WRAP Regional Analysis: Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS) efforts and Greater San Juan Basin updates

Four Corners Air Quality Group Update Meeting
December 1, 2016

Tom Moore

WRAP Air Quality Program Manager

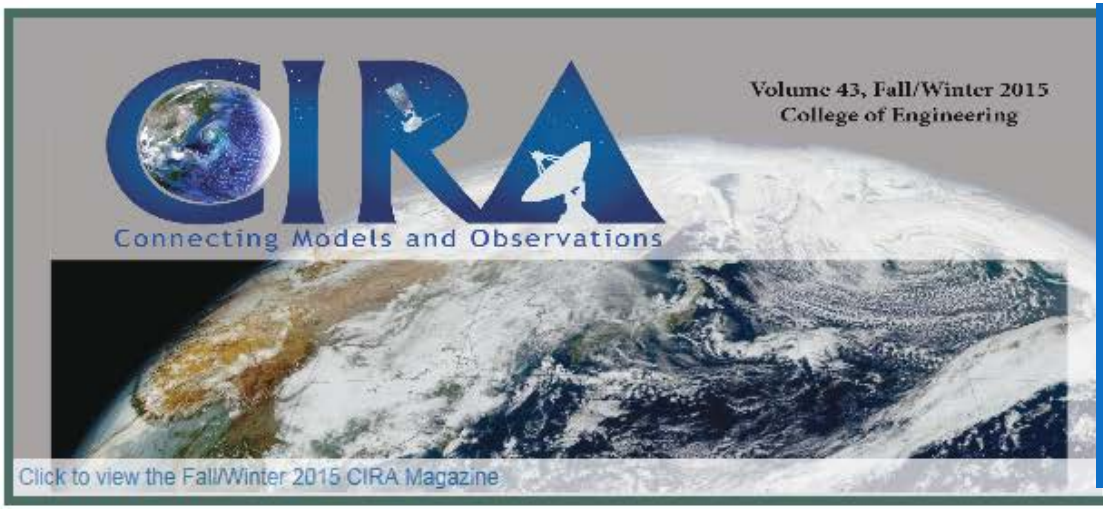
WESTAR Council

WESTAR
Western States Air Resources Council

www.westar.org

WRAP
Western Regional Air Partnership

www.wrapair2.org



Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS)

Applying the geographic and technical scope of the IWDW-WAQS for Air Quality analysis and planning.

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

CIRA is a cooperative institute that is also a research department within **CSU's College of Engineering**, in partnership with the **Department of Atmospheric Science**. Its vision is to conduct interdisciplinary research in the atmospheric sciences by entraining skills beyond the meteorological disciplines, exploiting advances in engineering and computer science, facilitating transitional activity between pure and applied research, leveraging both national and international resources and partnerships, and assisting

Current Conditions

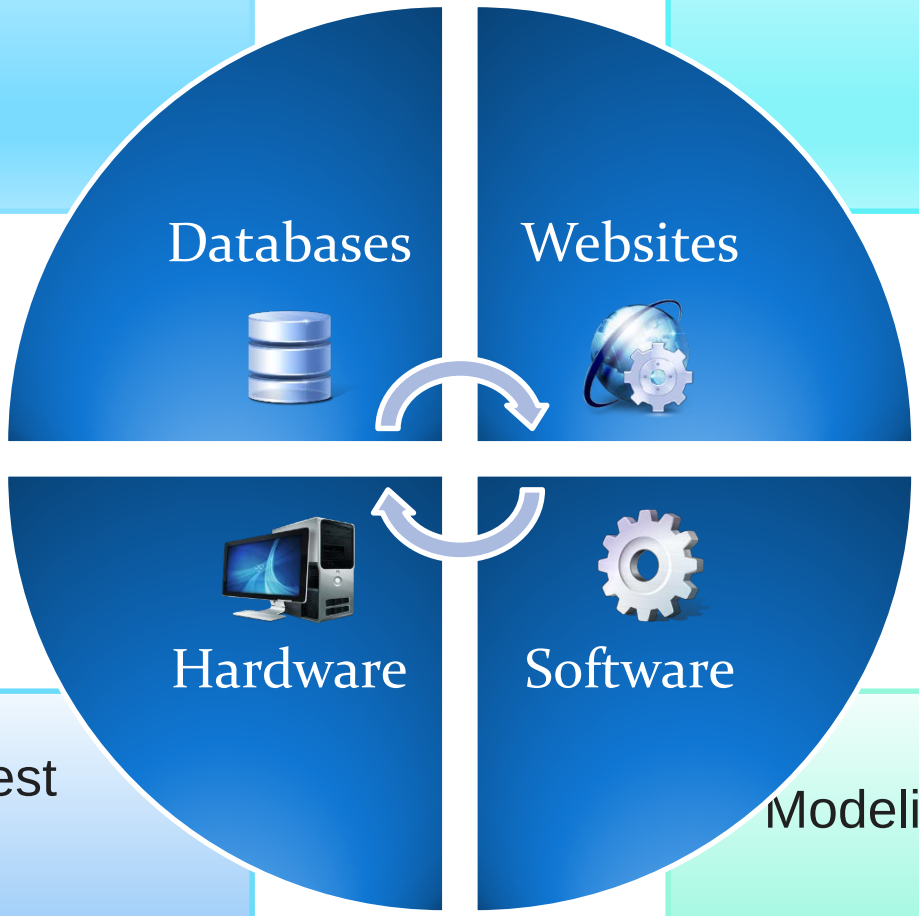
Temp:	75.6 F
Dew Point:	43.6 F
Relative Humidity:	32 %
Wind:	3.0 mph (NE)
Precip:	0.00 in
Barometer:	29.554 in

NPS Air Quality Conditions & Trends Tools (nps.gov)

Partners: NPS/ARD

Federal Land Manager Environmental Database (FED)

Partners: NPS, USFS



Intermountain West Data Warehouse (IWDW)

Partners: NPS, BLM, USFS, EPA, CO, WY, UT, NM

Southeastern Modeling, Analysis, and Planning (SEMAP)

Partners: EPA, AL, FL, GA, KY, MS, NC, SC, TN

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Partners: NPS

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Partners: AL, FL, GA, KY, MS, NC, SC, TN

Hardware

Software

Databases

- Schema design
- Data import & update
- Administration
- Query design

Relational database:

- 800,000,000 records
- 62 air quality networks
- 63 water quality networks
- 24 modeling and satellite datasets

File server:

- ~107 Terabytes of online data
- ~100 Terabytes of offline data
- ~85 Terabytes downloaded/transferred
- 7 complete modeling platforms

NPS Air Quality Conditi
(nps.gov)

Partners: N

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Hardware

Software

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Southeastern Modeling, Analysis, and Planning (SEMAP)

Partners: AL, FL, GA, KY, MS, NC, SC, TN

Websites:

- FED
- SEMAP
- IWDW
- NPSCAT
- TSS
- IMPROVE

Websites

- Website design
- Web hosting
- Tool development
- Web services

NPS Air Quality Conditions & Trends Tools (nps.gov)

Partners: NPS

Federal Land Manager Environmental Database

Partners: NPS, USFS

Databases

Websites

Hardware

Software

- Data access libraries
- Data manipulation
- Visualization tools
- Data analysis

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Databases

Websites

Hardware

- Server configuration
- Server maintenance
- Networking
- Troubleshooting & repair

Software

Intermoun
Data Wareh

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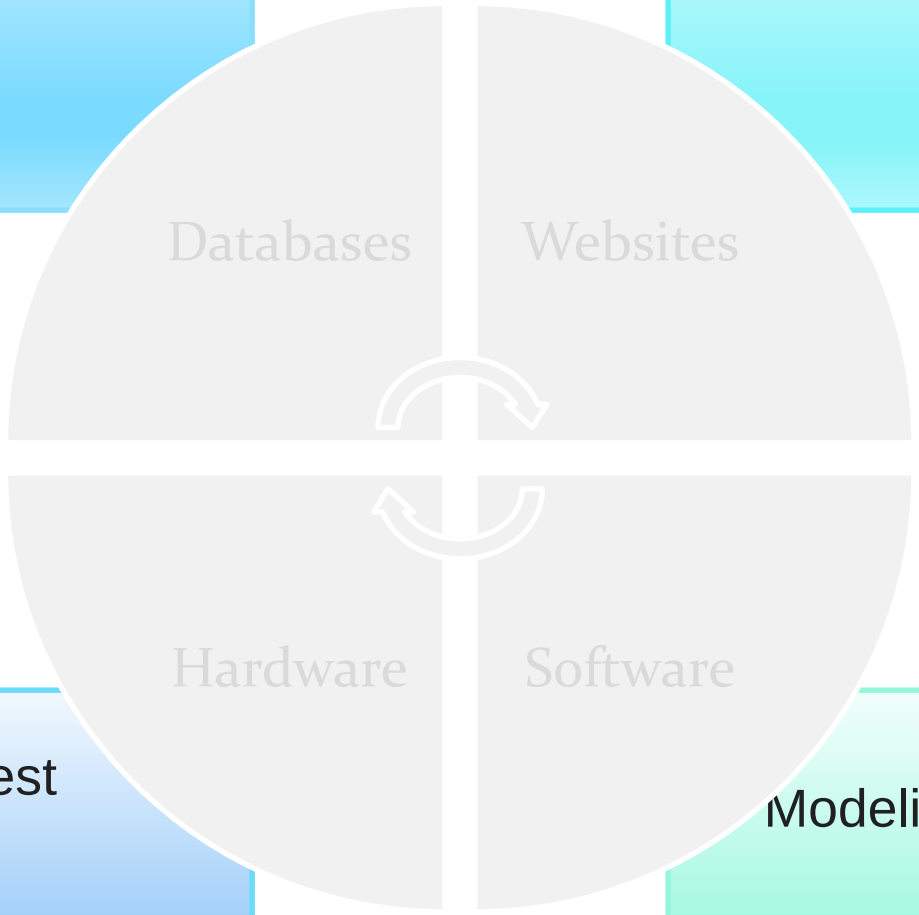

