

The background of the slide is a photograph of a dry, grassy field. In the lower-left foreground, a line of fire is burning, with a person standing nearby. The field extends to a low horizon under a clear blue sky. The text is overlaid on this image.

*Fire Activity & Emission
Inventories: Their Use in
Smoke Management
Decision Making and State
Implementation Plans*

Susan O'Neill, NRCS

NWCG Smoke Committee Workshop

February 24-26, 2009, Omaha, Nebraska

- What is an Emission Inventory (EI)?
- Why are Emission Inventories necessary?
- Why is it important to have good Fire Activity data and emissions incorporated into an EI?

The background of the slide is a photograph of a vast, open landscape. In the foreground, there is a field of dry, yellowish-brown grass. A line of fire is visible in the lower-left quadrant, with a person standing nearby. The middle ground shows rolling hills under a clear blue sky. The text is overlaid on this image.

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What is an Emission Inventory?

- A dataset of atmospheric trace gases emitted from various sources:

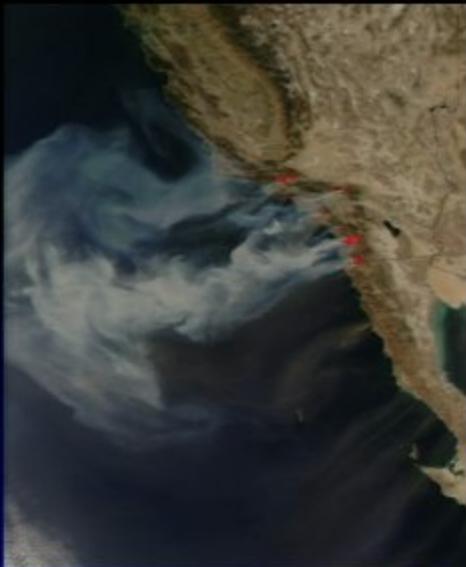
Point Sources



Vehicles – cars, trucks, trains, ships



Area Sources – ex. gas stations, cleaners, restaurants, agriculture



Fire, Dust

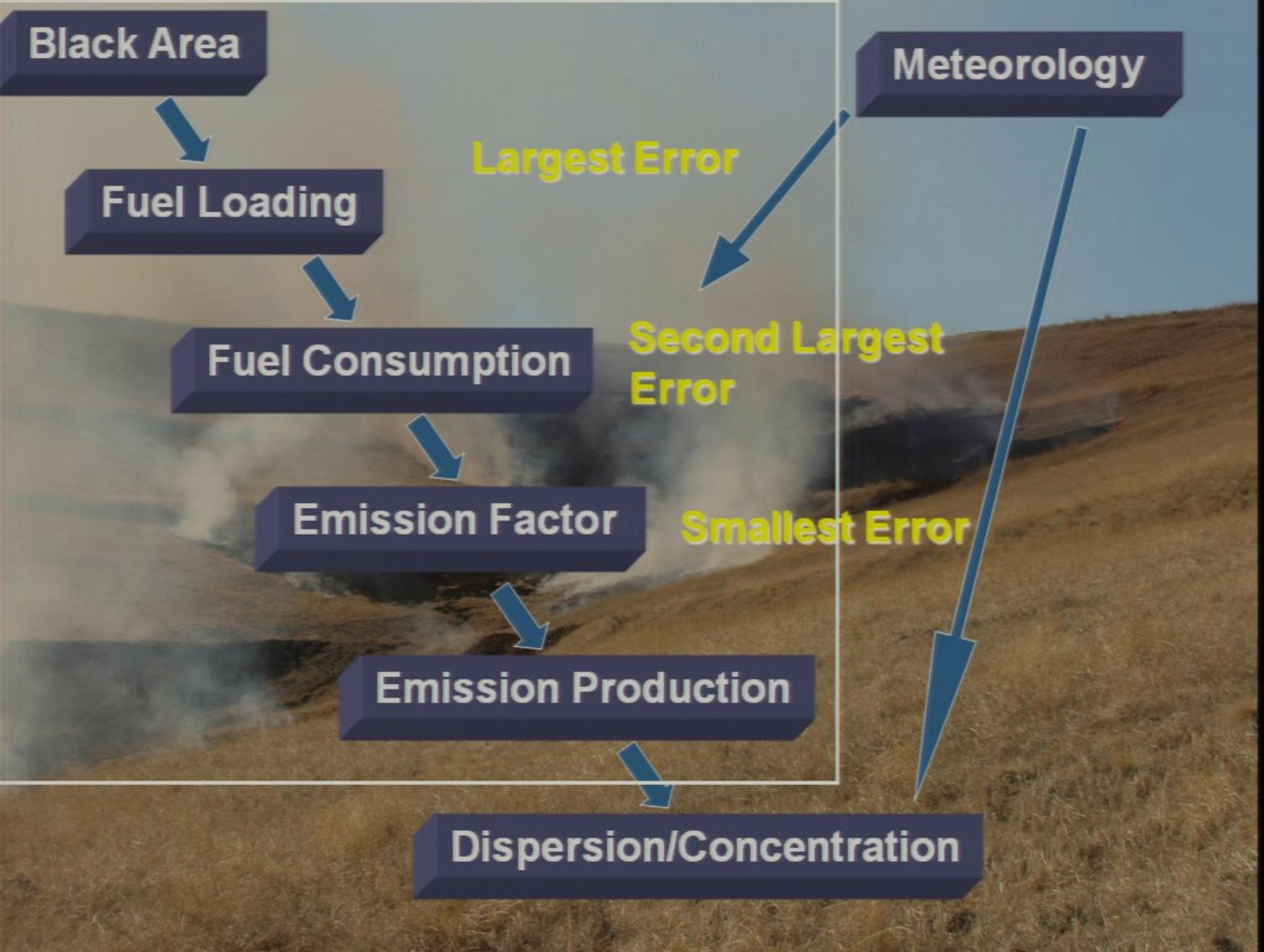


Biogenics – vegetation (ex. isoprene, terpenes)

Why Are Emission Inventories Necessary?

- Atmospheric dispersion modeling.
 - Useful for Smoke Management decision making
- Annual estimates of the prescribed fire program.
- Nonattainment and regional air quality planning.
- Els can help with:
 - an exceptional event demonstration
 - General Conformity requirements
 - NEPA requirements
 - Greenhouse gas issues

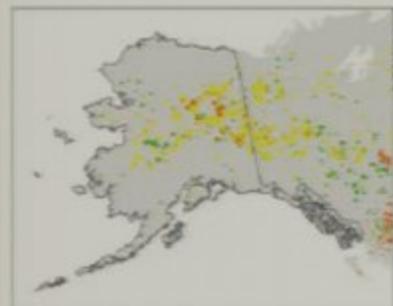
- 
- A photograph of a landscape with rolling hills covered in dry, golden-brown grass. In the distance, a fire is burning, sending a thick, dark plume of smoke into the sky. The smoke is partially obscured by a lighter, hazy atmosphere. The sky is a clear, pale blue.
- What does it take to create a fire emission inventory?



