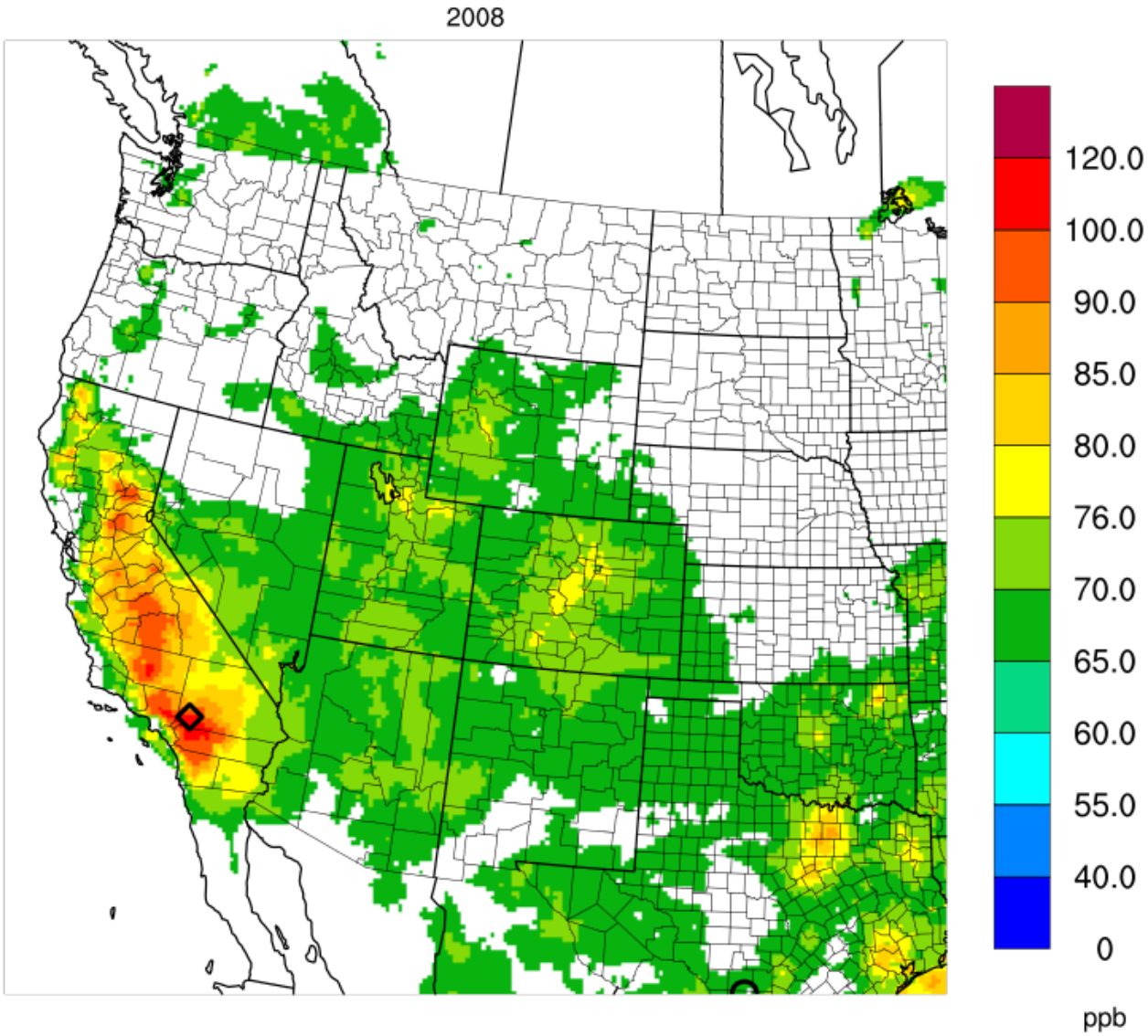
Ozone Modeled Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 76 ppb



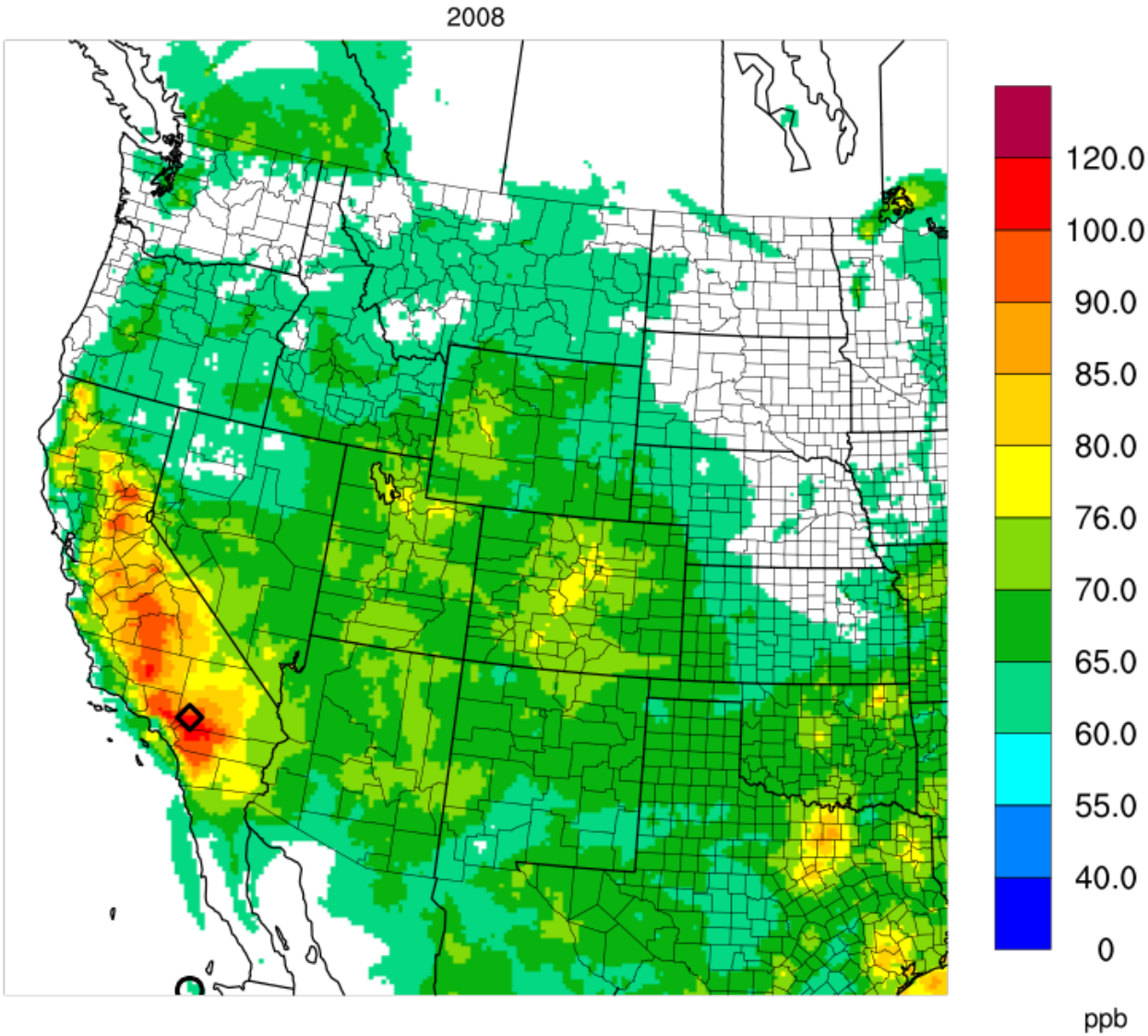
Ozone Modeled Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 70 ppb



Ozone Modeled Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 65 ppb



Ozone Modeled Attainment Test Software – Unmonitored Area Analysis with Design Value (2006-2010) ≥ 60 ppb