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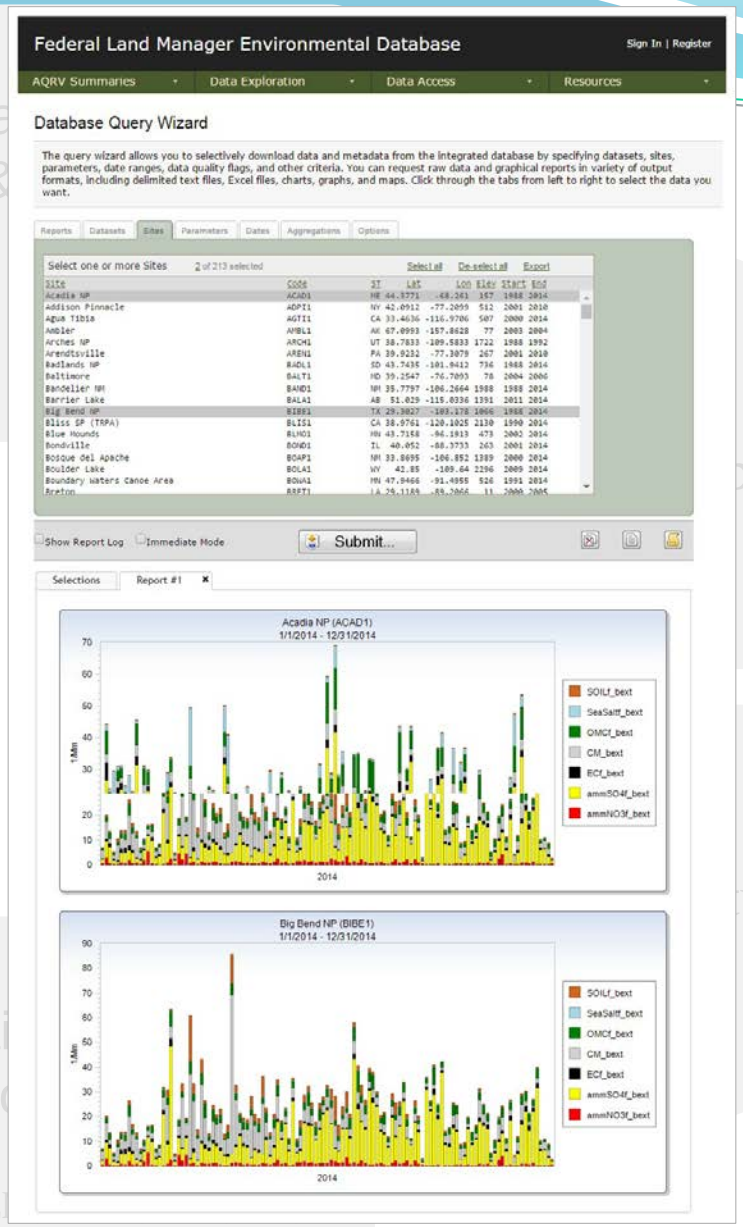

http://views.cira.colostate.edu/fed

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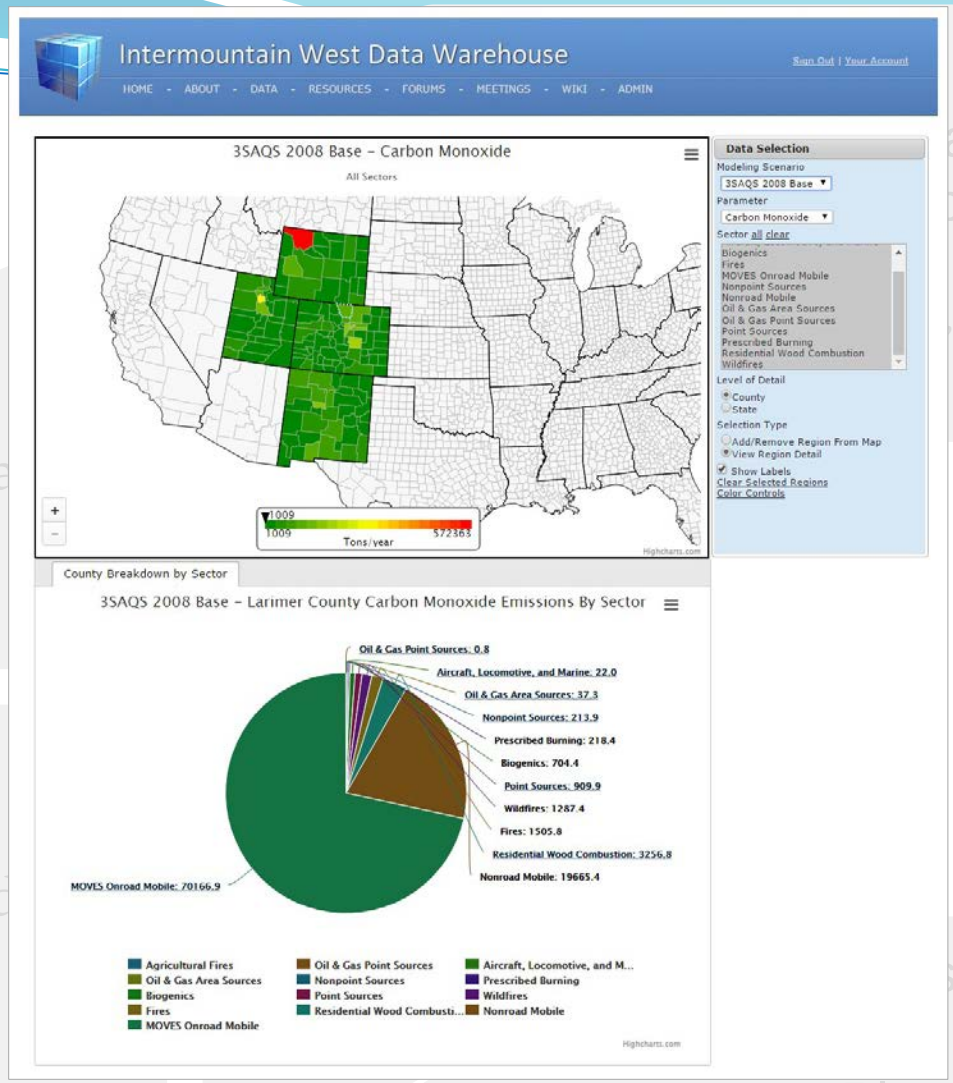

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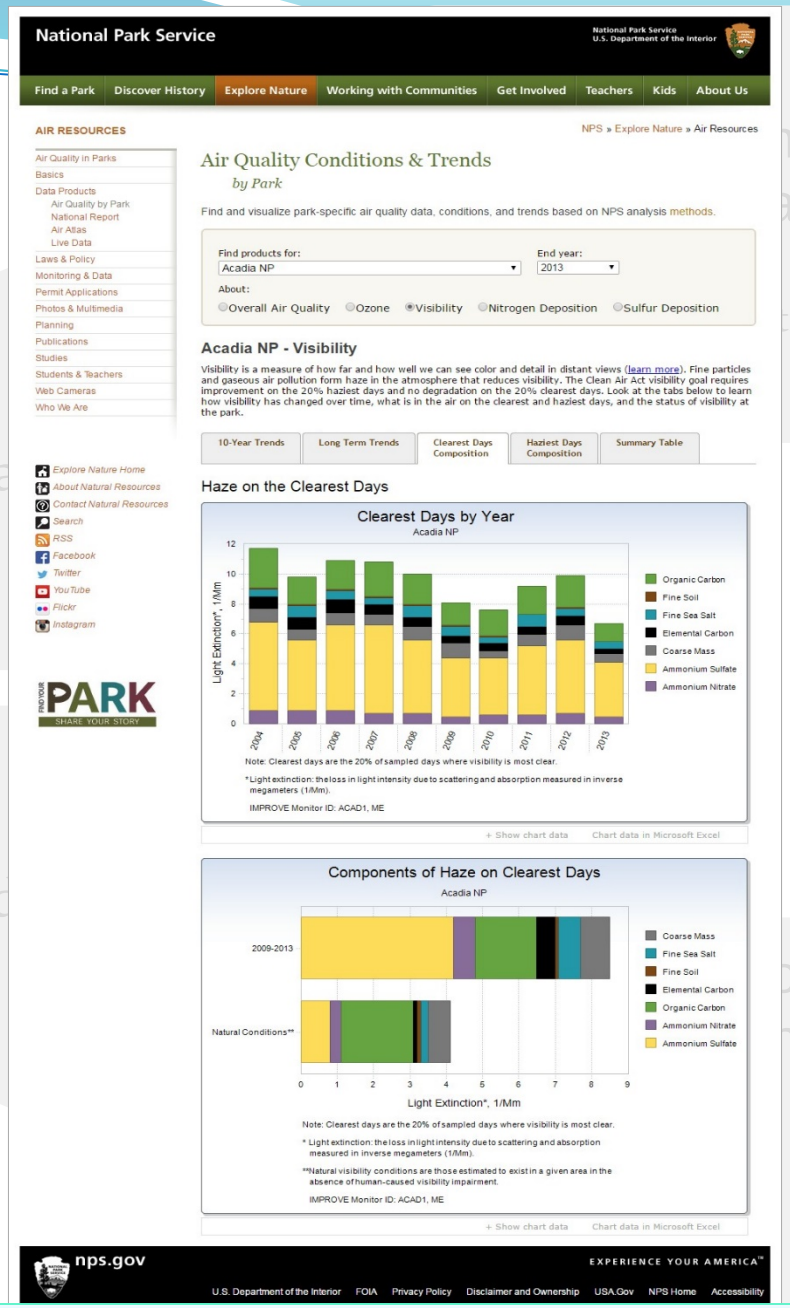