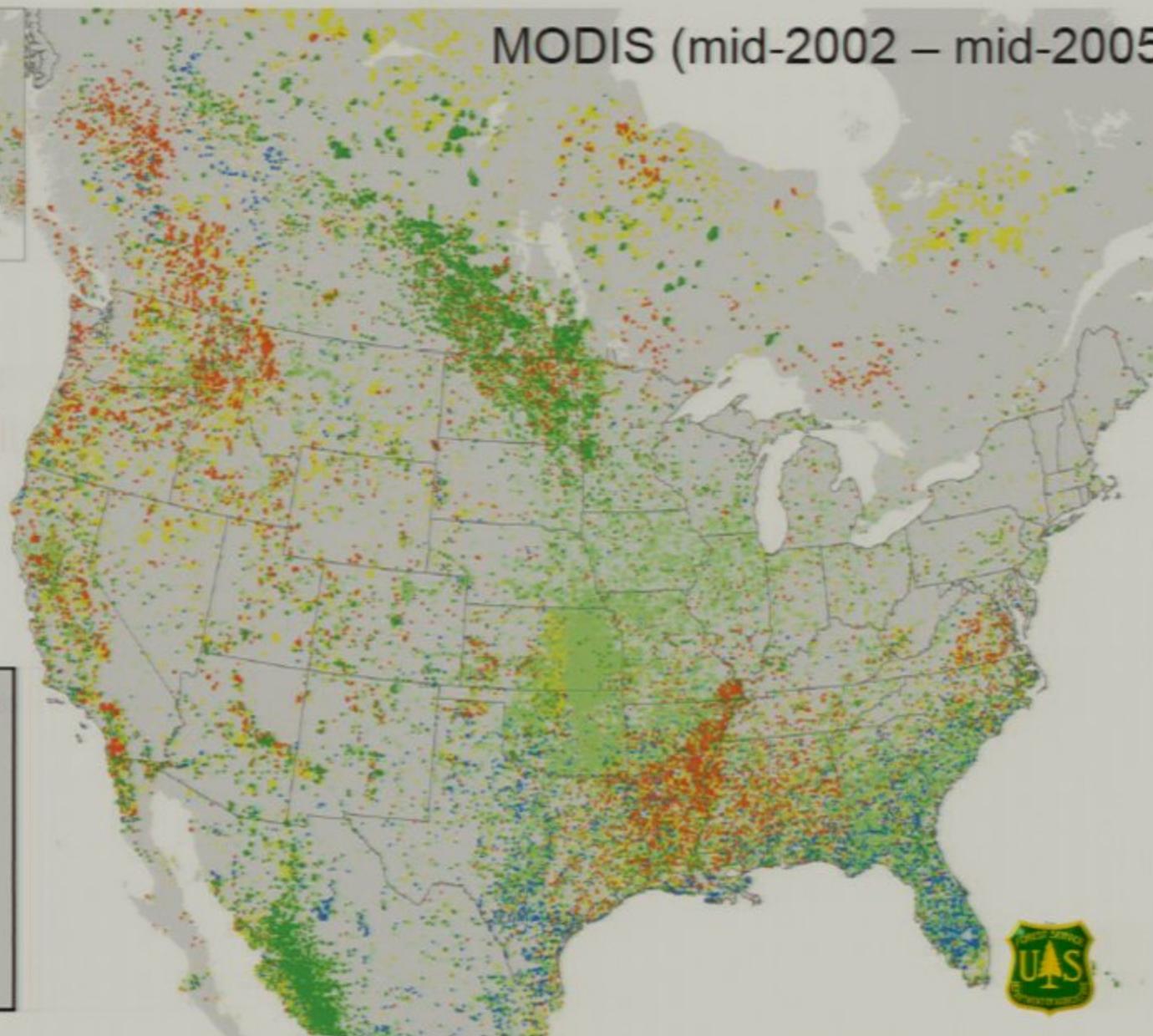
First Step: Fire Activity Data

Satellite Detected Fire Seasonality

MODIS (mid-2002 – mid-2005)



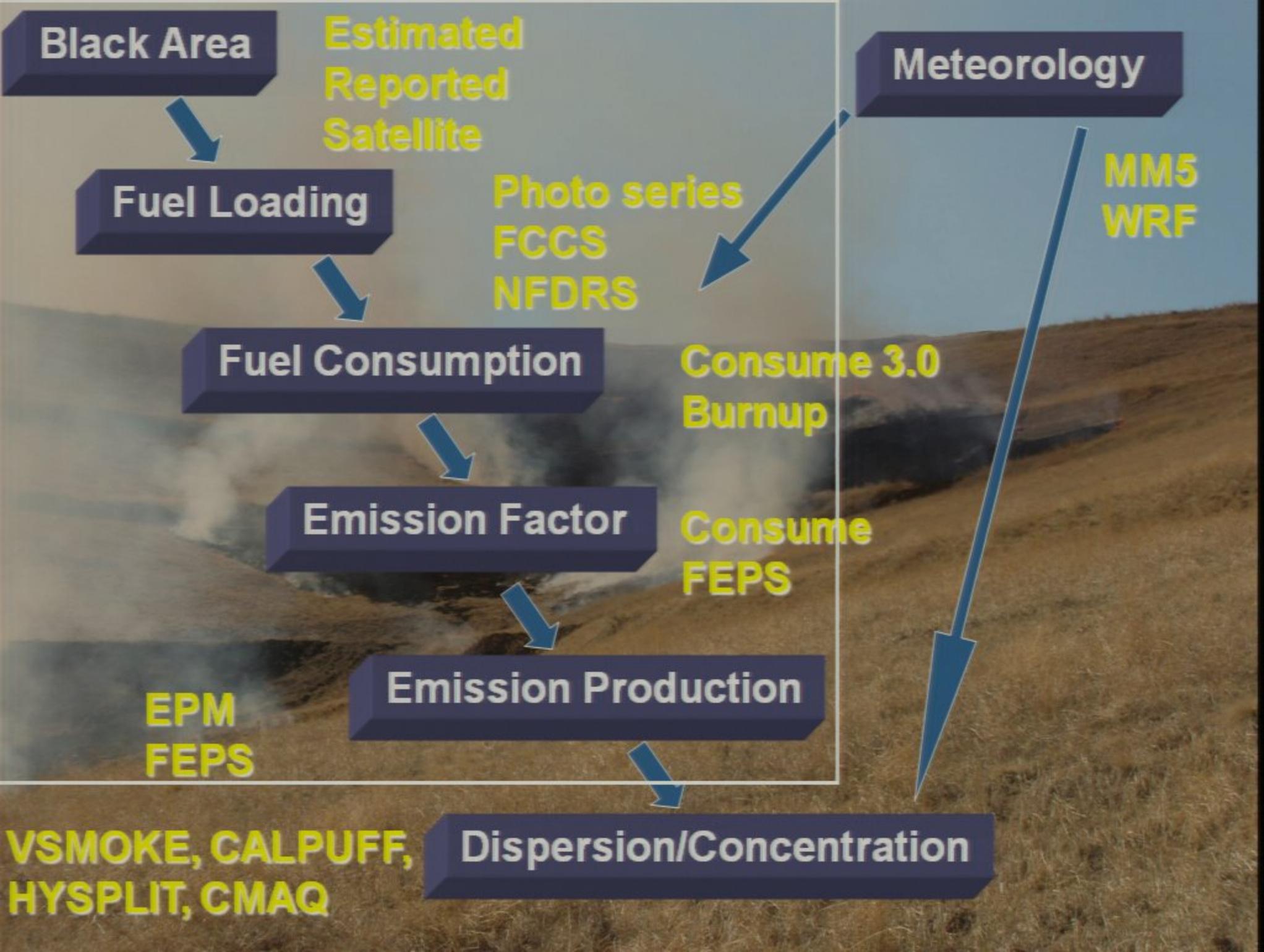
Satellite fires
have national
coverage



**Detected Hot Spots
Month**

- Jan, Feb
- Mar, Apr
- May, June
- Jul, Aug
- Sep, Oct
- Nov, Dec





Black Area

**Estimated
Reported
Satellite**

Meteorology

Fuel Loading

**Photo series
FCCS
NFDRS**

**MM5
WRF**

Fuel Consumption

**Consume 3.0
Burnup**

Emission Factor

**Consume
FEPS**

Emission Production

**EPM
FEPS**

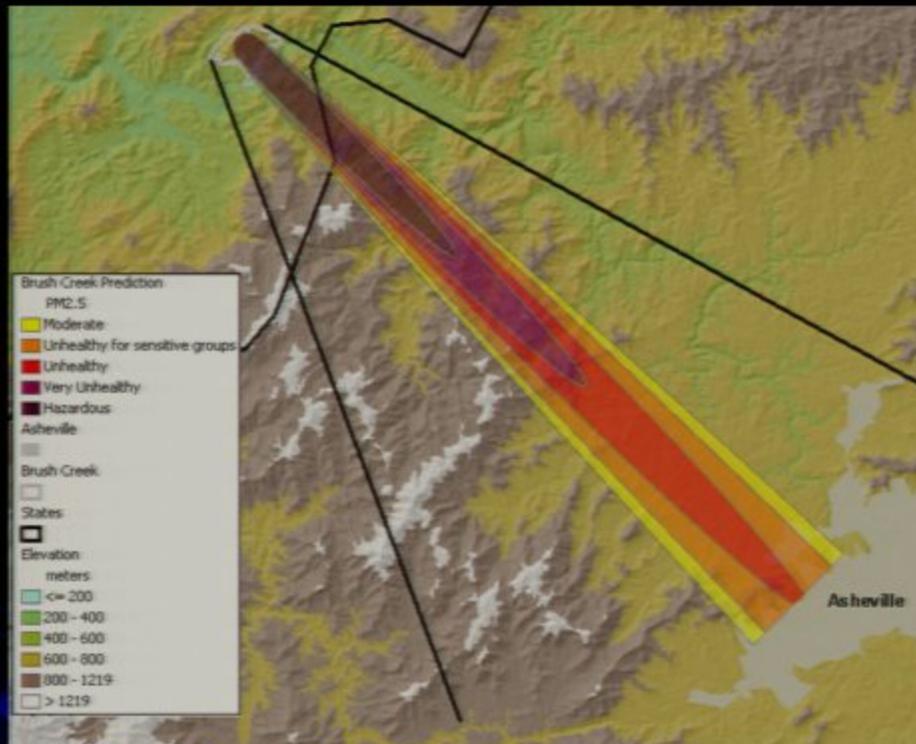
Dispersion/Concentration

**VSMOKE, CALPUFF,
HYSPLIT, CMAQ**

Uses of a Fire Emission Inventory

- So what do we do now that we've estimated hourly geo-located fire emissions?
 - Dispersion modeling for Smoke Management basic smoke management practices (BSMP)
 - Regional Coordination of burning activities (BSMP)
 - Regional air quality forecasting systems
 - Regional air quality modeling for regulatory purposes