○ Min(45,2) = 60.00, ◇ Max(45,67) = 113.30

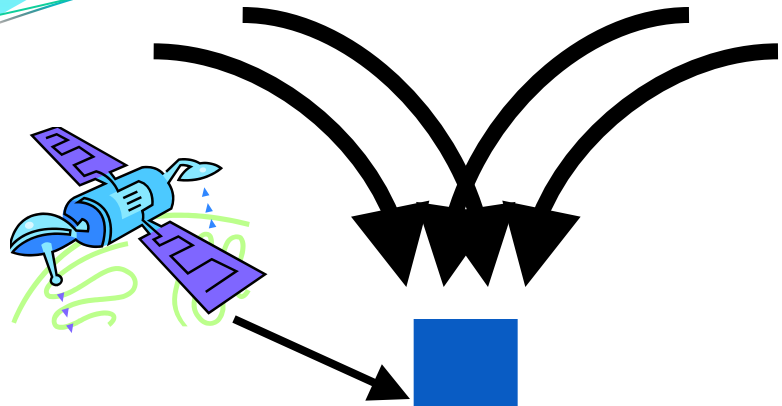
Tracking and Managing Smoke

- Significant impacts to both local and regional air quality
  - Large summer wildfires
  - Prescribed and agricultural burns in spring and fall
- States, locals, and tribes manage both planned burns & wildfire impacts
  - FLM Joint Fire Science Program projects enable continuing operation of WRAP's Fire Emissions Tracking System (**http://www.wrapfets.org/**)
  - Used daily by western states, tribes, and federal agencies to track planned fire and manage smoke
  - FETS
    - Used by states and OAQPS to evaluate 2008 NEI
    - Fire activity and emissions data used by EPA contractor for 2011 NEI
    - Will be applied in 2014 NEI

Track activity and emissions

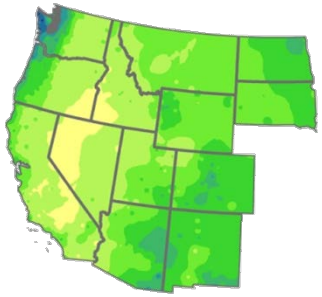
Determine source impact / contribution

Fire Activity Data (acres/day)