http://www.nature.nps.gov/air/data/products/parks/index.cfm

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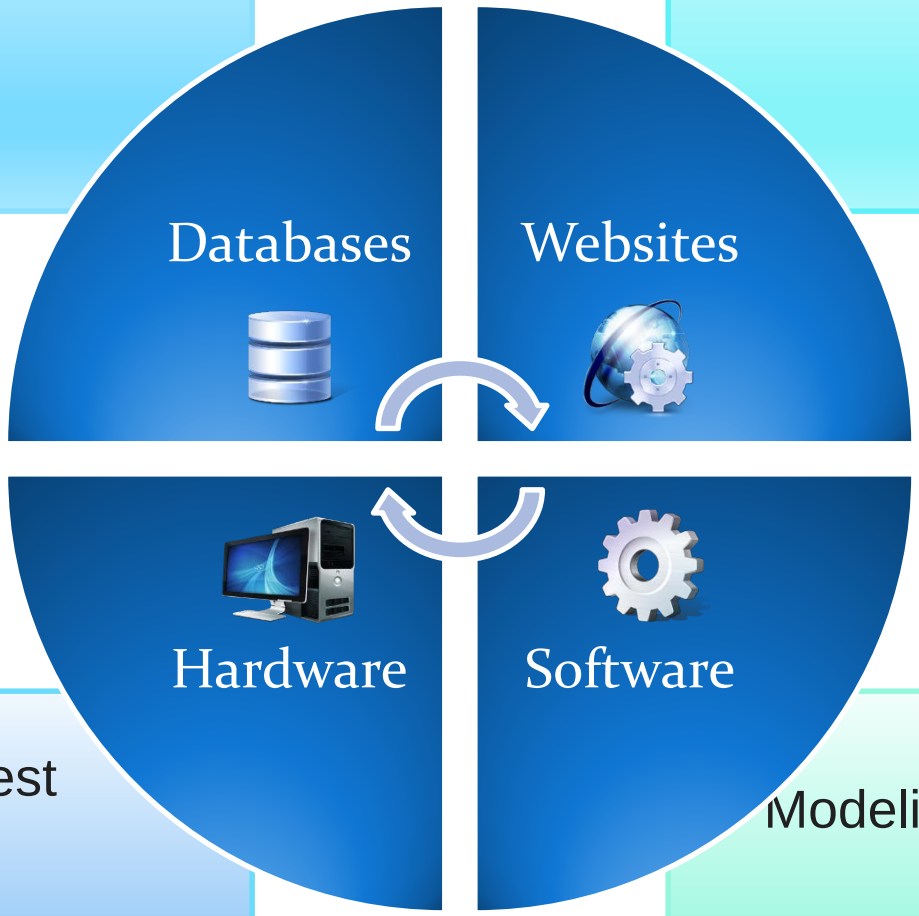

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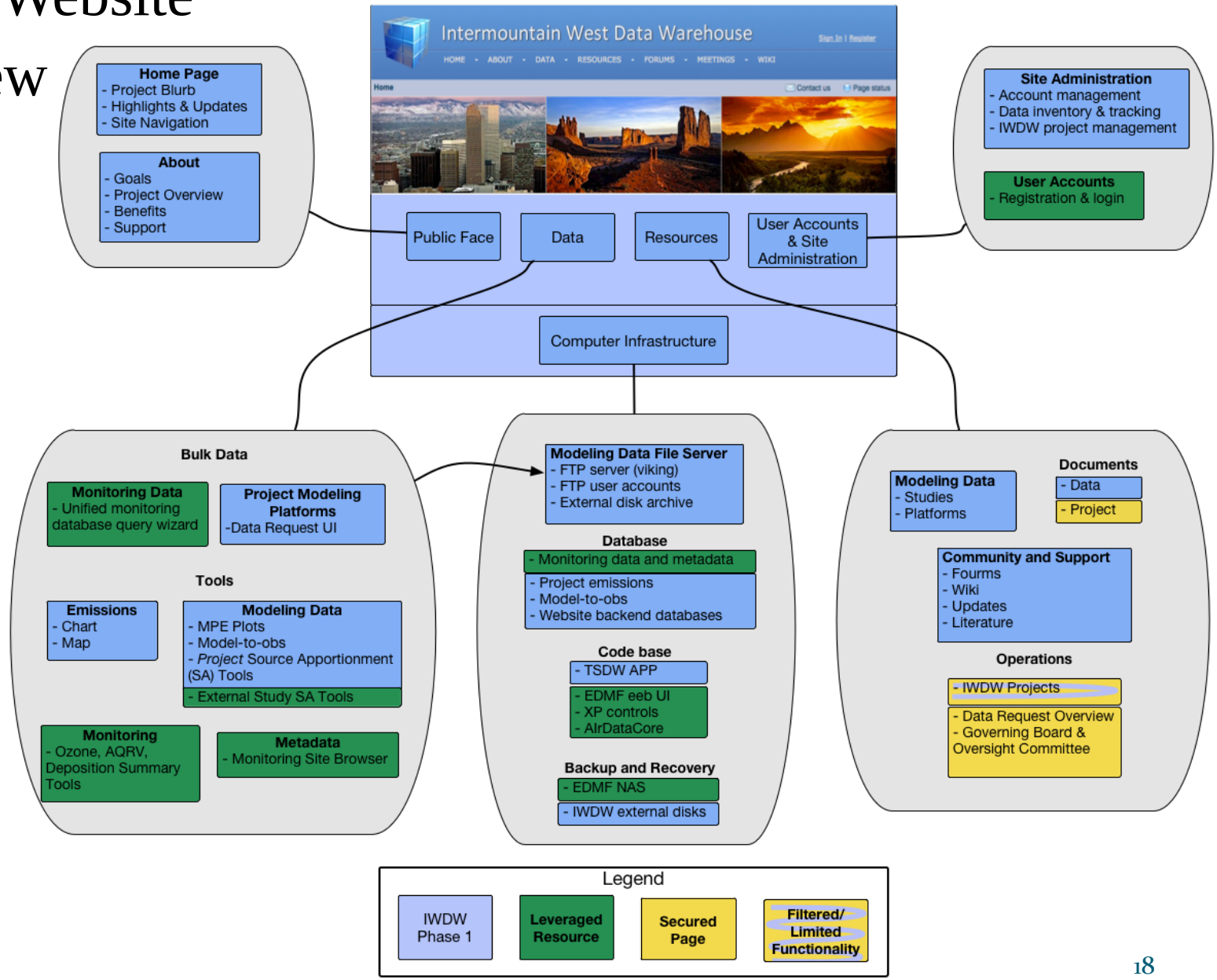
IWDW Website Overview



IWDW Website Home Page

IWDW Website About Page

About

Multiple federal and state agencies identified the need to more efficiently and expeditiously collect air quality data and conduct air quality modeling to assess the expanding number of oil and gas development on state or other lands. The participating agencies entered into an Memorandum of Understanding in 2011 to initiate a project to address this need. The initial name of the project was known as the Three State Air Quality Study (3SAQS), and is currently referred to as Intermountain West Data Warehouse - Western Air Quality Study (IWDW-WAQS).

The federal and state agency offices that are party to the MOUs, hereinafter referred to as the "Cooperators", include:

- U.S. Environmental Protection Agency Region 8 Office (EPA);
- Bureau of Land Management State Offices, Colorado, Wyoming and Utah and New Mexico (BLM);
- U.S. Forest Service, Rocky Mountain Region, Intermountain Region, and Southwestern Region (FS);
- National Park Service Intermountain Region (NPS);
- Fish and Wildlife Service, Mountain-Prairie Region 6 (FWS);
- Colorado Department of Public Health and Environment (CDPHE);
- Wyoming Department of Environmental Quality (WDEQ);
- Utah Department of Environmental Quality (UDEQ); and
- New Mexico Environment Department (NMED).