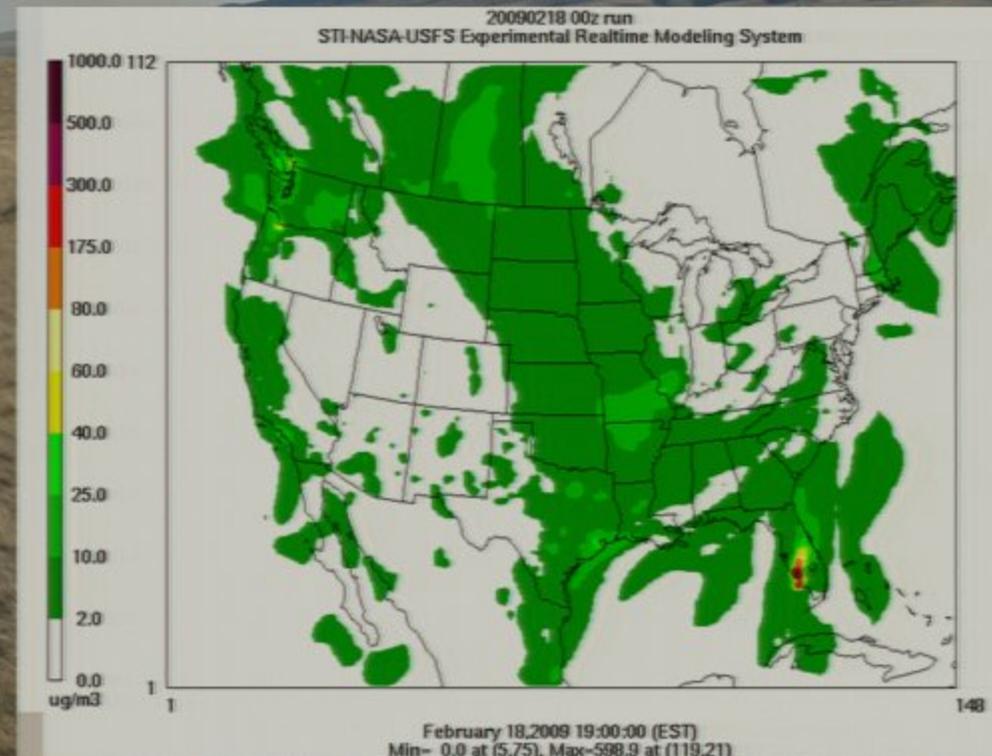
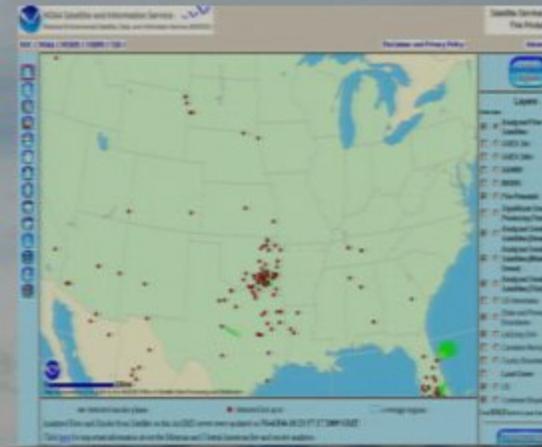
Dispersion Models



- Inputs: hourly emissions, meteorology
- Gaussian profile dispersion
- Standalone (ex. VSMOKE) or regional processing (ex. BlueSky)
- Dispersion modeling can be a BSMP and can be required in SMPs

Atmospheric Chemistry Models

- **Examples:**
CMAQ & CAMx
- **Used in:**
 - SIP development
(NAAQS, Regional Haze Rule)
 - Regional Air Quality Forecasting Systems
- **Include secondary processes**
 - Pollutants formed by chemical reaction in the atmosphere
 - Ozone
 - Fine Particulate Matter

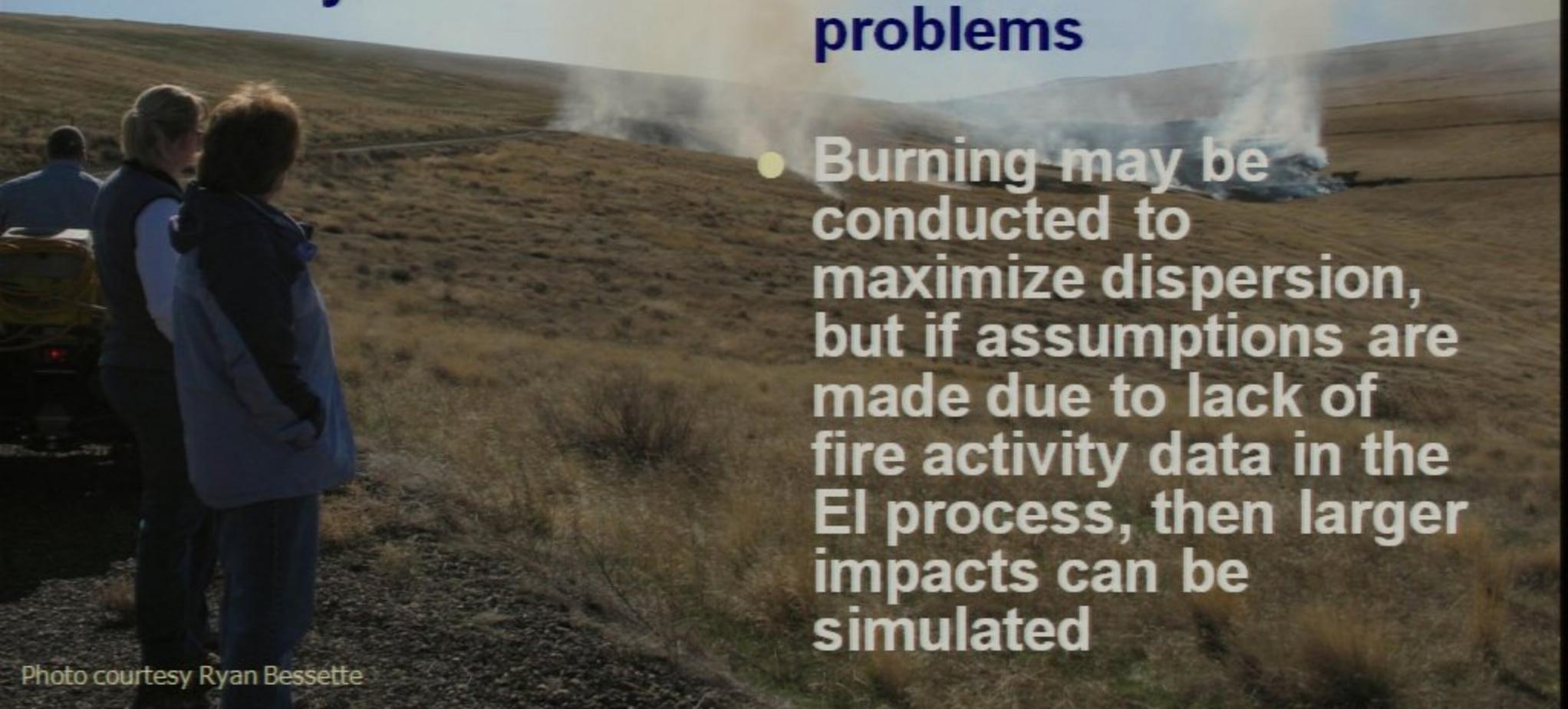


Air Quality Plans

- The air quality agencies will develop emissions inventories for all air pollution source categories.
- Assumptions will be made by the air quality agencies if the no input is offered or received from the forestry/rangeland community.
- Some stakeholders (like the utility industry) are actively questioning and researching wildland smoke impacts to air quality.

What can happen if incorrect assumptions are made about Fire Activity in EI's?

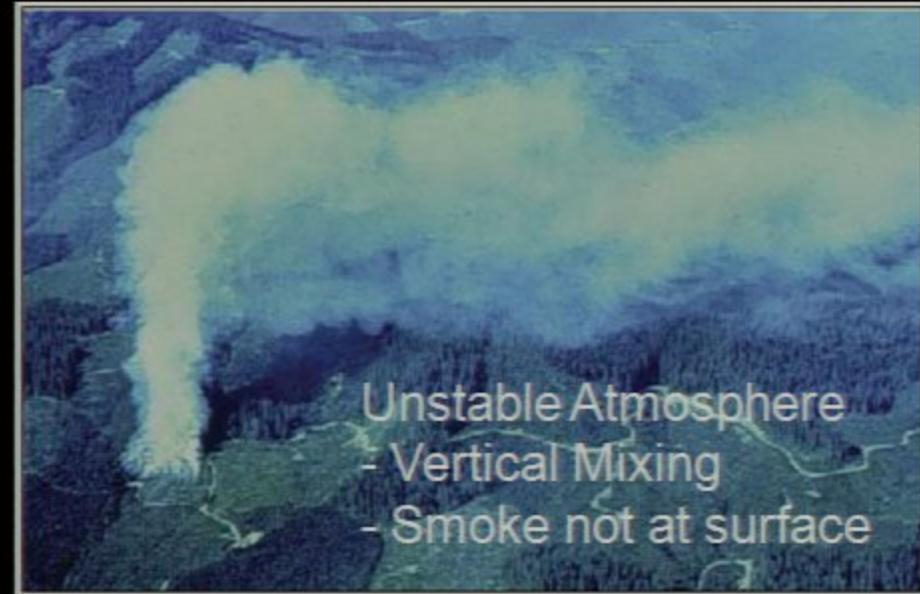
- Model results may not adequately reflect reality, leading to decisions that may not address nonattainment problems
- Burning may be conducted to maximize dispersion, but if assumptions are made due to lack of fire activity data in the EI process, then larger impacts can be simulated