Loading

Moisture

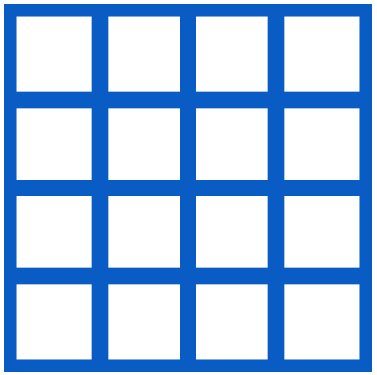


Emissions Model

FETS

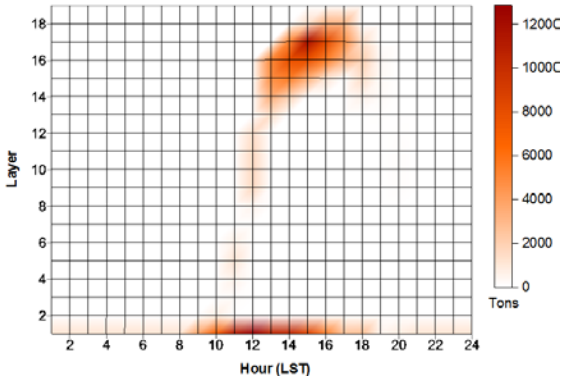
DEASCO$_3$ & PMDETAIL

distribute emissions

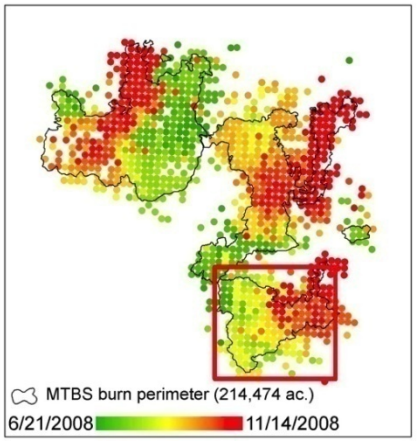


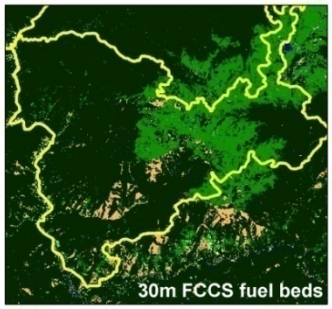
Chemical Profiles

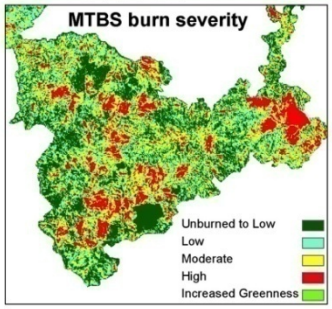
loft emissions



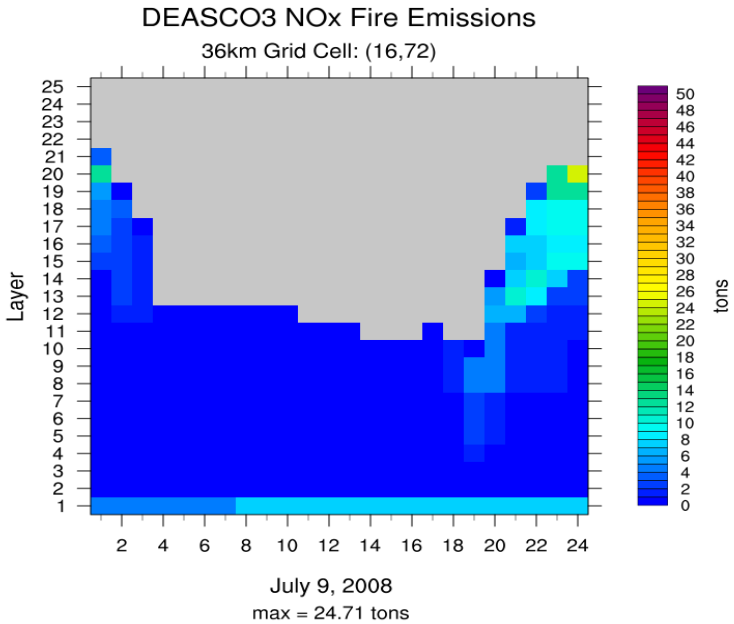
Smoke and Emissions Inventory Research



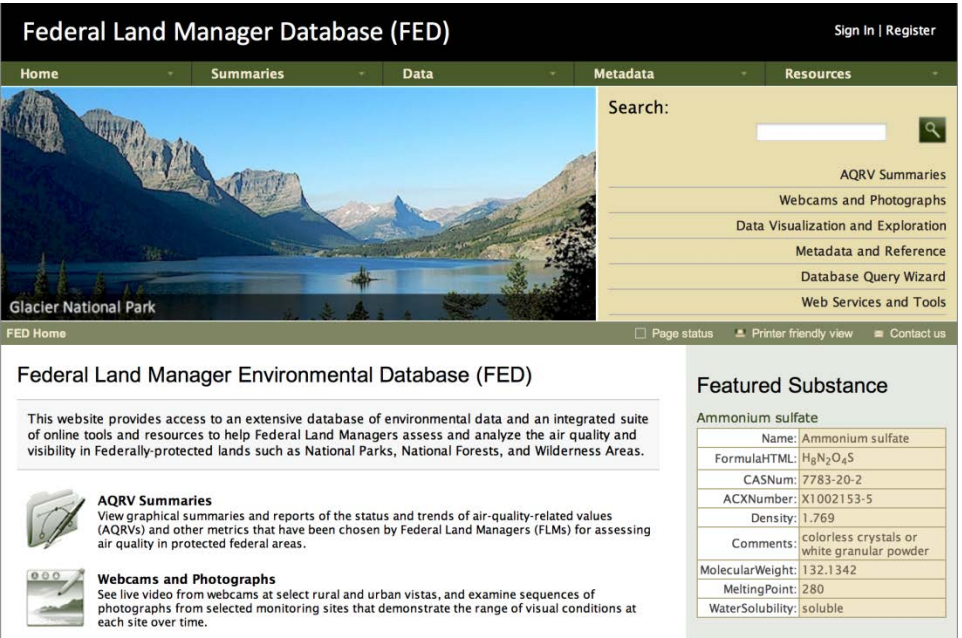




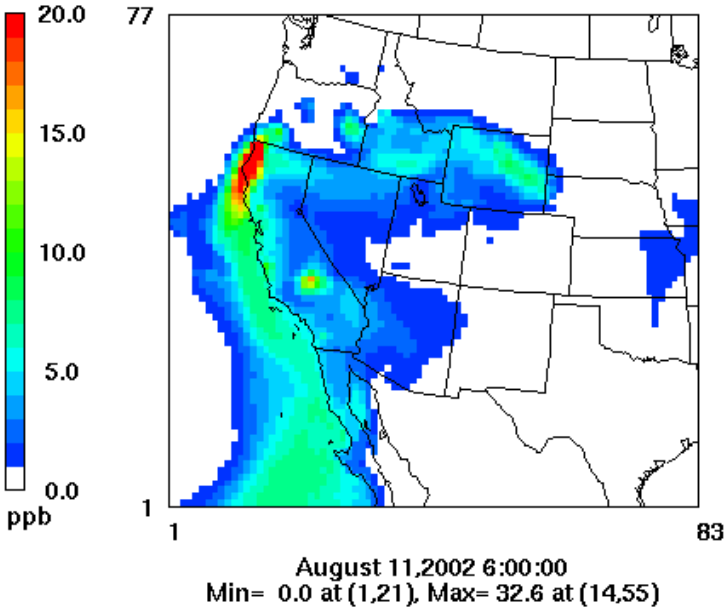
- Acres constrained by perimeter
- Daily growth & composite fuel loading
- Consumption scaled by severity