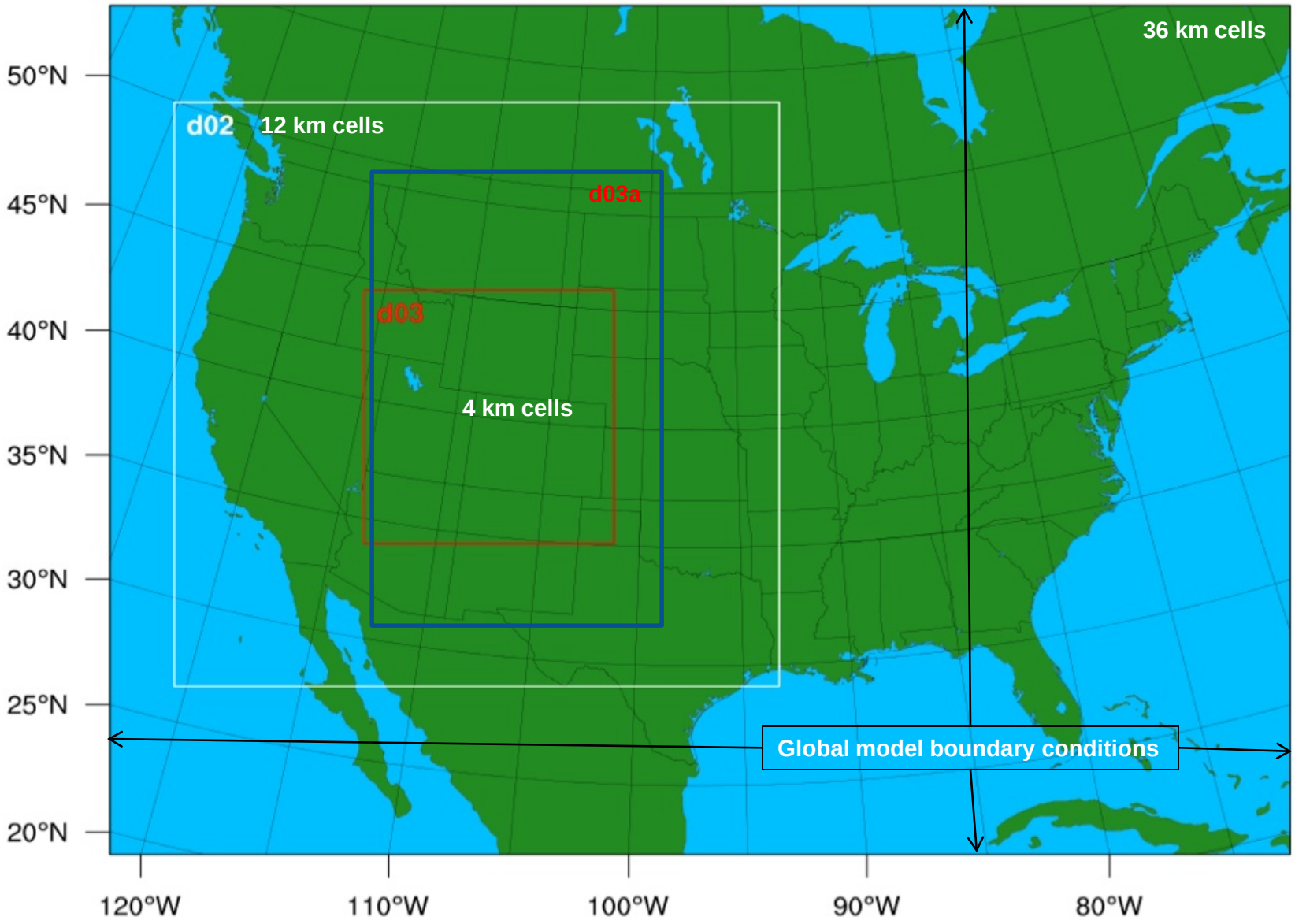
The Western Air Quality Study, with assistance from WESTAR-WRAP, develops state-of-the-art air quality data and photochemical grid modeling products to support studies assessing the air quality in the intermountain west region, including:

- National Environmental Protection Act (NEPA) modeling studies;
- State Implementation Plan (SIP) modeling for ozone, particulate matter, and haze planning; and
- Research studies that require comprehensive and up-to-date emissions inventories and air quality modeling platforms.

Cooperating Agencies

The Cooperators of the Study also develop and operate the Intermountain West Data Warehouse that contains documentation on the Study's organization and air quality products, provides a portal to access all the air quality monitoring and model data, and offers a suite of visualization tools to explore model results and ambient monitoring data.

IWDW-WAQS nested 36/12/4 km WRF/CAMx and CMAQ domains



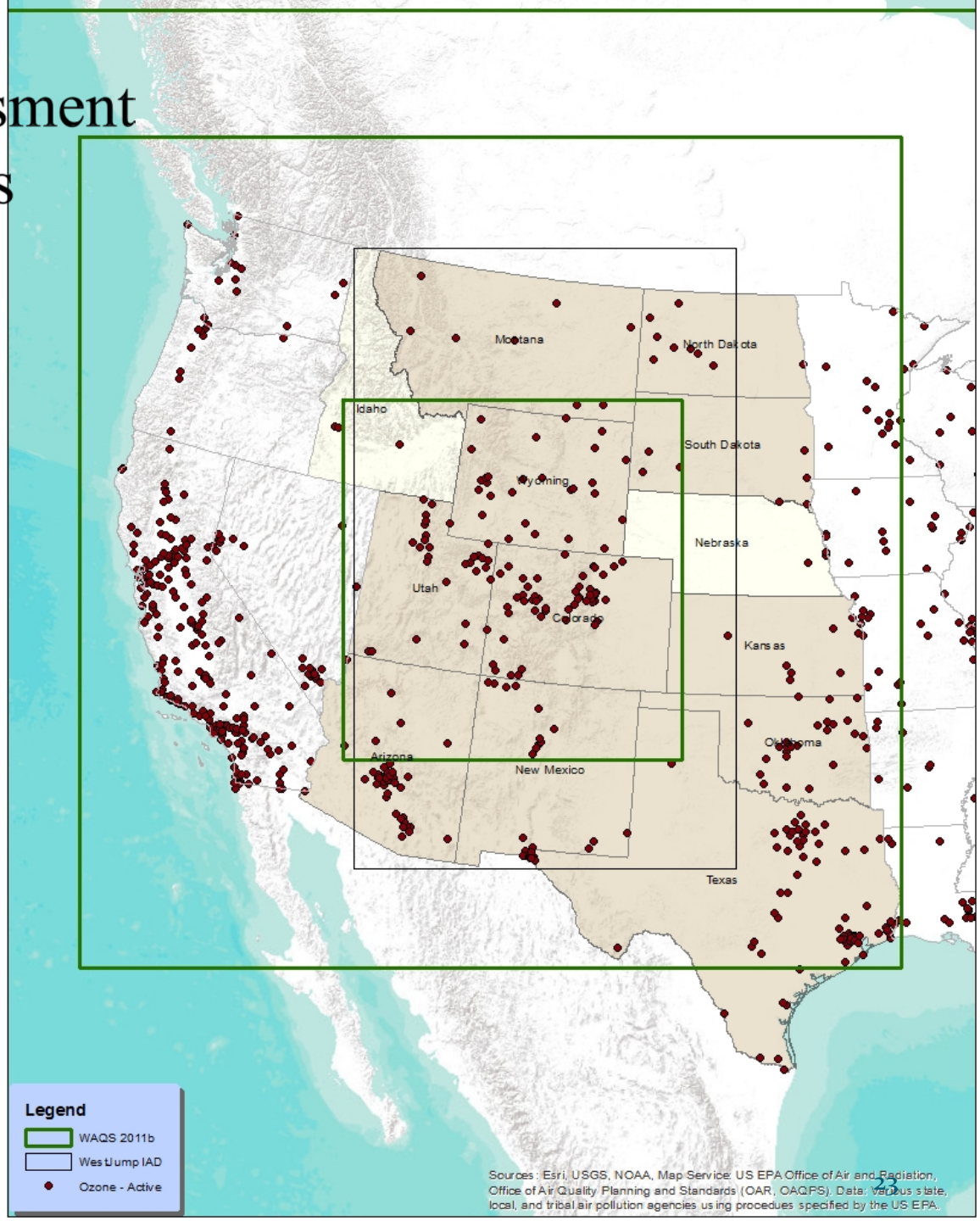
WAQS Monitoring Network Assessment Outline

- Objectives
  - Consider AQ monitoring and modeling needs of Study Cooperators
  - AQ regulations to consider (NEPA studies & Regional Haze and Ozone SIP planning)
- Tasks
- Monitoring Sites
  - Status of current network (solicit input from Cooperators)
  - Possible WAQS expansion (outreach to additional states)
- Analysis
  - Spatial analysis
  - NAAQS Design Values
  - Emissions & AQ modeling
- Cost Analysis
- Recommendations
- Timeline
- Background
- Working Group Action Items