Smoke Behavior

Timing of Fire Activity

- Fire Weather and Dispersion Modeling can inform no/no-go burn decisions to optimize dispersion
- These decisions are not captured in an EI unless fire activity is tracked



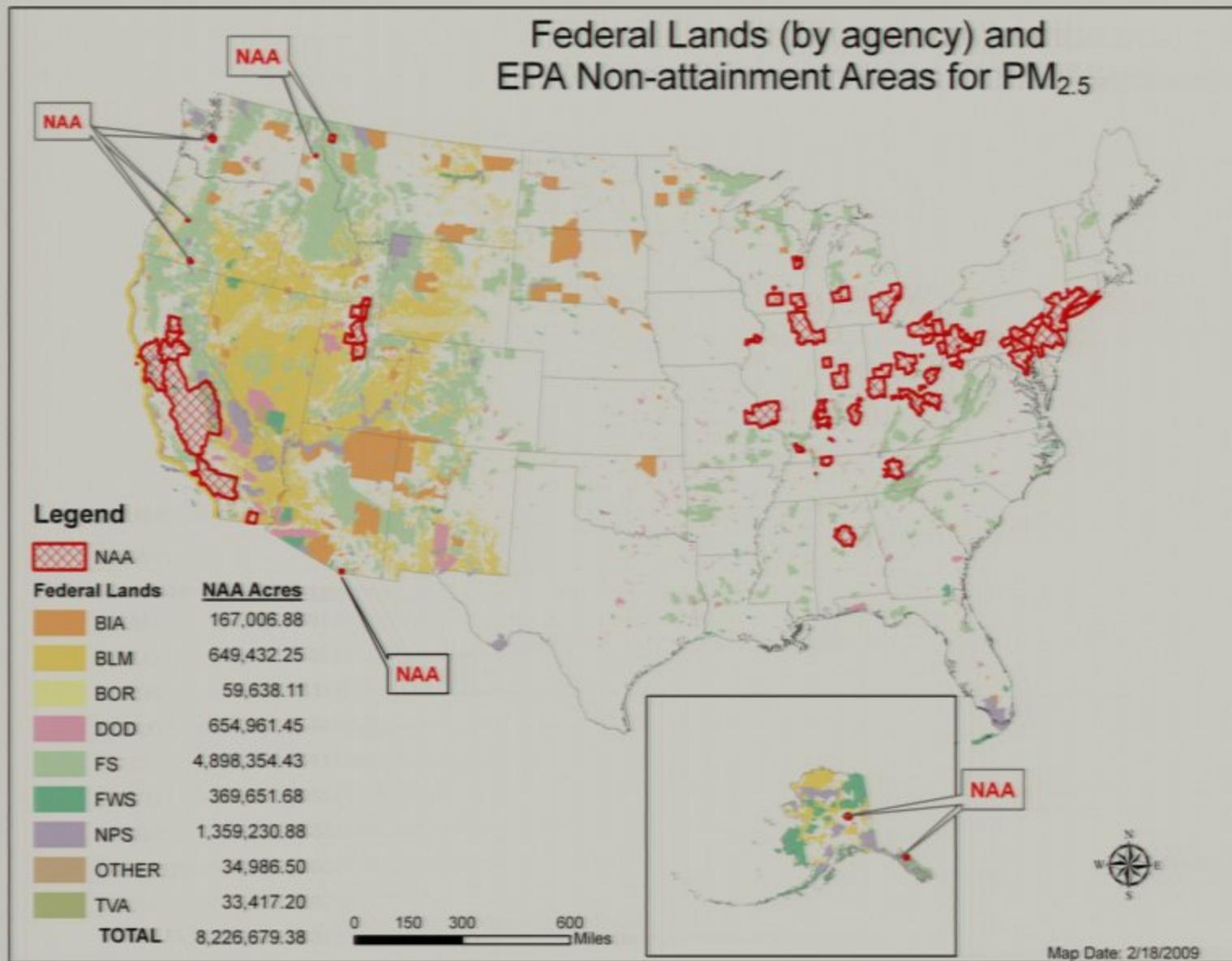
El's and NAAQS violations

- The Air Regulatory Agency will investigate the possible cause(s) of the violation (Exceptional Event?).
- Usually, one or more counties are designated as nonattainment.
- Emissions inventories are developed.
- Atmospheric models are used to demonstrate which emission reduction strategies may work to attain the NAAQS.

El's and NAAQS violations

- The State Implementation Plan will list what emission reductions necessary to bring the area back into attainment.
- Ambient monitoring may be expanded to determine if the Maintenance Plan is working.
- Federal activities in a Nonattainment Area are subject to General Conformity Determinations.

El's and NAAQS violations

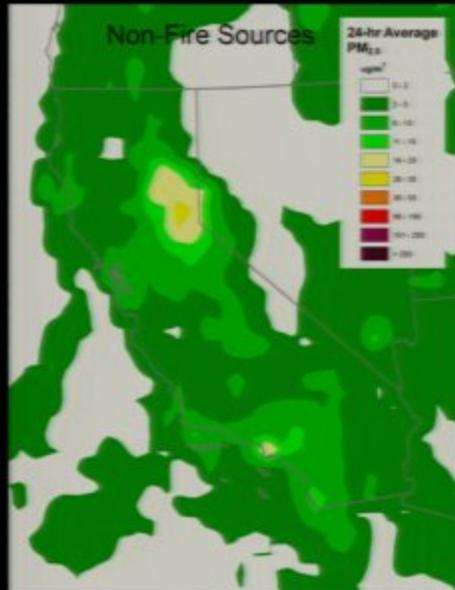


El's and NAAQS violations

- What Land Managers can do:
 - Communicate with the air regulatory agencies from State designation of nonattainment areas (NAAs) to EPA finalization and throughout the SIP process.
 - Submit emission estimates from wildland fires to the air regulatory agencies.
- Hopefully, the States will incorporate the fire emissions into their “base case” of existing emissions.

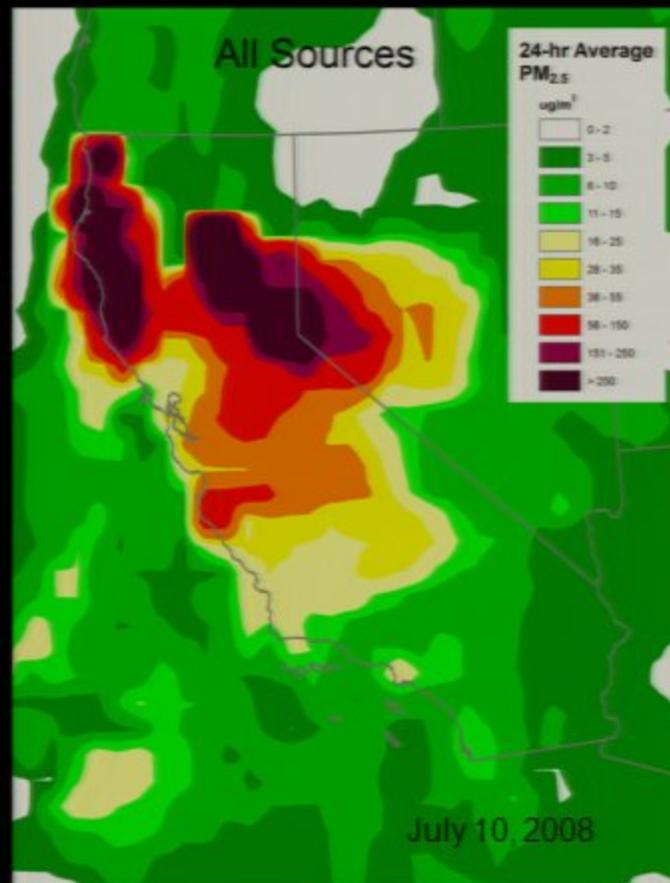
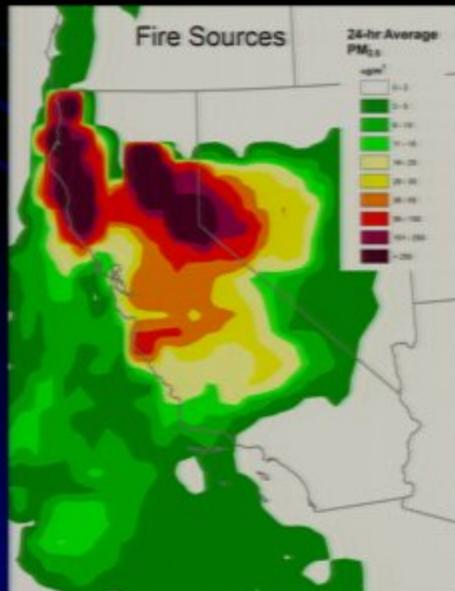
EIs for Exceptional Event Demonstrations

BlueSky Gateway models fire and non-fire $PM_{2.5}$ separately, allowing for exceptional event analysis.