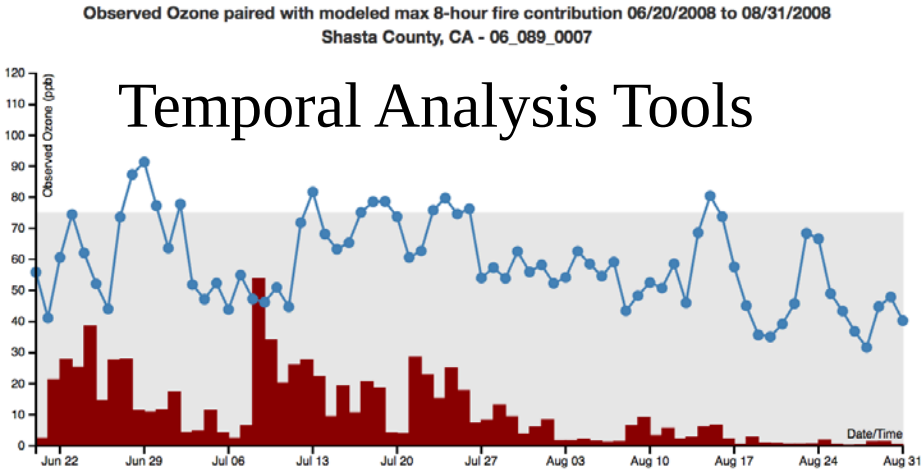
Smoke and Populations



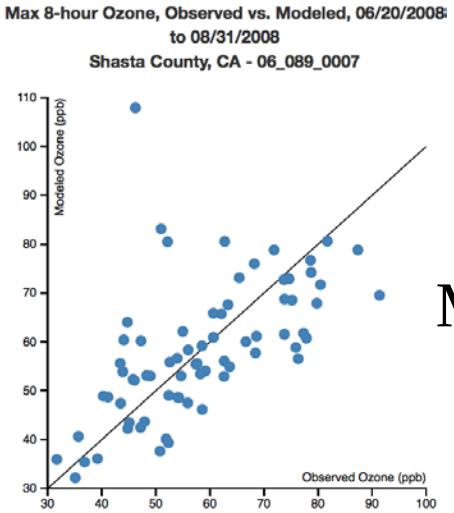
Fire and Smoke Model Evaluation



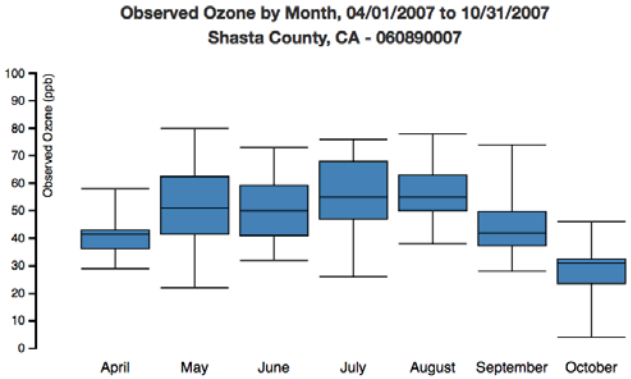
Temporal Analysis Tools



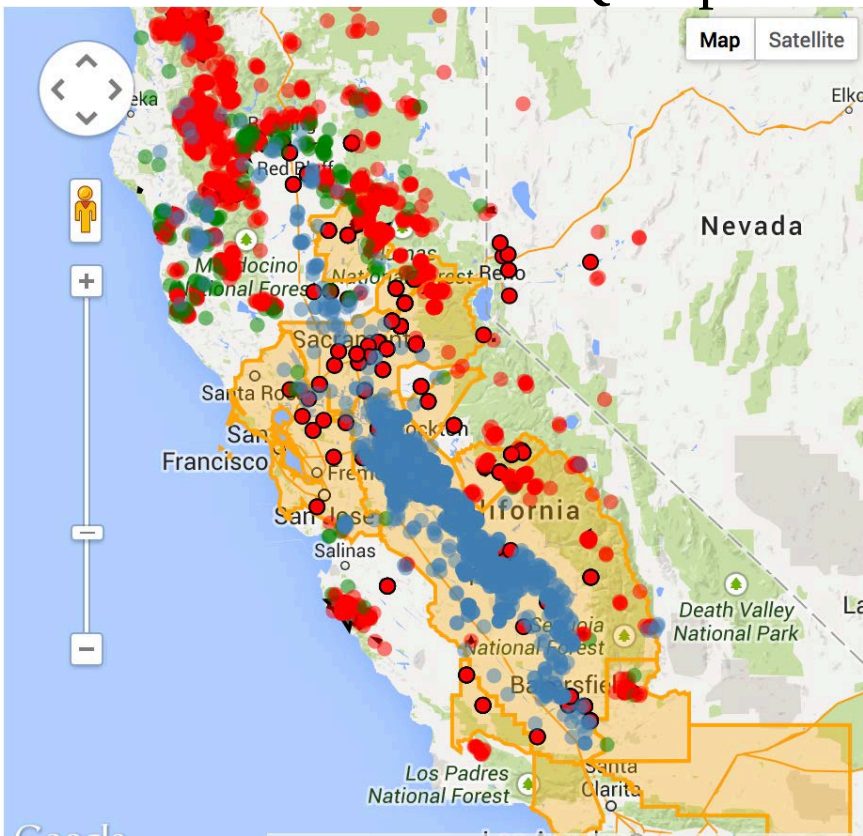
Model Evaluation

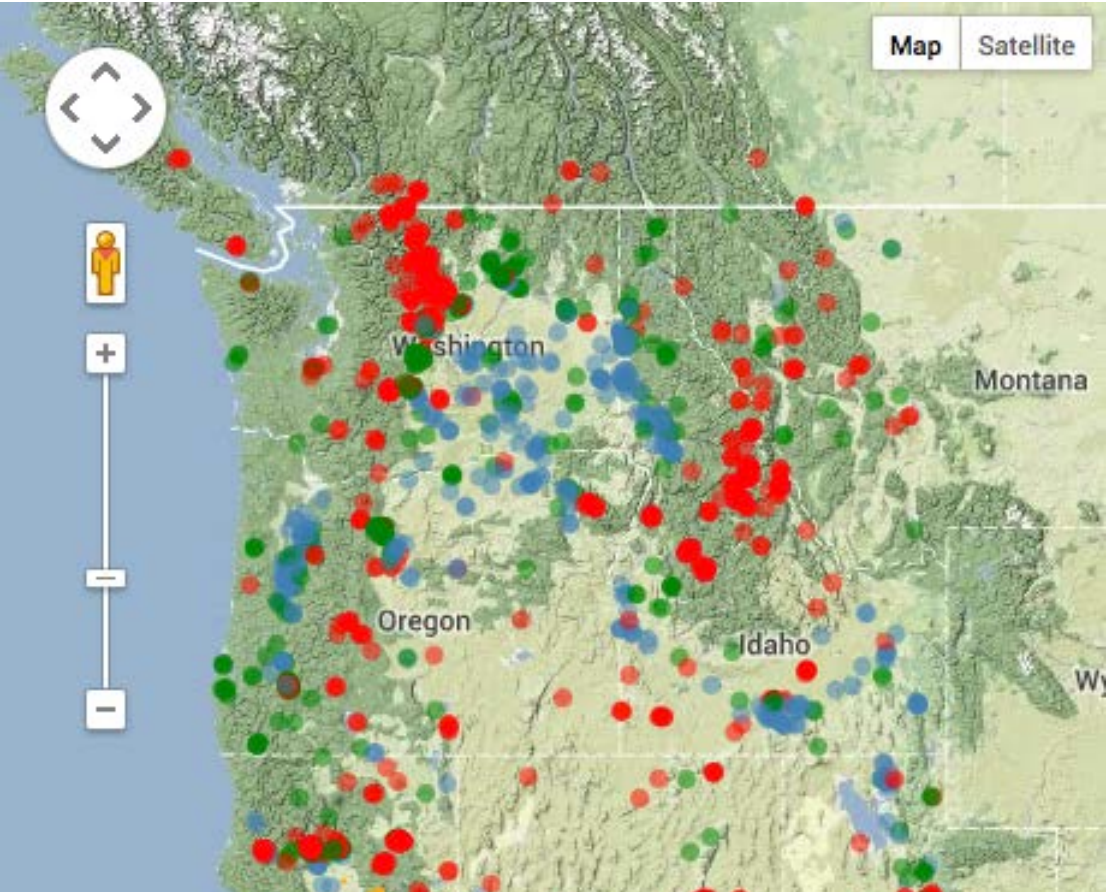


Fire Contributions to AQ Impacts



Inter-annual Observational Analysis