WAQS Network Assessment
Ozone Monitoring Sites

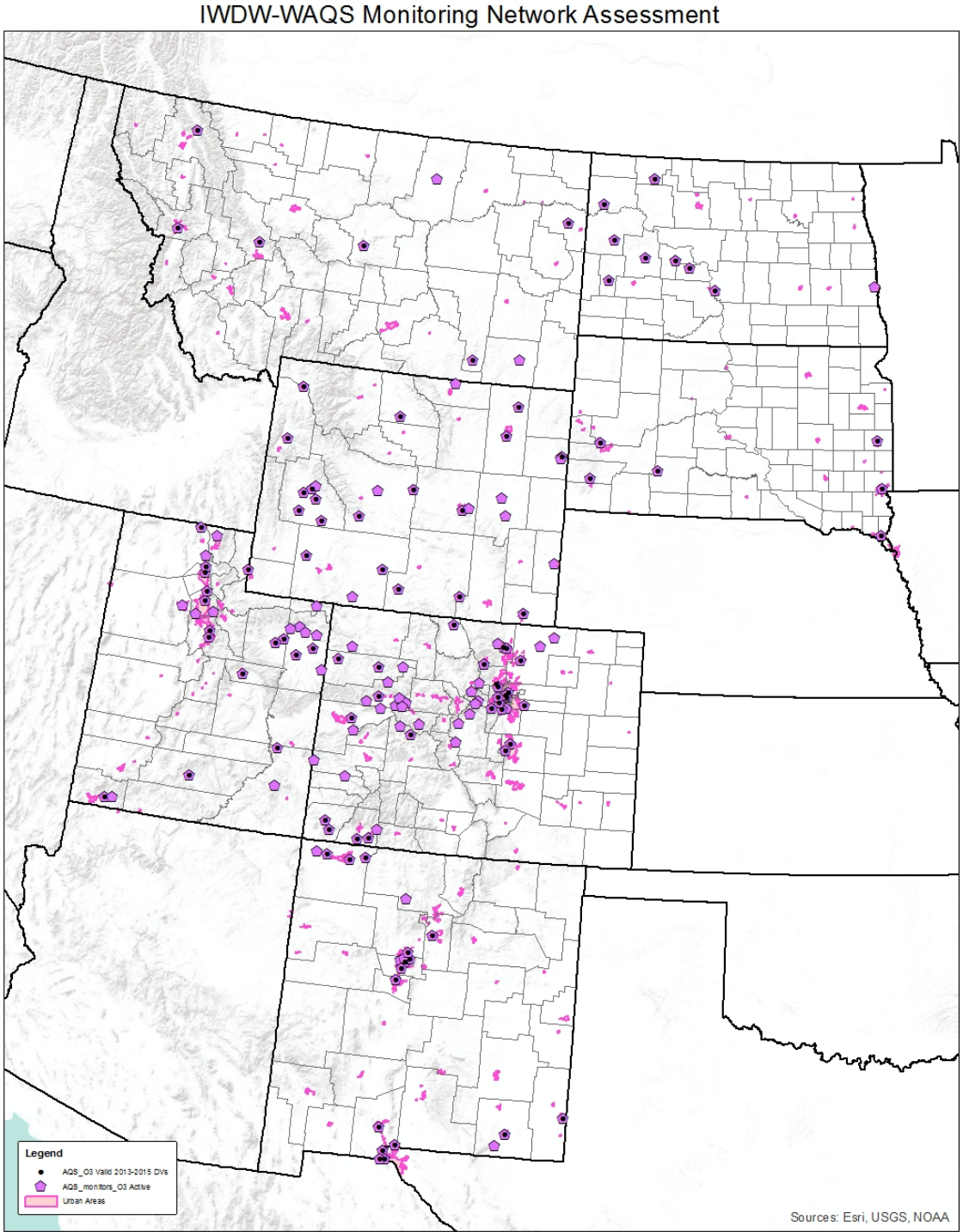
- Modeling domain progression
- AQS sites included in respective 4km and 12 km domains

State	AQS O3 monitoring sites
Texas	76
Arizona	45
Colorado	33
Wyoming	33
Utah	31
Oklahoma	28
New Mexico	26
Kansas	11
North Dakota	9
Montana	8
Nebraska	6
South Dakota	6
Idaho	3



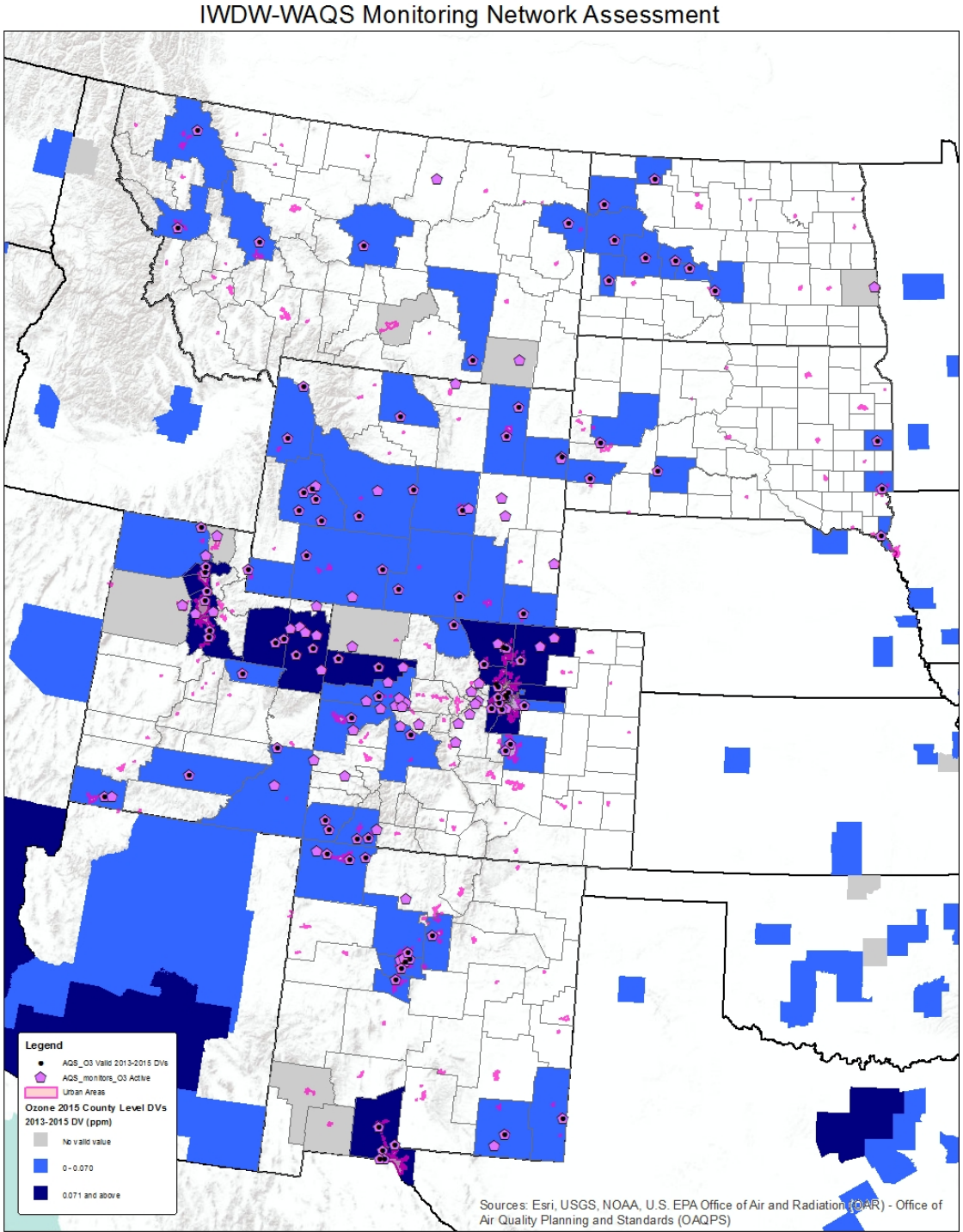
Map Features

- WAQS 7-state region
- Urban Areas
- Active ozone monitors
- Sites reporting valid 2013-15 ozone DVs