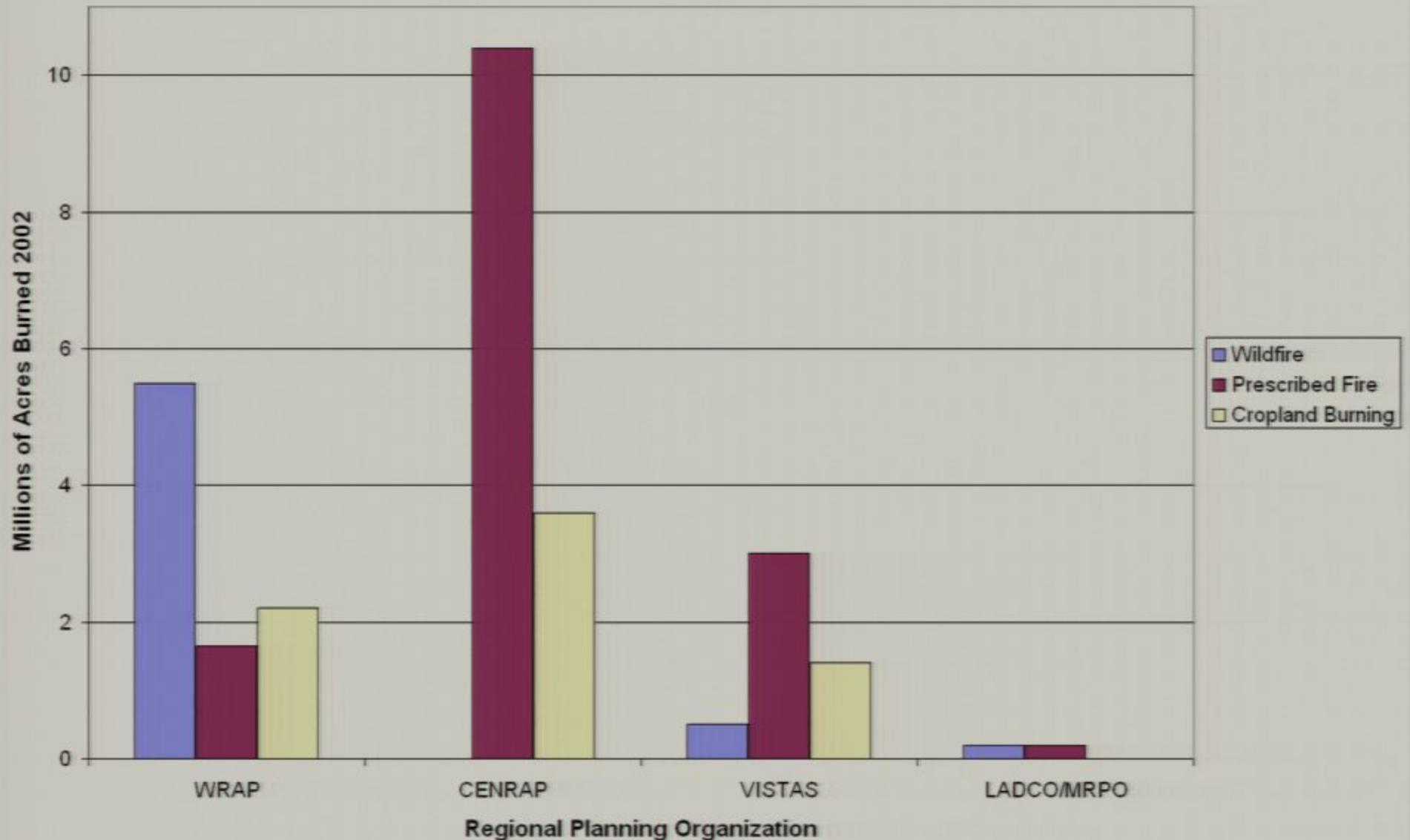


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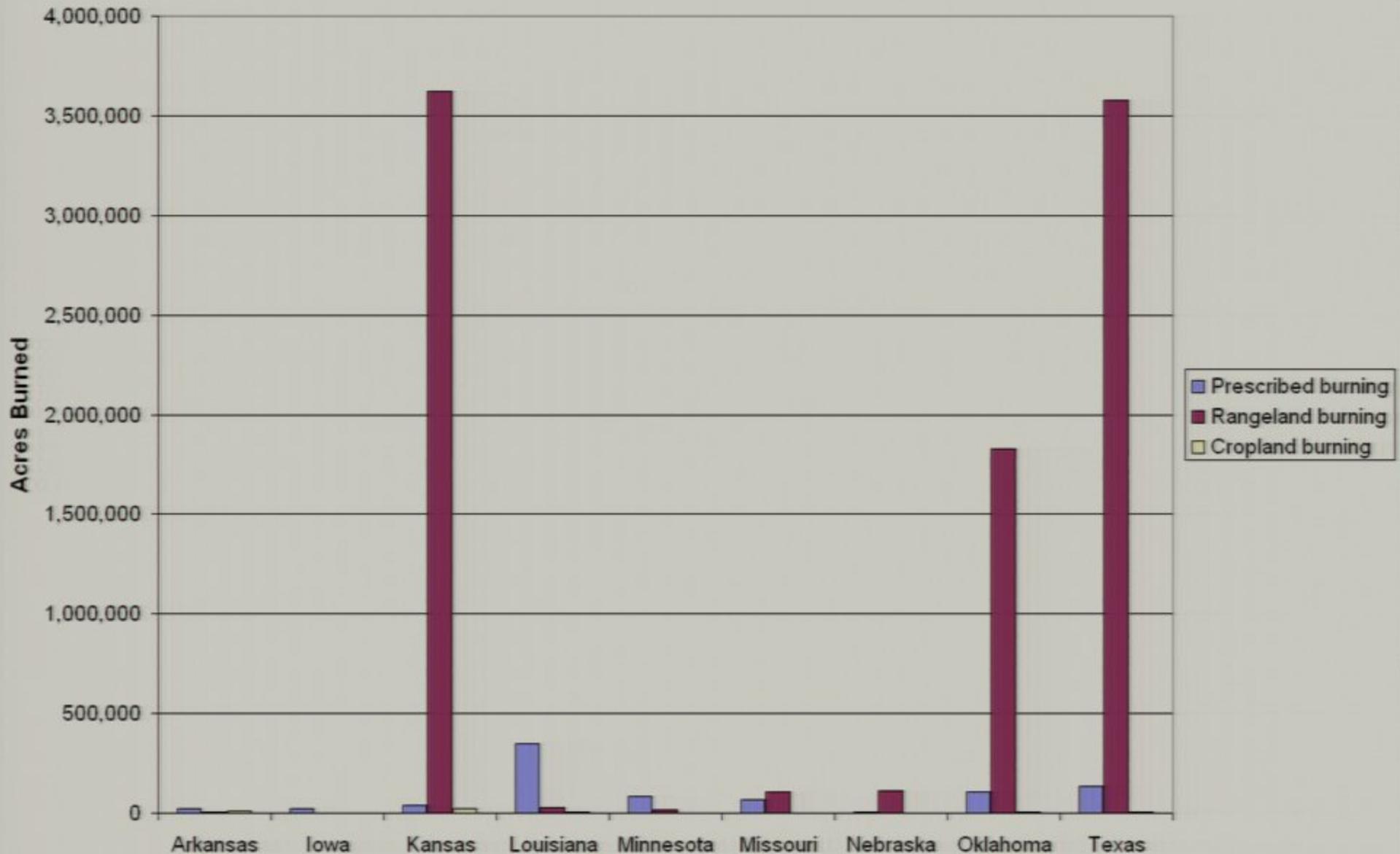
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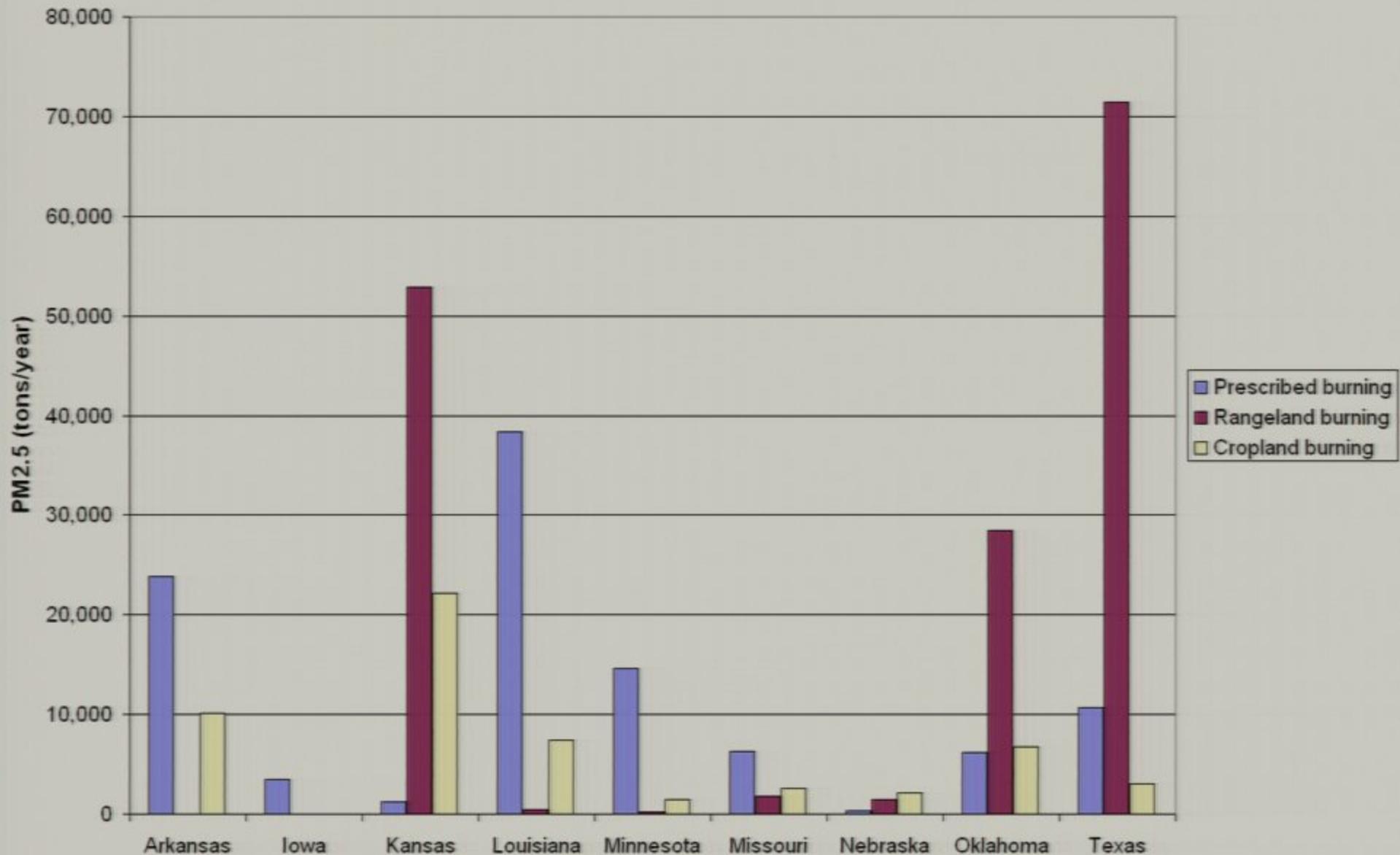
2002 Fire Emission Inventory Inter-RPO Comparison - Acres Burned