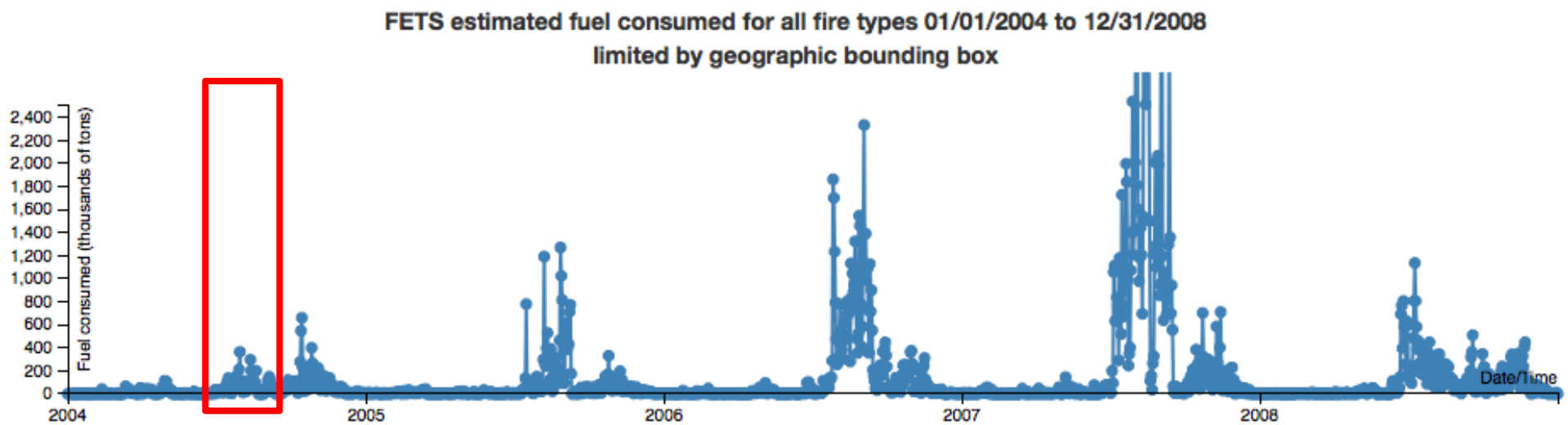


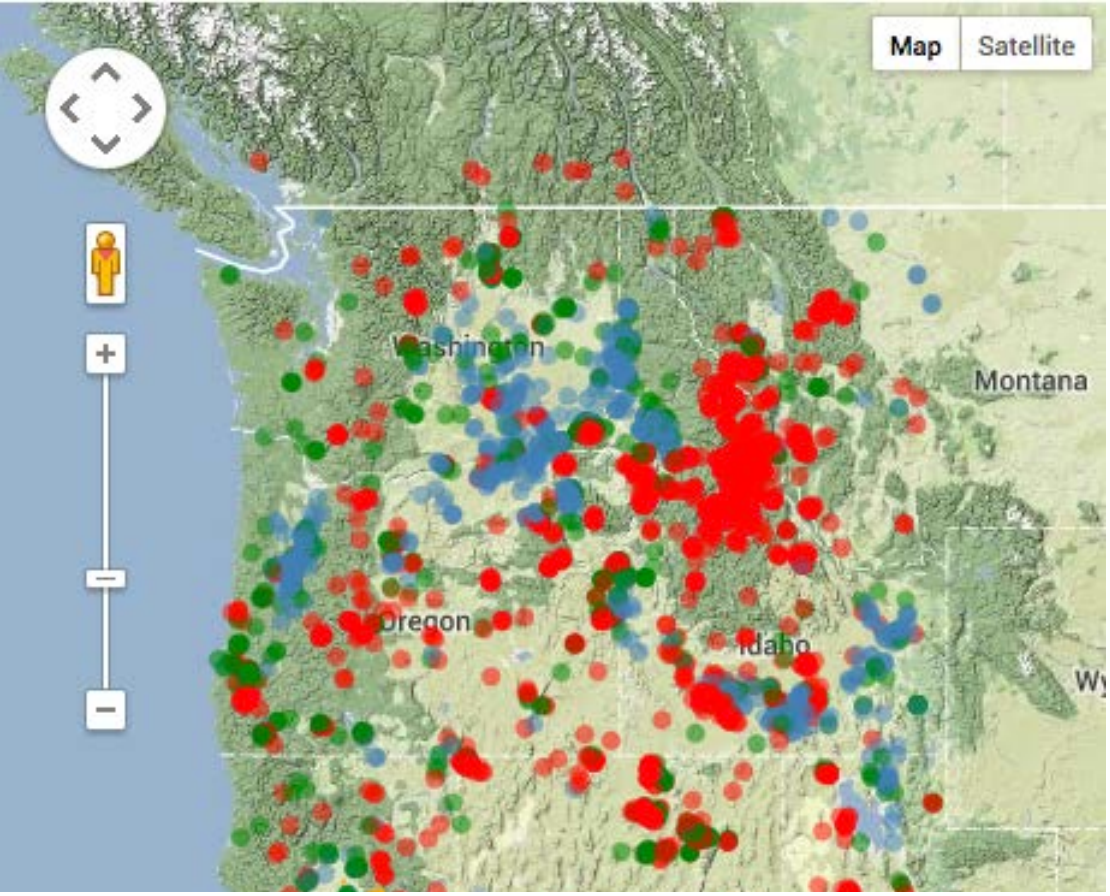


2004

6/20 – 8/31

Limited by bounding box





2005

6/20 – 8/31

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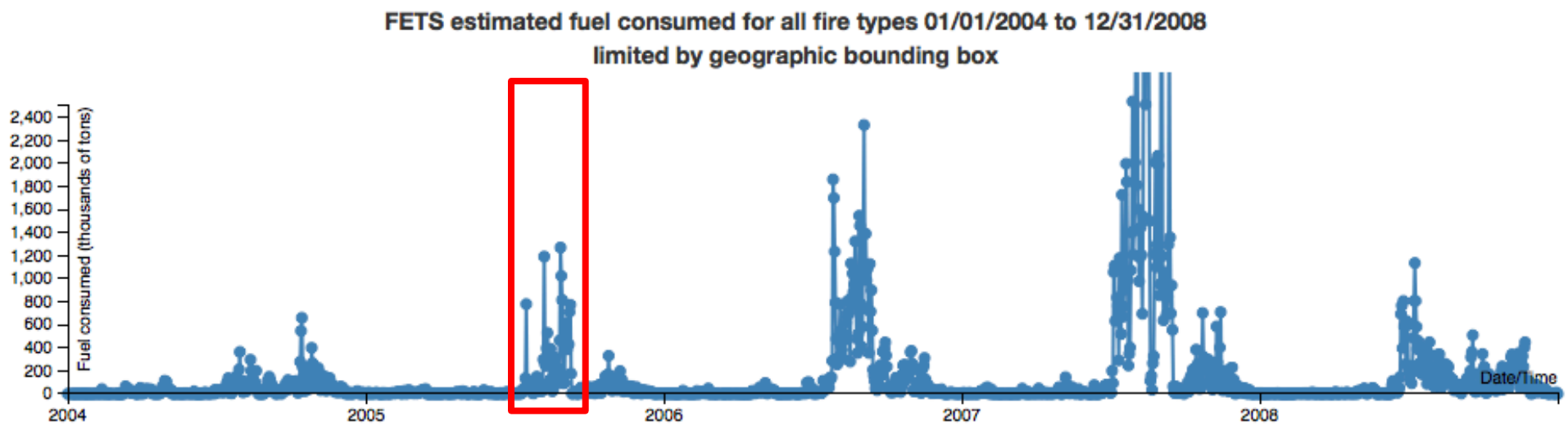

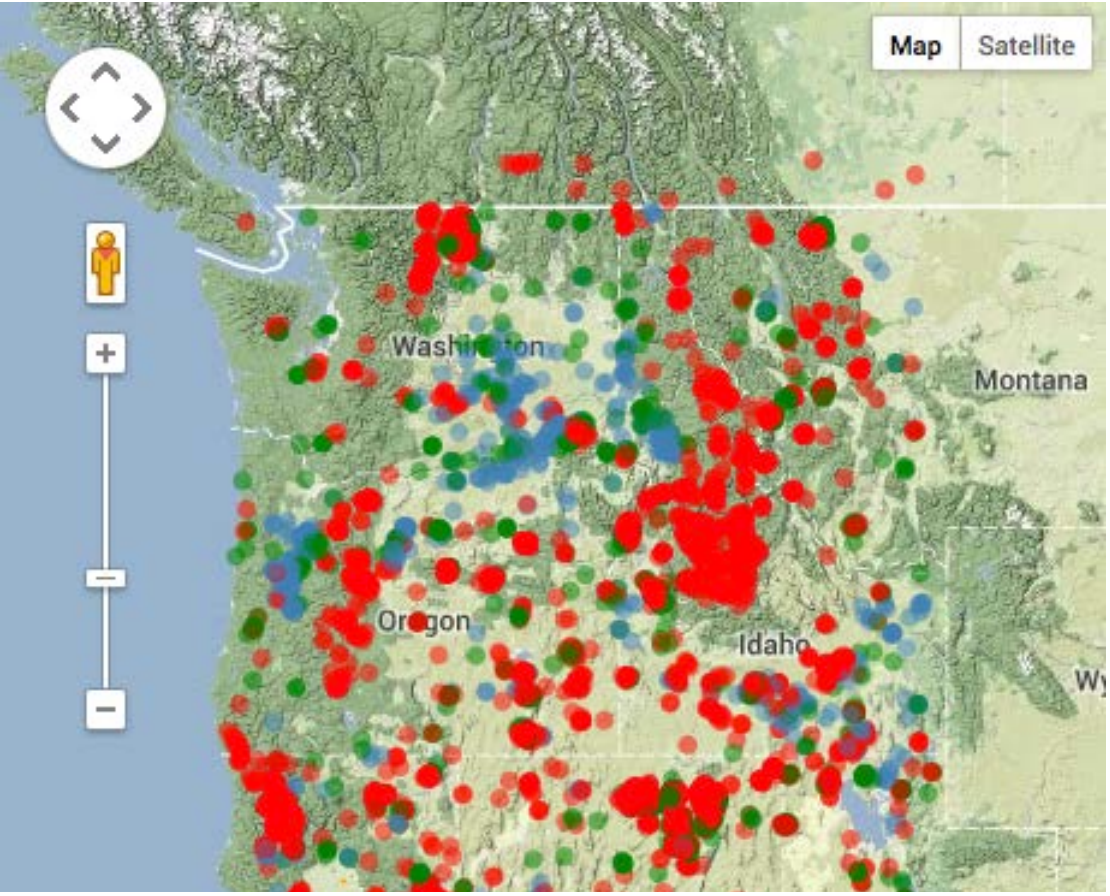

2006

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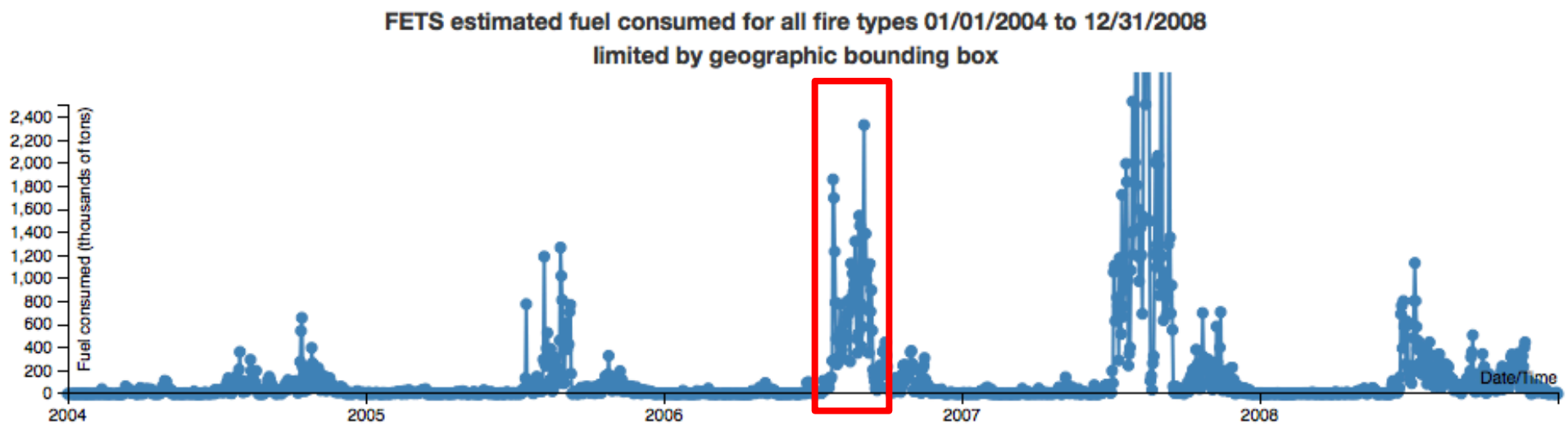