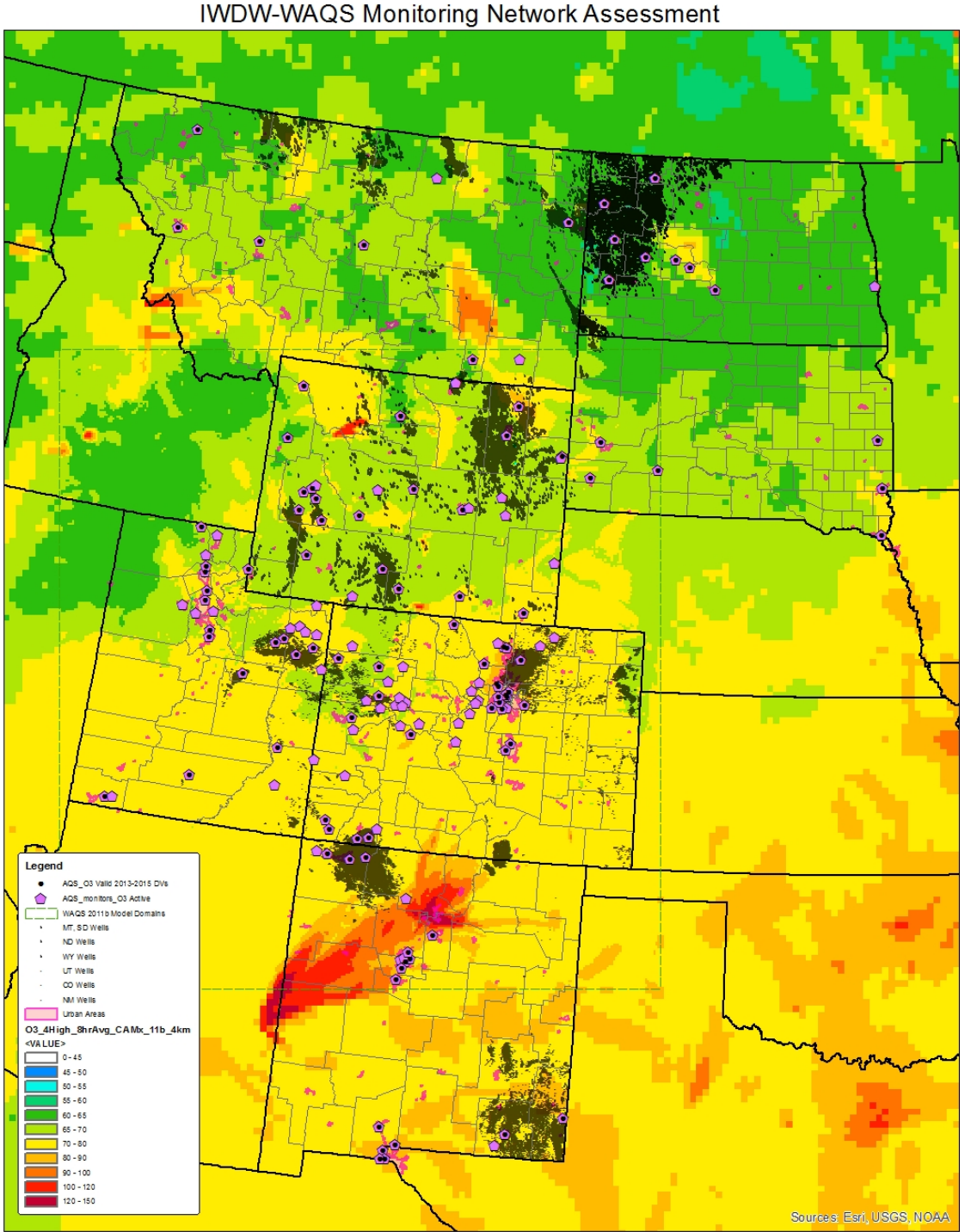
Map Features

- WAQS 7-state region
- Urban Areas
- Active ozone monitors
- Sites reporting valid 2013-15 ozone DVs
- County level 2013-15 ozone DVs

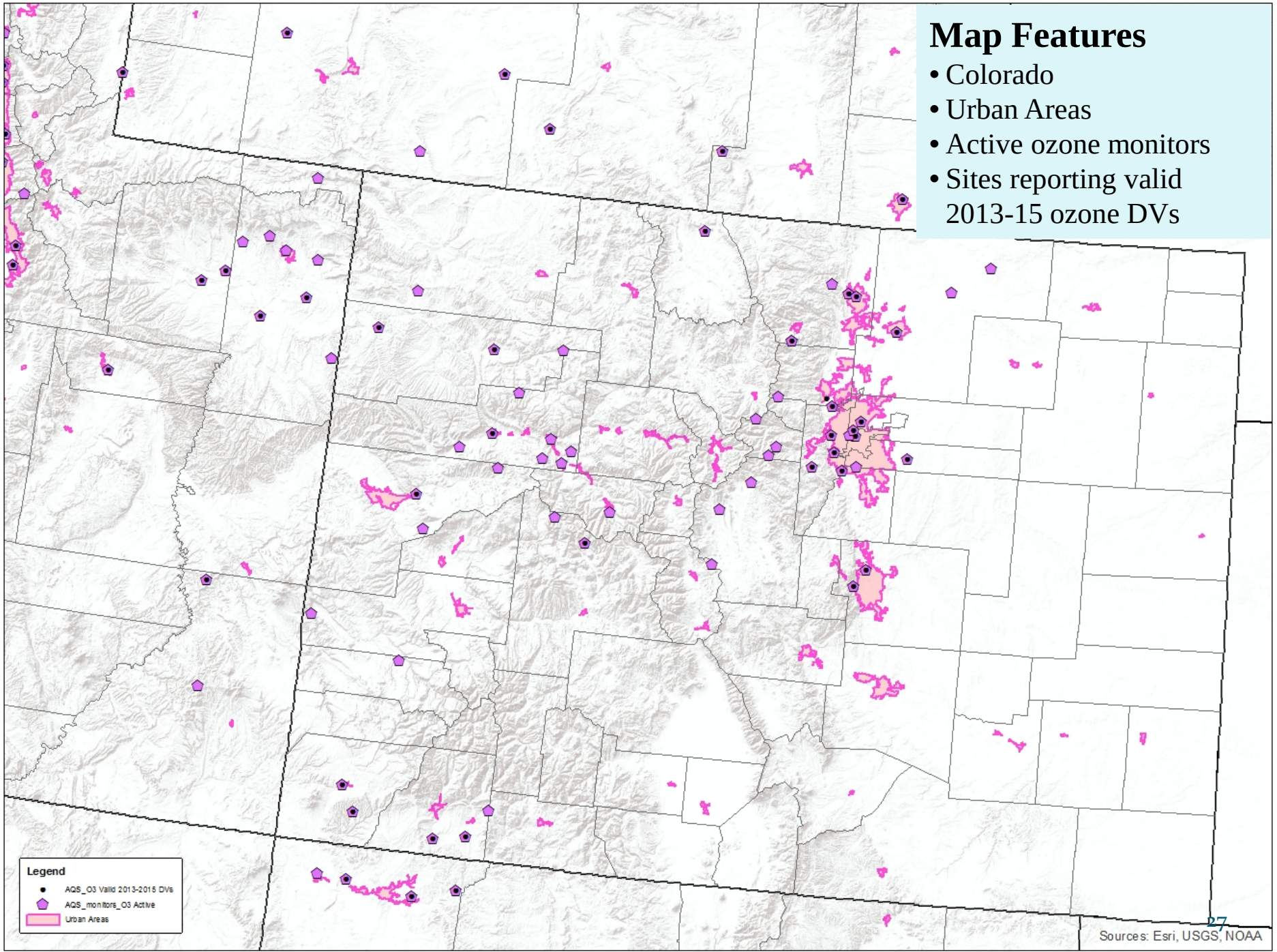


Map Features

- WAQS 7-state region
- Urban Areas
- Active ozone monitors
- Sites reporting valid 2013-15 ozone DVs
- WAQS 2011b 4th highest 8-hr ozone
- Active O&G wells