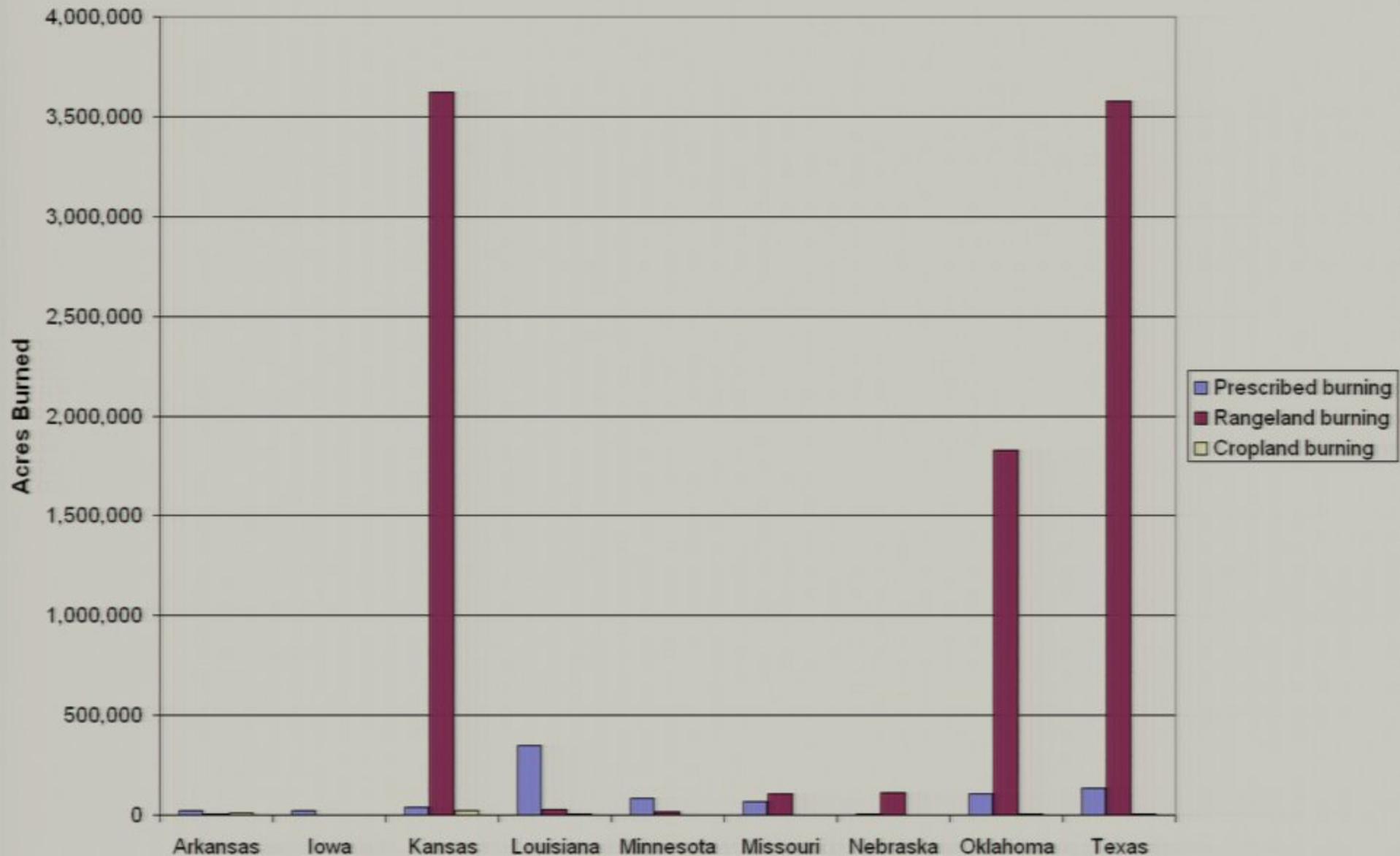
2002 CENRAP RPO Emissions Inventory Acres Burned



2002 CENRAP RPO Emissions Inventory PM2.5 Emissions



2002 CENRAP RPO Emissions Inventory Acres Burned

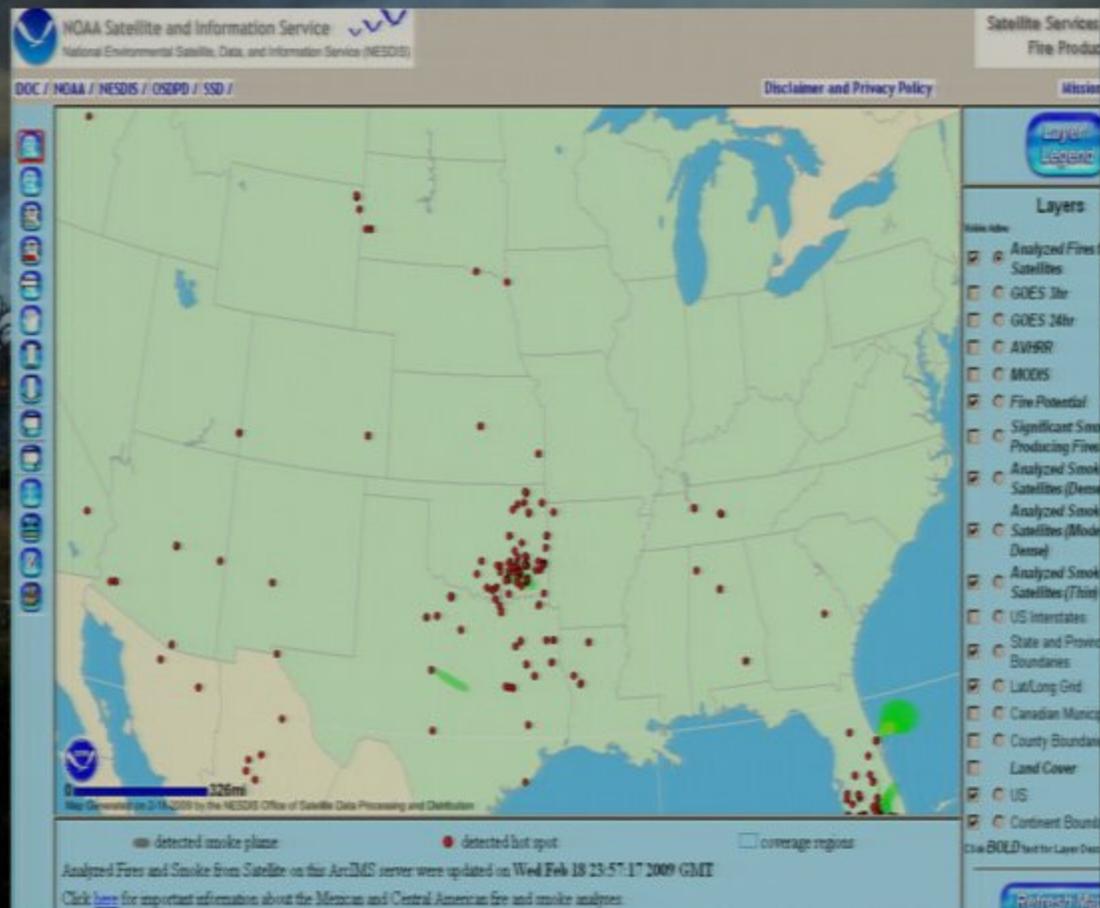


2002 CENRAP RPO Emissions Inventory PM2.5 Emissions



EPA 2008 Fire National Emission Inventory

- Released 2/2009
- Unique Features:
 - Satellite-based fire detections augmented with ground-based fire activity information
 - Greenhouse gases may be reported