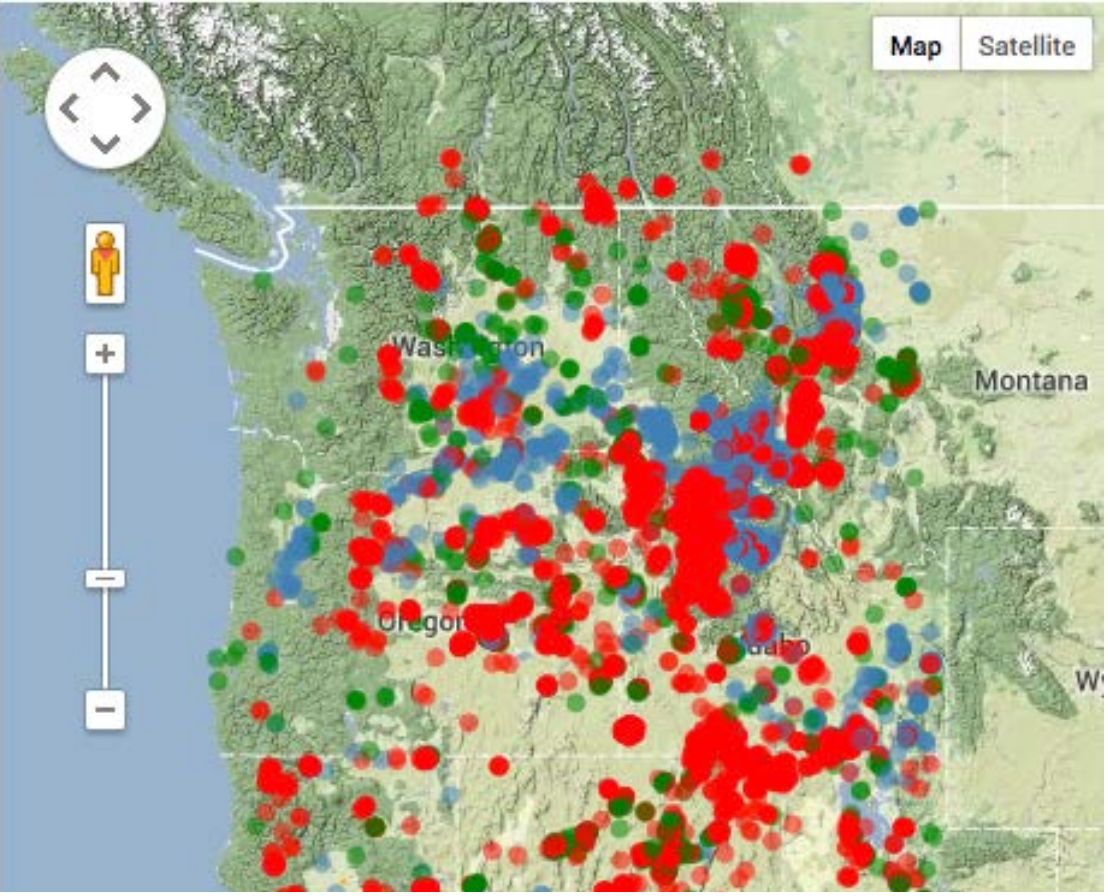

2007

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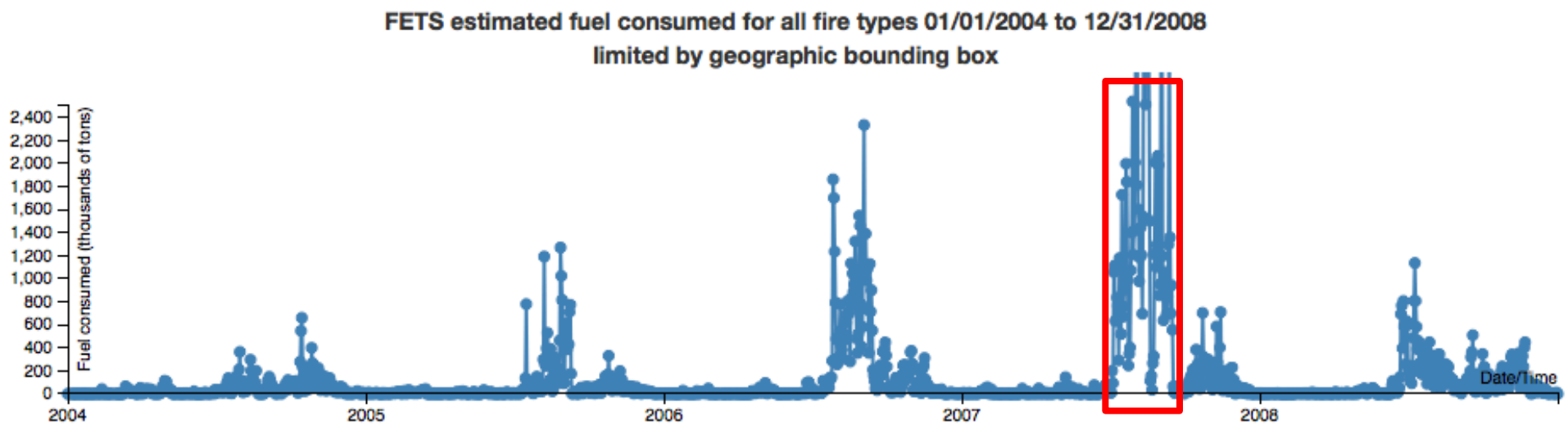