IWDW-WAQS Monitoring Network Assessment



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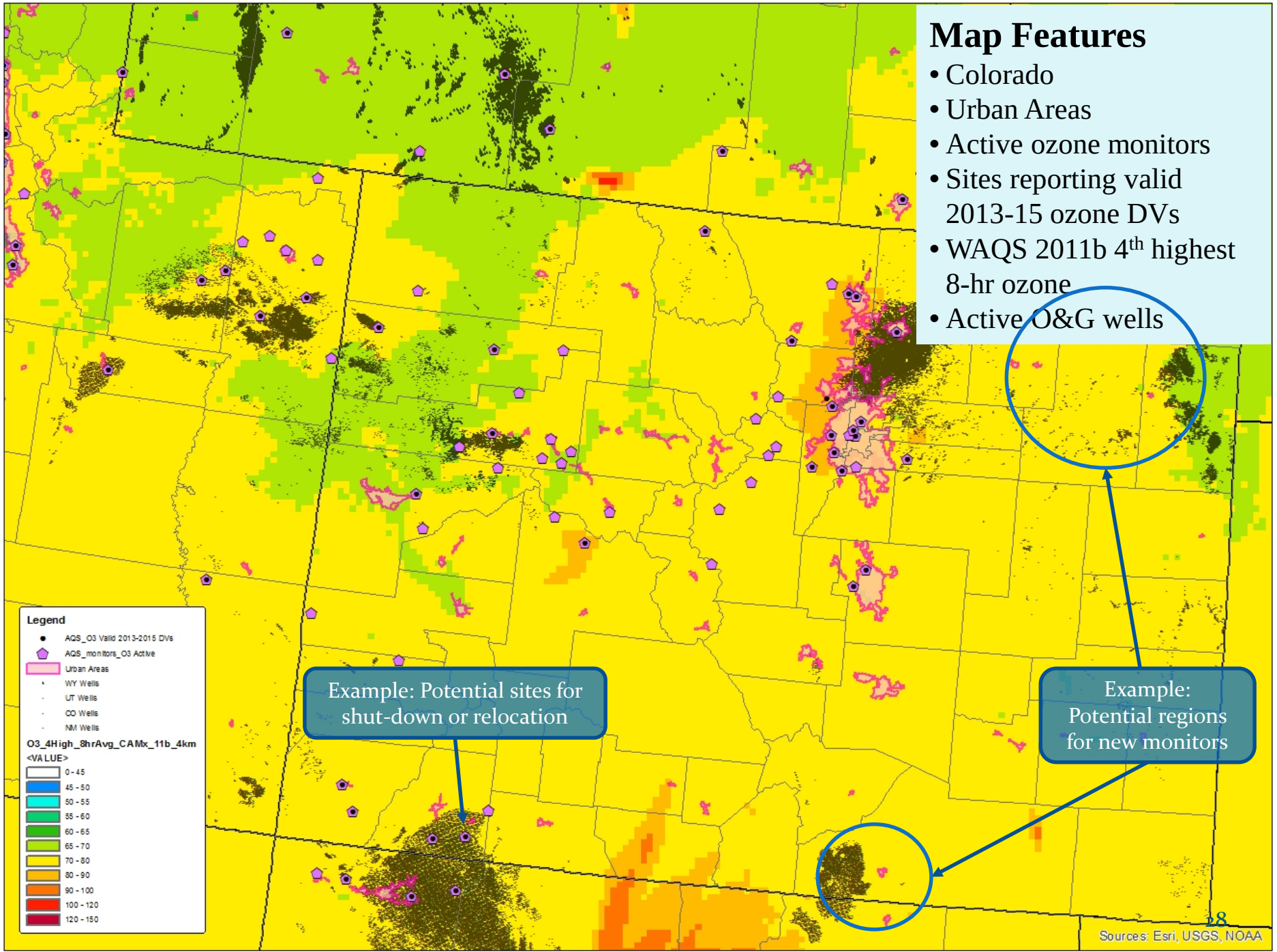
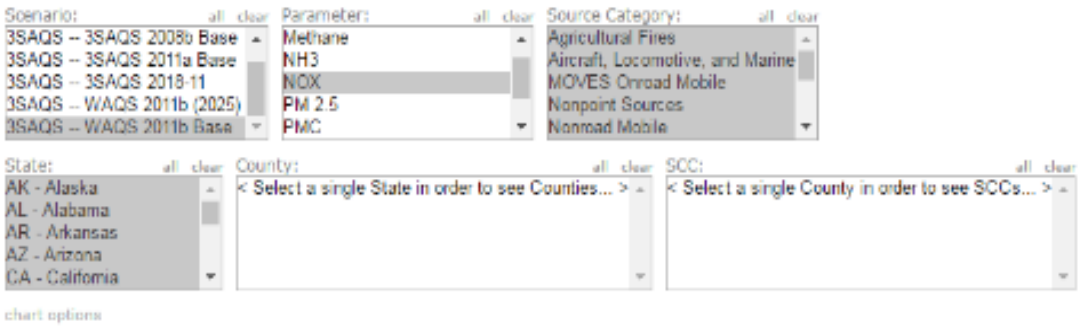
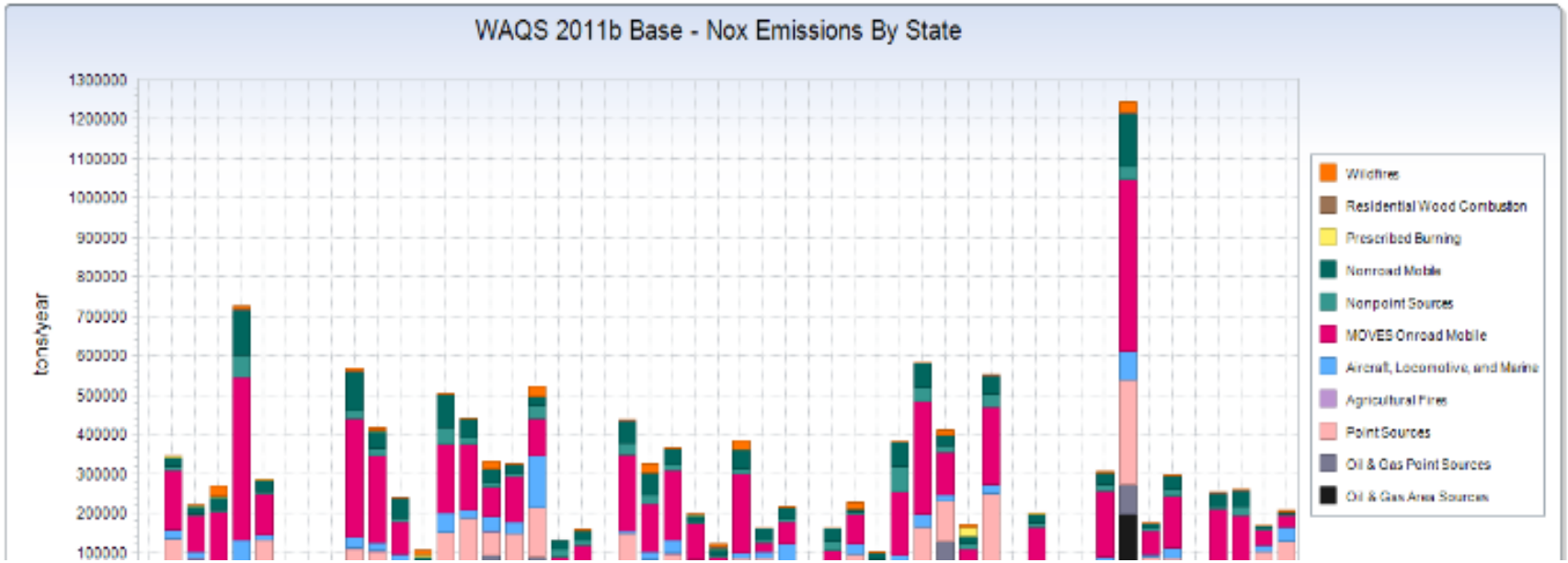
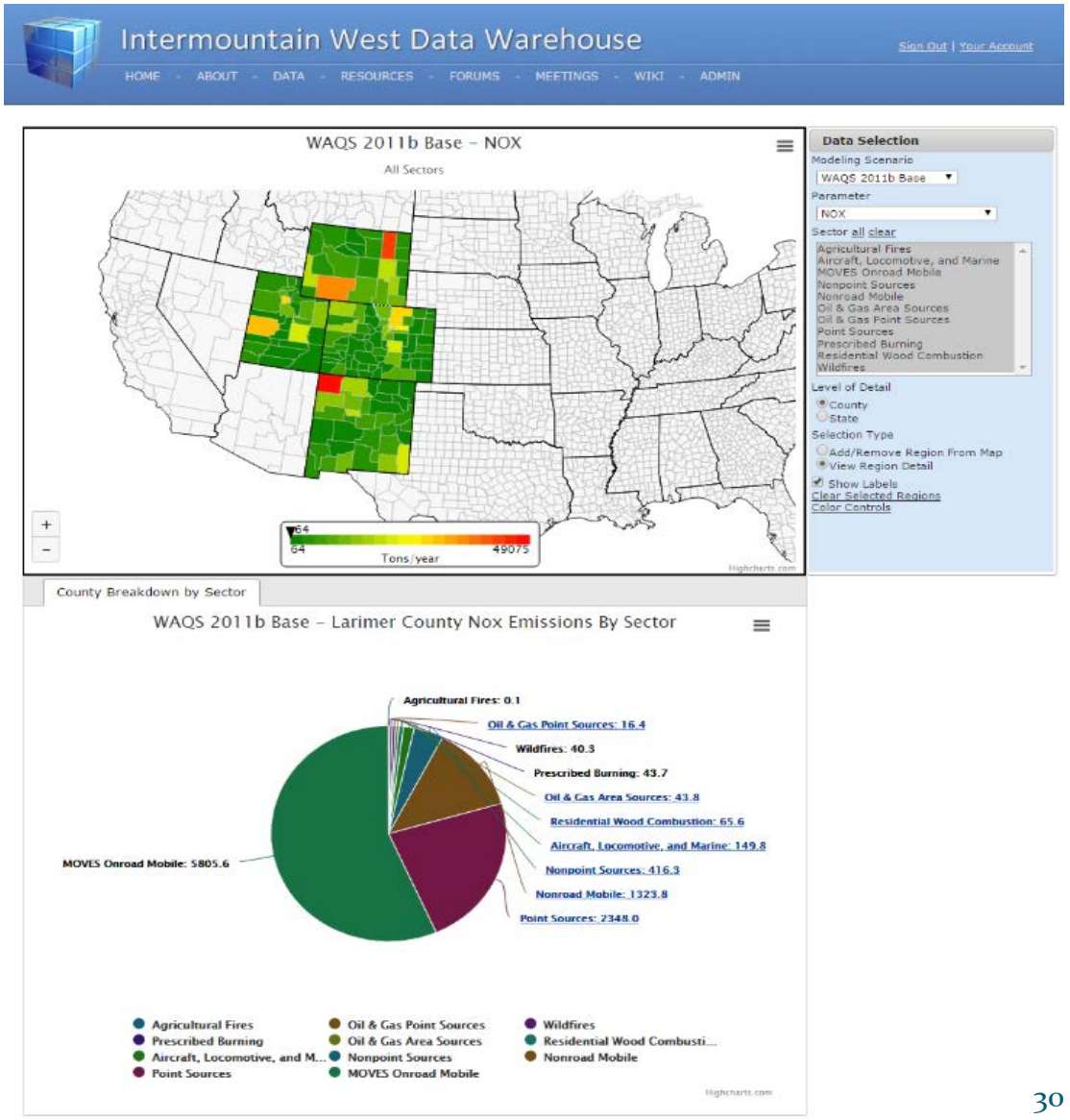


IWDW Website
Emissions Review Tool





IWDW Website
Emissions Review Map



Greater San Juan Basin 2014 Oil and Gas data

Oil and gas activity by county (counties without oil and gas production are not shown).