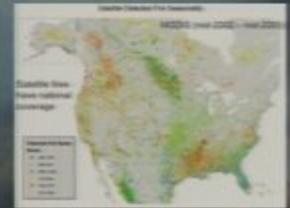
SMARTFIRE: Incorporating Satellite Fire Data

Ground-based Systems

- FETS
- FAETS

Satellite fire info
(NOAA HMS)

<http://www.ssd.noaa.gov/PS/FIRE/hms.html>



SMARTFIRE

Reconciled fire info
including sub-grid fuels
and plume information

BLUESKY

<http://www.getbluesky.org/bluesky/sti>

SMARTFIRE: Incorporating Satellite Fire Data

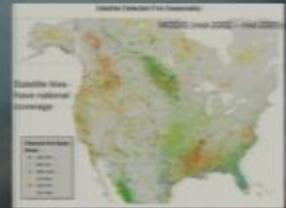
Ground-based Systems

- FETS
- FAETS

Expert Users
(ex. Incident Command Teams)

Satellite fire info
(NOAA HMS)

<http://www.ssd.noaa.gov/PS/FIRE/hms.html>



SMARTFIRE

Reconciled fire info including sub-grid fuels and plume information

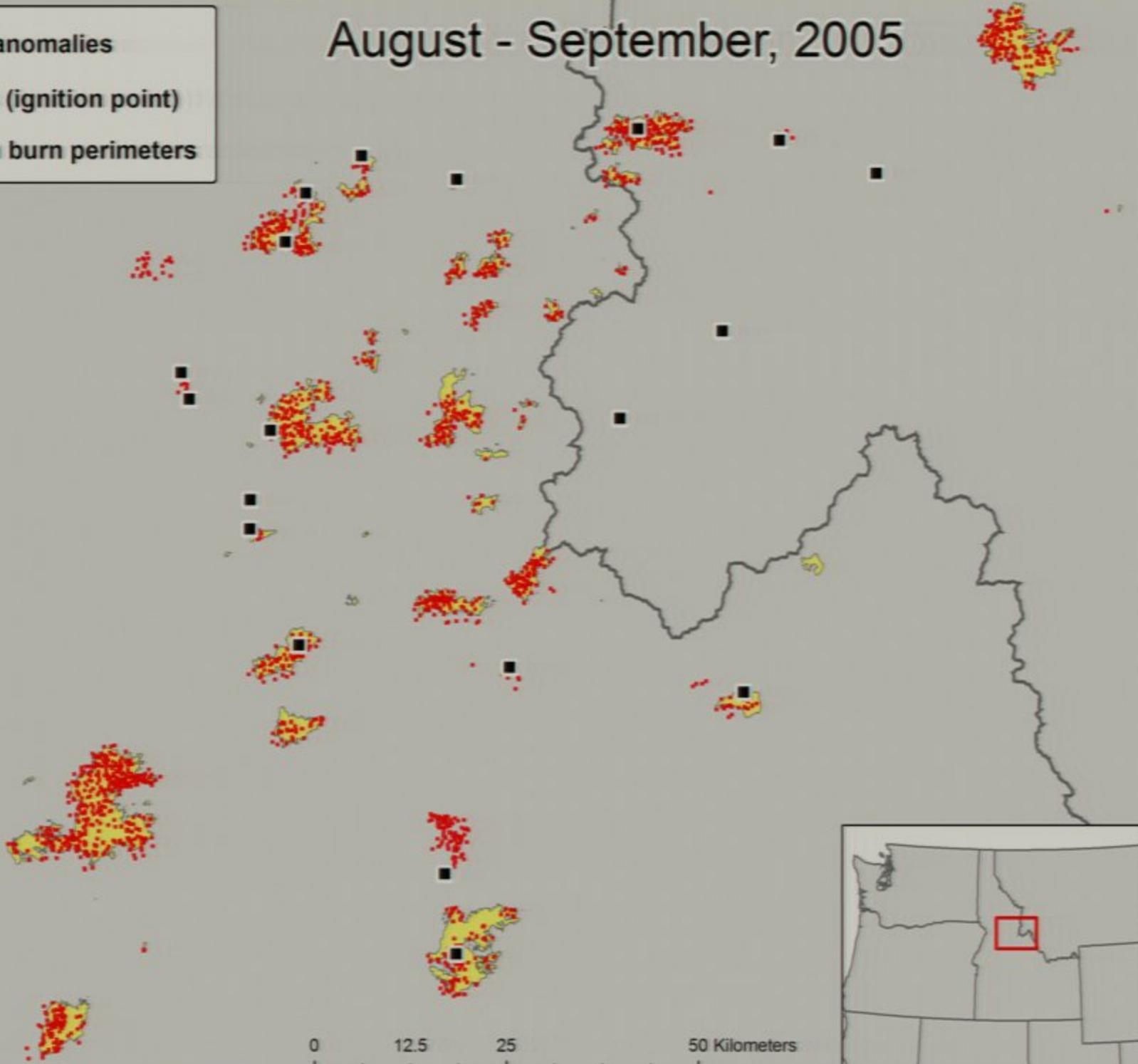
BLUESKY

<http://www.getbluesky.org/bluesky/sti>



August - September, 2005

- MODIS thermal anomalies
- ICS-209 Reports (ignition point)
- 🔺 Helicopter-flown burn perimeters



Satellite-detected Fires vs. Reports

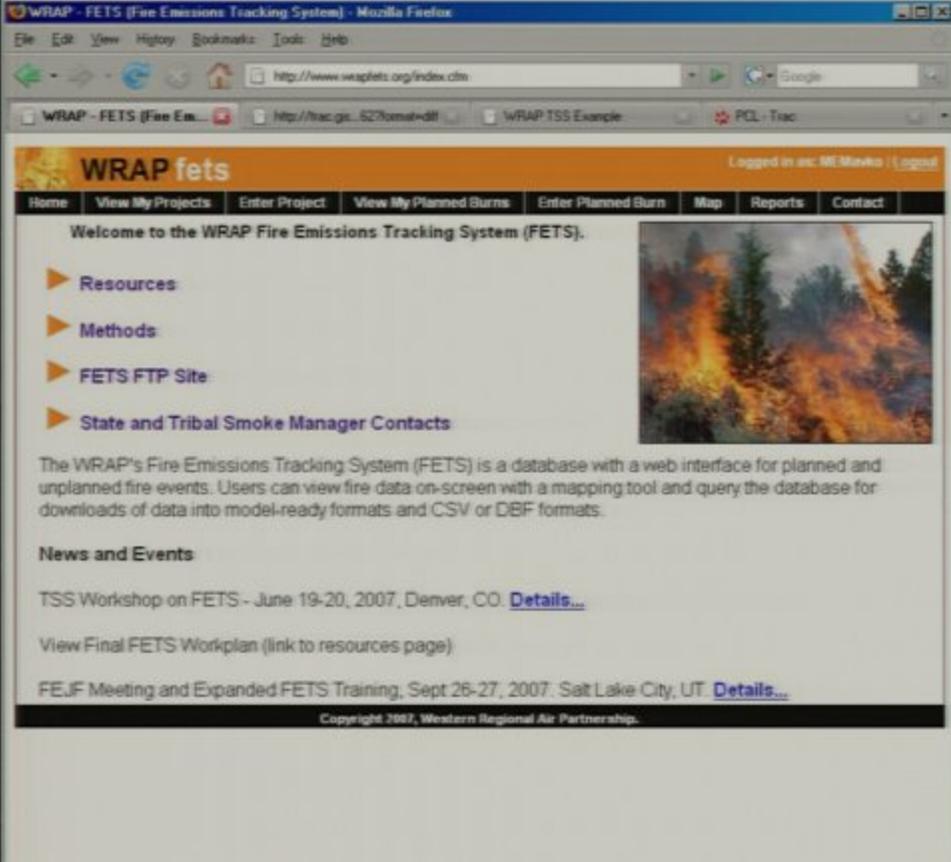
Clearly, satellite-detected fires are better than ICS-209 reports for this application.

Or are they?