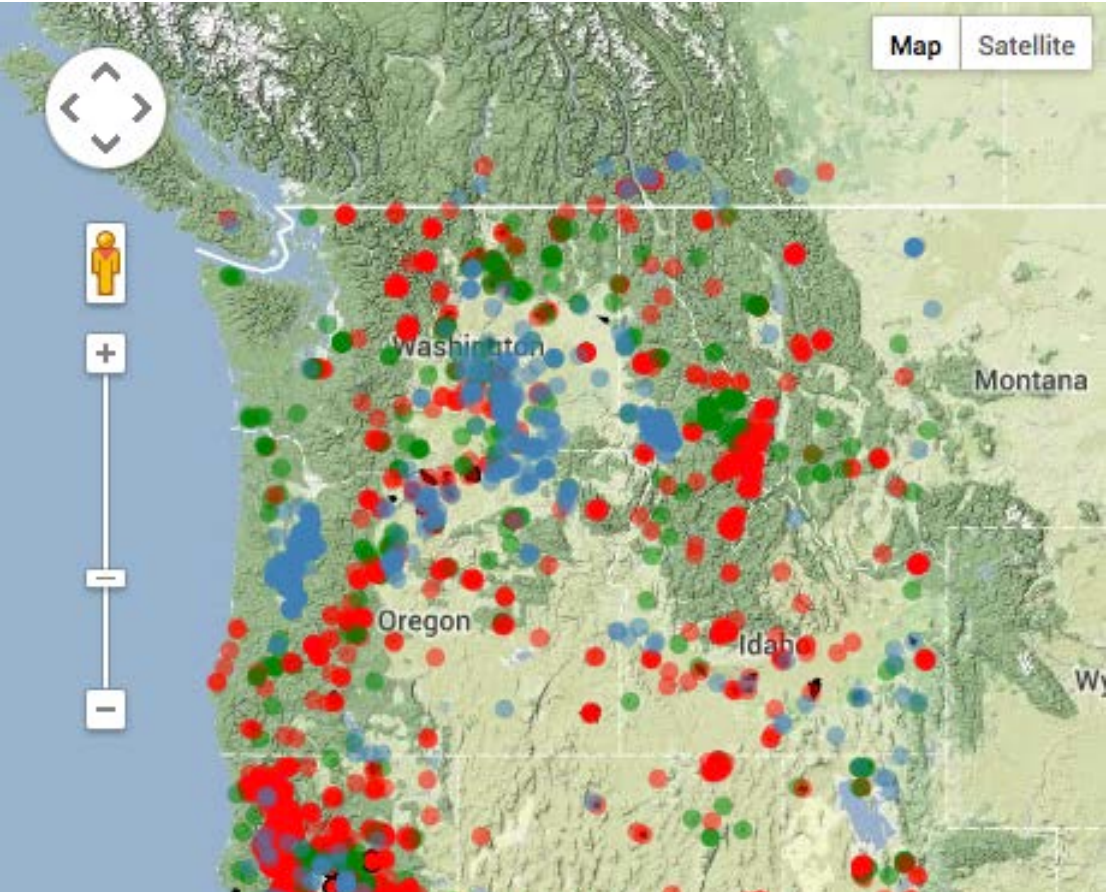

2008

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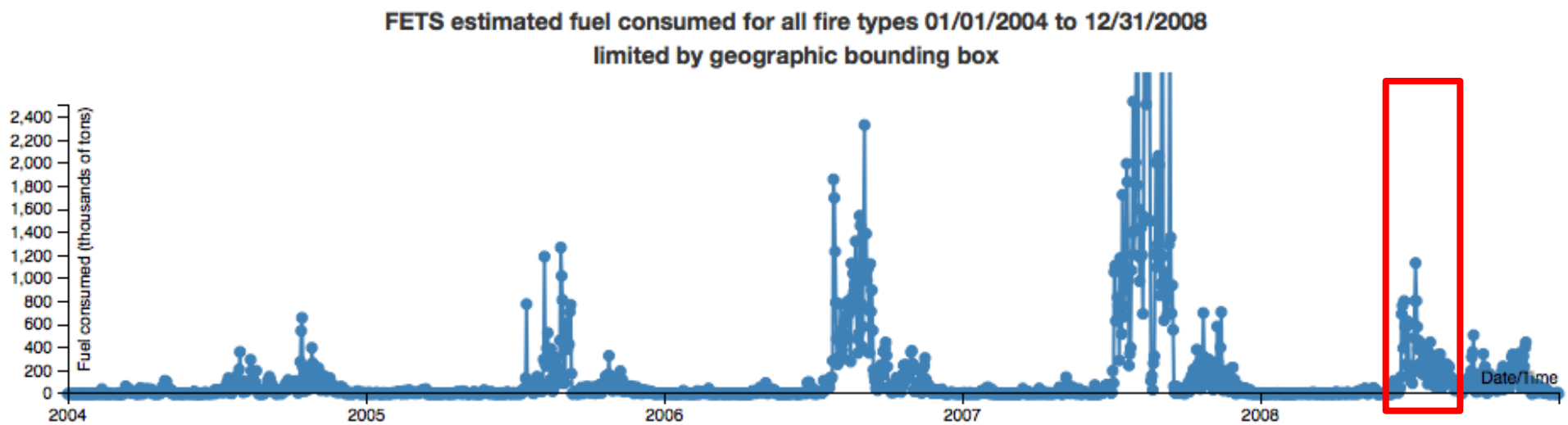


Exceptional Events Support

The following case studies are related to the Exceptional Events Support analysis type. To begin click on one of the case studies to review it, or select **Start a New Analysis** to begin creating your own study.

The purpose of this analysis tool is to assist with understanding whether fire might have contributed to an ozone exceedance; and assist with knowing what kind of information might be helpful to a state for preparing an Exceptional Event demonstration package(s) for air quality excursions affected by fire and smoke. The effects of wildland fire on ozone are complex, and meeting the exceptional events requirement is difficult for most if not all fire occurrences. This is, in part, because wildland fires occur at the same time of high ozone caused by anthropogenic emissions. Thus, separating the contribution of wildland fire from anthropogenic emissions is challenging: the but-for test. Yet, EPA requires this for their concurrence. Using the combination of observed ozone and CMAX model output, this tool examines selected cases—planned, unplanned, and combinations of the two—fires contribution to ozone impacts.

Exceptional Events Support Overview

A State Exceptional Event demonstration package must provide evidence that:

A. The event affects air quality, is not reasonably controllable or preventable, and is an event caused by human activity that is unlikely to recur at a particular location or a natural event;
B. There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;
C. The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and
D. There would have been no exceedance or violation but for the event.

States are responsible for demonstrating to EPA that unplanned fires or certain planned fires were responsible for an exceedance of the ozone standard at a particular monitoring site or group of sites. In attempting to make this demonstration, a state may request certain information from land managers. This might include: the smoke emissions; particulate monitoring particular to the fire or photographs; the timing of the burn along with how it was distributed through the day in terms of combustion and smoldering; and to what extent smoke management regulations were complied with

Review a Related Analysis

Title	Sections
Biscuit Wildfire	10
Chatfield, CO July 2004-2007	16
Chatfield, CO July 2008	12
Evans Road Wildfire (Pocosin NWR) / Peat burning	12
Fall burning in southern Louisiana, 2008	9
Flint Hills	8
McNally Wildfire	6
Missionary Ridge & Hayman Wildfires	7
Northern California Wildfires, 2008	17

edit list

These are the current analyses associated with Exceptional Events Support. To review an

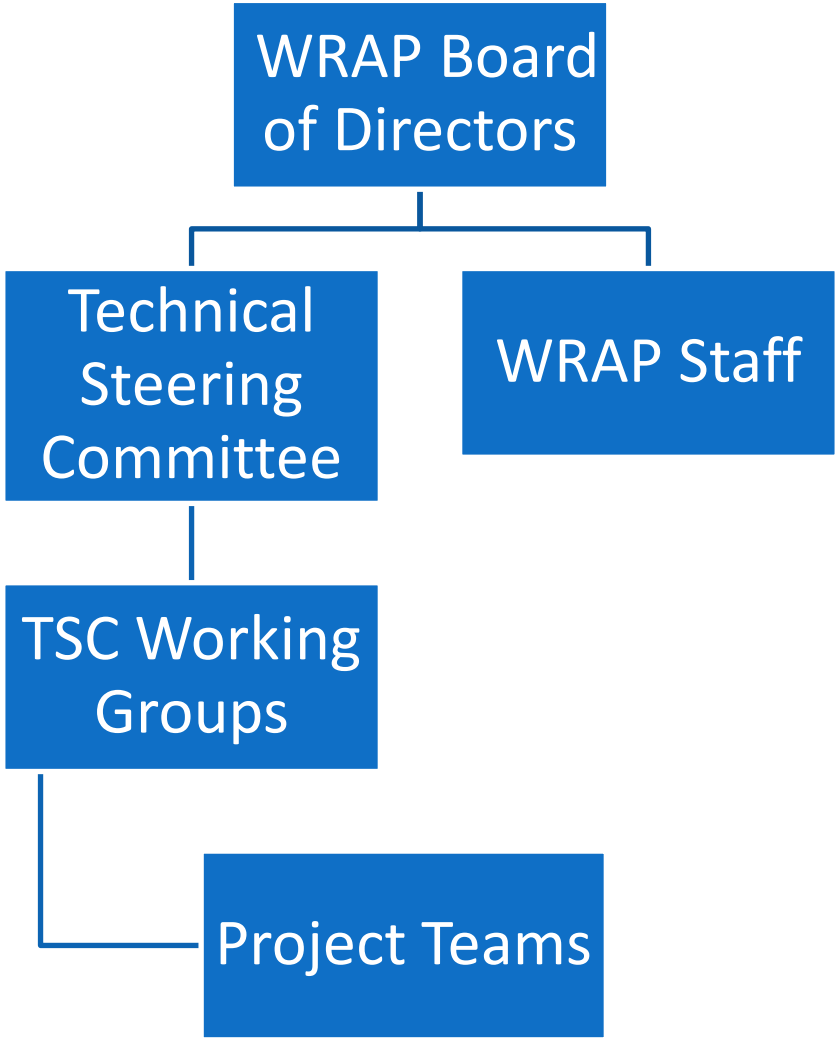
Regional Haze: Reasonable Progress Reports + July 2018 SIP