County, State	Active Well Count			Liquid Hydrocarbon		Gas Production (MMCF/yr)			Spuds
	Gas	Oil	CBM	Condensate	Oil	Natural Gas	Associated Gas	CBM	
Archuleta, CO	3	6	93	0	2	609	0	15,011	1
La Plata, CO	858	80	2,154	7	23	22,962	40	311,200	19
Colorado Subtotals	***861***	***86***	***2,247***	***7***	***25***	***23,571***	***40***	***326,211***	***20***
McKinley, NM	2	112	8	17	51	0	0	181	0
Rio Arriba, NM	6,746	729	1,057	638	871	190,228	8,926	84,916	24
Sandoval, NM	149	203	33	42	1,849	565	7,889	1,162	26
San Juan, NM	8,289	595	3,753	950	1,618	212,426	6,978	197,307	52
New Mexico Subtotals	***15,186***	***1,639***	***4,851***	***1,647***	***4,389***	***403,219***	***23,793***	***283,566***	***102***
Basin-wide Totals	**16,047**	**1,725**	**7,098**	**1,653**	**4,413**	**426,789**	**23,833**	**609,777**	**122**

Greater San Juan Basin percent of 2014 oil and gas activity by mineral designation.

Mineral Designation	Active Well Count			Liquid Hydrocarbon		Gas Production			Spuds
	Gas	Oil	CBM	Oil	Condensate	Natural Gas	Associated Gas	CBM	
Private/State	18%	19%	34%	22%	14%	19%	18%	45%	25
Tribal	15%	30%	13%	12%	12%	12%	16%	19%	14
Federal	67%	51%	54%	66%	74%	69%	66%	36%	61

Greater San Juan Basin 2014 Oil and Gas Emission Inventory Inputs (1 of 2)

- **Final Report completed Nov. 2016**
- **Project website (https://www.wrapair2.org/SanJuanPermian.aspx)**
- Next step is to prepare 2014 and projection year inventories
- Beyond inputs collected, recommendations to improve inventories:
  - EPA could make all underlying data in GHGRP Subpart W reporting available so that more source category inputs could be sourced from GHGRP Subpart W data;
  - Improve accuracy of the inputs (produced gas compositions, tank flashing gas compositions, and equipment profiles and operations) through additional operator participation in the wellsite survey efforts.
  - Need input factors for potential fugitive emissions from oil and gas pipelines from well heads to the main compressor stations.

Greater San Juan Basin 2014 Oil and Gas Emission Inventory Inputs (2 of 2)

- Recommendations beyond current inputs collected, continued:
  - Some compressor stations are missing from the current midstream permit data emissions because either these facilities do not meet state or federal reporting criteria or emissions estimates were not readily available from the state or federal agency. Including those sources through would enhance inventory completeness.
  - Data for certain wellsite source categories (amine units, truck loading at gas and NGL processing plants, and water disposal pits) were not collected but including data for these categories would enhance inventory completeness.

- **Preparation of 2014 and projection year inventories**
  - Inventory inputs will be used to prepare a comprehensive by county and SCC emission inventory for the Greater San Juan and Permian basins for a base year of 2014 and forecasted to a future year.
  - The inventories will be developed using the inventory input data collected
  - Work to be completed in Spring 2017 timeframe

Typical Sources affecting Visibility

	Source	Controllability	Trend	Variability
Anthropogenic	US Anthropogenic	Some emissions are controllable	Downward as sources are controlled	Relatively stable
		Some emissions will remain after all reasonable controls implemented	Could rise because of population increases	Relatively stable
	International Anthropogenic	Not controllable by state or federal regulations	Likely increasing due to increased development worldwide and rising population	Relatively stable
Natural	Fire, Dust, Sea Salt	Natural, not controllable	Increases due to climate change	Highly variable
	Volcanic	Natural, not controllable	Unpredictable	Highly variable
	Other Natural Sources	Not controllable	Potentially affected by climate change, e.g., changes in temperature	Relatively stable

Table Note: Shaded areas represent emissions that states cannot control.

Preliminary Draft WESTAR-WRAP Work Plan for Regional Haze SIP Revision for 2028 Reasonable Progress Goals

2014 Inventory – Base Case

All dates for individual tasks would be updated, shifted three years ahead

2011 Base Case				2013	2014	2015	2016	2017	2018
Task	Days	Start	Finish	J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J
Template/Outline	360	12/13	12/14						
Analysis	1354	7/13	3/17						
Meteorological Modeling - 2011	270	1/14	9/14						
Identify sectors for additional studies	80	1/14	3/14						
Additional sector studies	360	3/14	3/15						
Emissions Inventory - 2011	360	7/13	6/15						
Emissions Modeling - 2011	270	3/15	12/15						
AQ Modeling - 2011	360	9/15	9/16						
ID existing controls implemented by 2018	180	1/14	6/14						
Emissions Inventory - 2018	270	1/14	9/15						
Emissions Modeling - 2018	270	3/15	12/15						
AQ Modeling - 2018	450	9/15	12/16						
ID existing controls implemented by 2028	360	1/14	12/14						
Identify "What If" Control Strategies - 2028	450	1/14	3/15						
Emissions Inventory - 2028	270	1/14	6/15						
Emissions Modeling - 2028	360	3/15	3/16						
AQ Modeling - 2028	450	9/15	12/16						
Identify how to do 4-Factor Analysis	360	1/14	12/14						
4 Factor Analysis	720	12/14	12/16						
Finalize State and Regional Control Strategies	270	6/16	3/17						
Establish 2028 Reasonable Progress Goals	1200	1/14	4/17						
Decide if going to reconsider natural conditions	80	1/14	3/14						
Reconsider natural conditions	450	3/14	6/15						
Identify emission reductions to 2028	180	9/16	3/17						
Evaluate glidepath & set 2028 goal	120	12/16	4/17						
Evaluate Previous Period's Progress	1170	1/14	3/17						
Last year of monitoring data collected	360	1/14	12/14						
Data analyzed	540	12/14	6/16						
Haze analysis	180	6/16	12/16						
Determine if 2018 goal met	90	12/16	3/17						
State Adoption Process (calculates backwards)	450	5/17	7/18						
Draft SIP	60	5/17	7/17						
FLN comment period	60	7/17	9/17						
Revised based on comments, respond to comments	60	9/17	11/17						
Public comment period	30	11/17	12/17						
Revise based on comments, respond to comments	30	12/17	1/18						
State approval process (CO needs to start 1/1/18)	210	1/18	7/18						
Submit to EPA	1	7/18	7/18						

Regulatory required time periods

Flexible dates

WESTAR must finish regional work by Spring 2020 if SIPS due Summer of 2021

Sources of O_3 in the Western U.S.

O_3 Source	Meteorological Characteristics	Chemical characteristics	CAA Controllable
Local photochemical buildup	Stagnation, high temperatures.	CO/NOx/VOCs/PM consistent with local sources	Y
Regional transport (domestic sources)	Regional transport from major source regions (e.g., California) - currently not well characterized	CO/NOy/VOCs consistent with upwind sources + chemistry	Y
Upper trop/Lower strat intrusions (UTLS)	Post-cold front Broad spatial distribution (high O_3 in non-urban areas)	Very dry air.	N
Very long-range transport (VLRT)	Important at higher elevation. Subsidence and mixing into the boundary layer can enhance local concentrations.	Dry. Can be hard to distinguish from UTLS without good chemical data.	N
Wildfire smoke	Warm. Can be stagnant or not. Can be regional or large distant fires.	Chemistry complex & different from typical urban. O_3 enhancements not always seen. O_3-PM often poorly correlated. PM/CO/NOy always well correlated and ratios very different from typical urban.	N

Reducing uncertainty for air quality planning through analysis

- Regional Haze planning
  - Enable choices of cost-effective controls that improve visibility
  - Assessments of natural and uncontrollable– ever more important
- Ozone background and transport
  - Local vs. regional / less controllable vs. uncontrollable
- Exceptional Events - how important will these be?
  - Resources to analyze
  - EPA decides which to act on
  - Sources causing these events are large and not infrequent
- Western O&G supply chain value proposition
  - Price of commodities
  - Regulatory programs have been increasing
- Fire and O&G impacts for regional haze and ozone
  - Projections of all emissions for future year ozone & regional haze planning

Regional analysis timelines for regional haze and ozone transport

- Regional Haze
  - Final Rule late 2016
  - Final guidance early 2017
  - Regional analyses in 2017
    - 2014 base year
    - 2028 rules on the books
    - Associated air quality modeling
  - 2018 and 2019 analyses
    - Evaluation of reasonable progress controls
    - Associated air quality modeling
  - Plans due July 2021
- Ozone transport and planning
  - 70 ppb standard on Oct. 1, 2015
  - Implementation Guidance proposed Nov. 2016
    - Comments for 60 days on:
      - nonattainment area classification thresholds & deadlines for planning,
      - implementation of emission controls,
      - attainment
  - Transport “good neighbor” SIPs due 2018 for 2023 projection year
  - Marginal/Moderate nonattainment plans in 2023 then reduce both local and transport emissions