- Limitations of satellite data
 - Detection limit – variable, 0.5 ha optimally
 - Limited detection of underburns and rangeland burns
 - Cloud interference
 - Size estimation
 - Only active burns (no planned/future info)
- Benefits of reported fire activity data
 - Smaller fires, Planned/Future fires
 - Additional useful information
 - Fuels information, Fire size, Ignition Time
 - Not all fires reported

Fire Activity Reporting

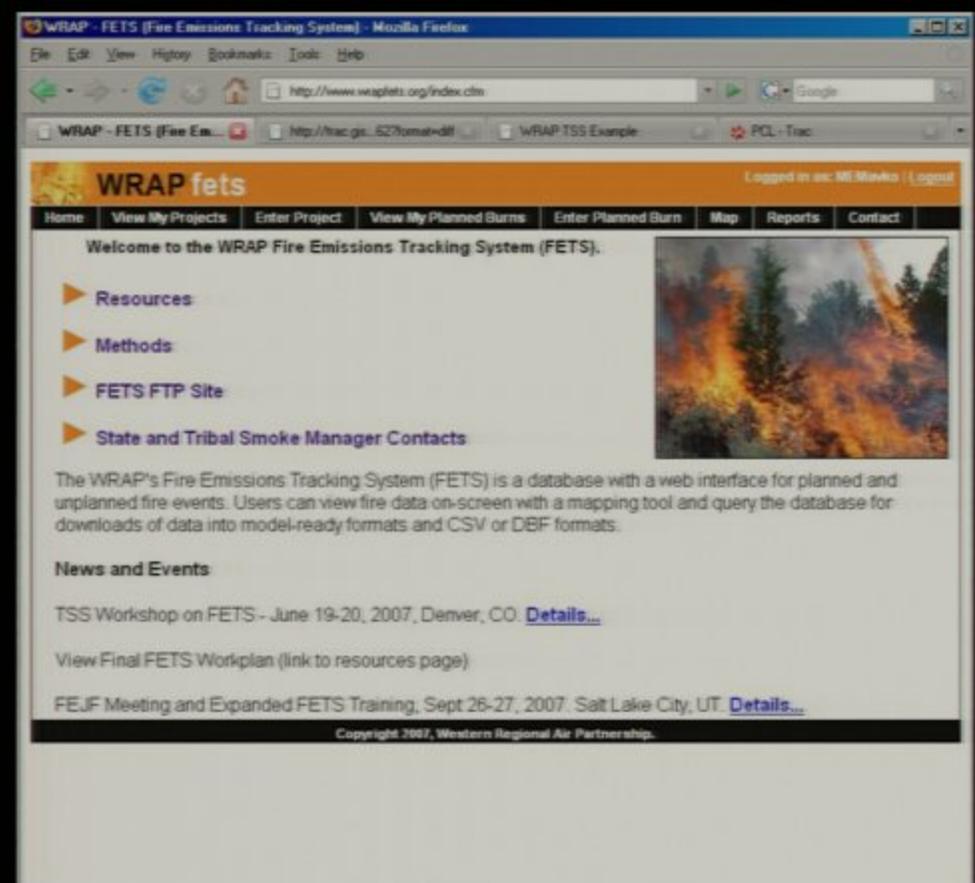
- WRAP Fire Emission Tracking System (FETS)
 - Web-based
 - Coordination with existing fire tracking databases
 - Burn Data requirements: Date, Location, Area, Fuel Type, Fuel Loading, Type
 - Other elements: Mapped fuel loads, emissions calculations, emission reduction techniques
- Fire Activity and Emission Tracking System (FAETS)
 - North Carolina, Pennsylvania
 - Awaiting funds
 - Based upon Florida System



The screenshot shows a web browser window displaying the WRAP FETS (Fire Emission Tracking System) homepage. The browser's address bar shows the URL <http://www.wrapfets.org/index.cfm>. The page features a navigation menu with links for Home, View My Projects, Enter Project, View My Planned Burns, Enter Planned Burn, Map, Reports, and Contact. A welcome message reads: "Welcome to the WRAP Fire Emissions Tracking System (FETS)." Below this, there are four resource links: Resources, Methods, FETS FTP Site, and State and Tribal Smoke Manager Contacts. A photograph of a forest fire is visible on the right side of the page. The main content area describes the FETS as a database with a web interface for planned and unplanned fire events, allowing users to view data on-screen with a mapping tool and query the database for downloads in model-ready formats and CSV or DBF formats. Under the "News and Events" section, there are two entries: "TSS Workshop on FETS - June 19-20, 2007, Denver, CO" with a [Details...](#) link, and "View Final FETS Workplan (link to resources page)". A second news entry is "FEJF Meeting and Expanded FETS Training, Sept 26-27, 2007, Salt Lake City, UT" with a [Details...](#) link. The footer of the page contains the text "Copyright 2007, Western Regional Air Partnership."

Fire Activity Reporting

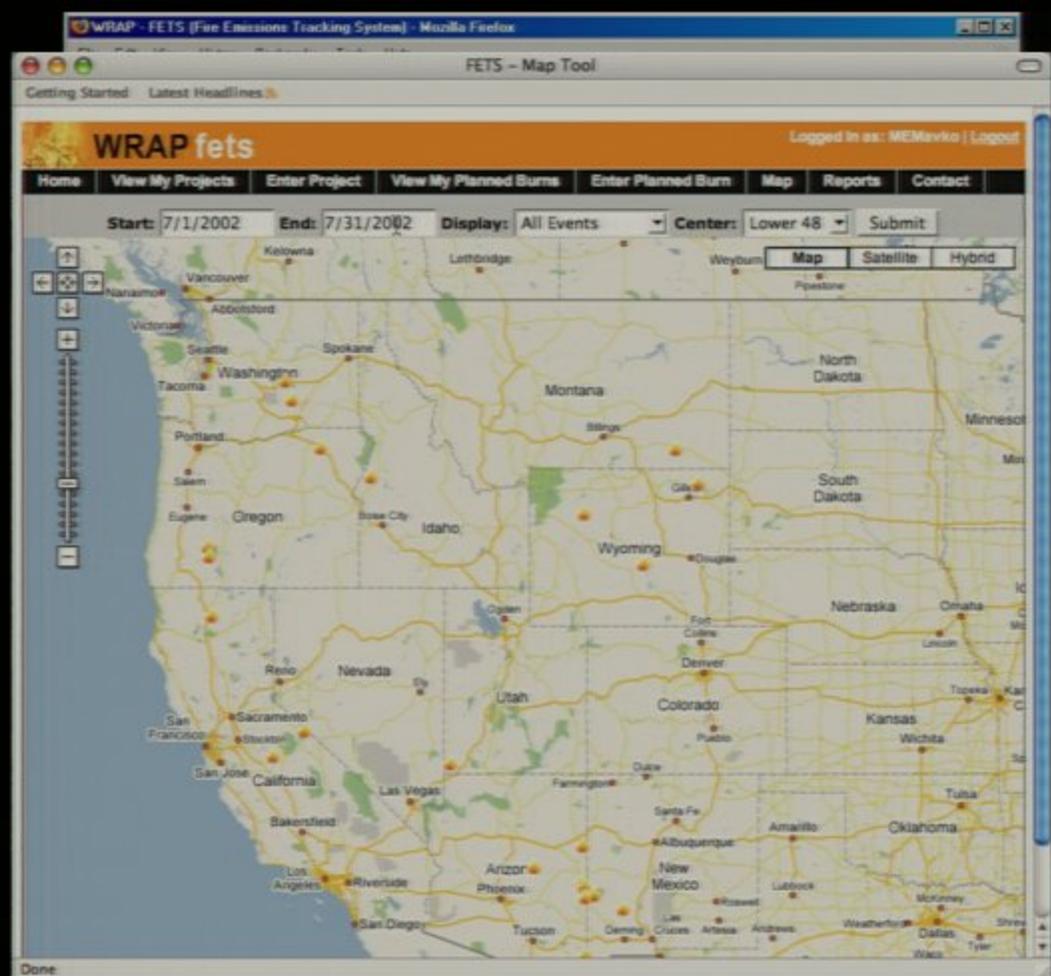
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Project ID	Project Name	State	County	Agency	View Data
111-124	Washburn	OR	Wasco County	4232	View Data
111-180	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-243	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-244	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-245	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-246	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-247	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-248	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-249	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-250	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-251	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-252	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-253	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-254	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-255	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-256	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-257	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-258	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-259	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data
111-260	2007-2008 Oregon Statewide Fuel Management	OR	Wasco County	4232	View Data

Fire Activity Reporting

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The screenshot shows a table of project data. The table has columns for Project ID, Project Name, State, County, and Agency. The data is as follows:

Project ID	Project Name	State	County	Agency
11111	Project 1	CA	San Diego County	11111
11112	Project 2	CA	San Diego County	11112
11113	Project 3	CA	San Diego County	11113
11114	Project 4	CA	San Diego County	11114
11115	Project 5	CA	San Diego County	11115
11116	Project 6	CA	San Diego County	11116
11117	Project 7	CA	San Diego County	11117
11118	Project 8	CA	San Diego County	11118
11119	Project 9	CA	San Diego County	11119
11120	Project 10	CA	San Diego County	11120

The screenshot shows a form for entering project data. The form has the following fields:

- Enter Project Name:
- Agency:
- State:
- County:
- Latitude:
- Longitude:
- Fuel Type:
- Area Type:
- Project Name:
- Start Date:
- End Date:

EPA 2008 Fire National Emission Inventory - Timeline

- Now – 7/2009: States submit fire activity data to FETS (emission estimates not required)
- 7-10/2009: EPA runs SMARTFIRE & BlueSky
- 10/1/2009: preliminary fire EI available for review
- 7/09 – 6/10: States submit fire activity data to the EIS system
- 6/4-7/16, 2010: EPA selects combined preliminary fire EI (SMARTFIRE + State submittals)
- 7/19/2010 – 10/30/2010: Review & comment on fire EI
- 12/31/2010: Public release of fire EI

Thank you! Questions, Comments, Discussion

National Smoke Management Website

<http://www.nifc.gov/smoke>

My Fire Community "Air Quality and Fire Issues"

www.myfirecommunity.net

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503-273-2438

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