- WRAP produced a comprehensive, regionally-consistent technical report – completed Summer 2013
  - Regional, state, and Class I area reports
  - Technical analyses required by Regional Haze Rule
  - Western states will use as a common basis in preparing individual SIP revisions
  - Progress report SIP revisions are due in the 2013-15 timeframe
- WRAP providing western 2008 emissions data
  - Leveraged from WestJumpAQMS
  - States will use to evaluate changes in monitored visibility
- Project reports at: http://www.wrapair2.org/reghaze.aspx
- Regional technical support for July 2018 SIPs in WRAP Work Plan

3-State Air Quality Study - Objectives

- Combined effort of States of CO, WY, UT, and NPS, BLM, EPA, and USFS
- Facilitate more complete and consistent AQ Analysis for NEPA and other AQ decisions such as SIP planning
- Improve timeliness and collaboration
- Reduce duplication of AQ analysis resulting in lower costs
- Improvements include:
  - Six new monitoring sites
  - More region-specific modeled emissions
  - More current base case and better future case air quality modeling
  - A data warehouse to contain all this improved information and future data for access by agencies and those they approve to use it

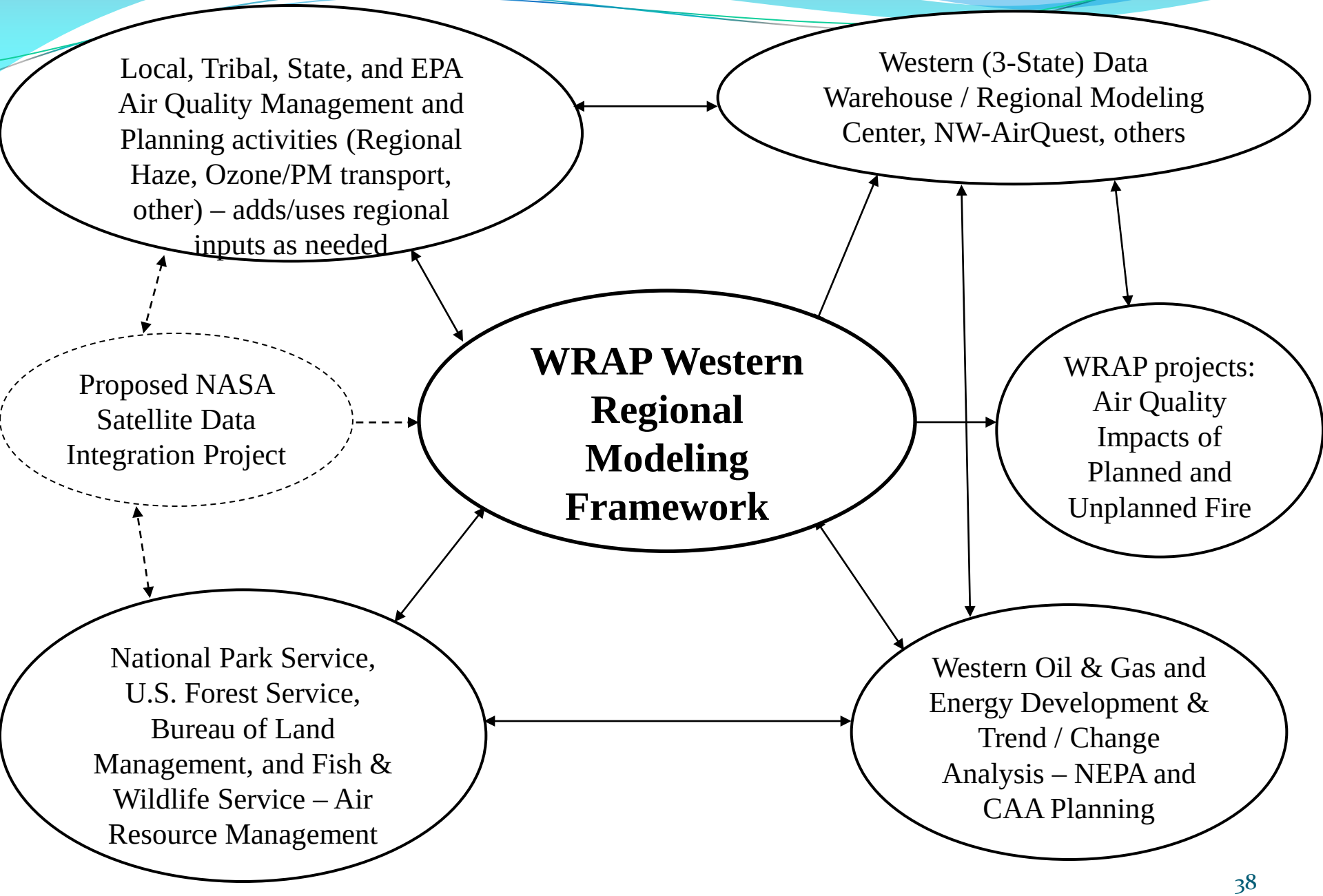
WRAP Work Plan - organizational structure



Opportunities for Western Data Warehouse and Applying Regional Modeling Results from Western Regional Technical Studies

- Leveraged studies address both regulatory planning needs and fill gaps where data are needed
  - Working for the users of the data
- Tracking key western source categories / source areas
  - Regionally consistent, comparable, transparent, and reproducible
- Modeling analyses of Ozone and PM background and transport on a routine basis and during elevated episodes
  - NEPA air quality studies
  - Background data for SIP planning
  - Impacts of fire on ozone and PM across West
- Better oil & gas, fire, biogenics emissions data
  - Improves assessment of natural vs. anthropogenic contributions
- Next Step – develop Western Air Quality Modeling Framework concept paper

WRAP members and relationship to regional technical activities



WRAP 2014-18 Integrated Work Plan – development, review , and adoption process

- All materials at: 2014-18 Integrated Work Plan
- Led by Technical Steering Committee
- Review Draft released week of Sept. 8th
- WRAP-wide review call on Thursday Oct. 2nd
- Comments through October
- Board review and adoption steps in Nov. and Dec.

Thanks –

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Western Regional Air Partnership | www.wrapair2.org

extra slides

Fire's Effects on Elevated Regional Ozone & PM

Deterministic & Empirical Assessment of Smoke's Contribution to Ozone (DEASCO$_3$) – completed Summer 2013

and leveraged companion study underway:

Prescribed and Other Fire Emissions: Particulate Matter Deterministic & Empirical Tagging & Assessment of Impacts on Levels (PMDETAIL)

Funding for both from FLM Joint Fire Sciences Program

Both projects, analysis toolbox / data, and FETS access at: http://wraptools.org/

New proposal under JFSP review:
Contribution of Smoke Emissions to Secondary Organic Aerosols (SOA): Real-World Evaluation of Fire SOA Emissions Factors from Fires in a Data Management System (REFERS-DMS)

Attributes of WRAP Regional Analysis and Planning Support Activities

Desirable Capabilities
Remote sensing/Satellite data,
Improved technical resolution for international transport,
Efficient regional data and decision support systems, et cetera

Necessary Regional Activities
Regional Haze Planning Support,
Tracking and Analysis of Controls, et cetera

Required Foundational Activities
(Western Regional Modeling Framework,
Tracking and Projection of Regional Emissions,
Preparation/delivery of ready-to-use Datasets, e.g., Monitoring, Meteorology, et cetera

Coordination with western air agencies ensures that the WRAP serves as a resource and repository for federal, state, tribal and local air planning activities.

3-State Data Warehouse

Western Regional Modeling Framework (future)