Development of Wildland Fire Emission Inventories for 2003-2006 and Sensitivity Analyses

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Emission Inventory Processing

- Contiguous United States
- August 2002 through 2006
- Wildfire, WFUs, prescribed burning
- Agricultural burning excluded

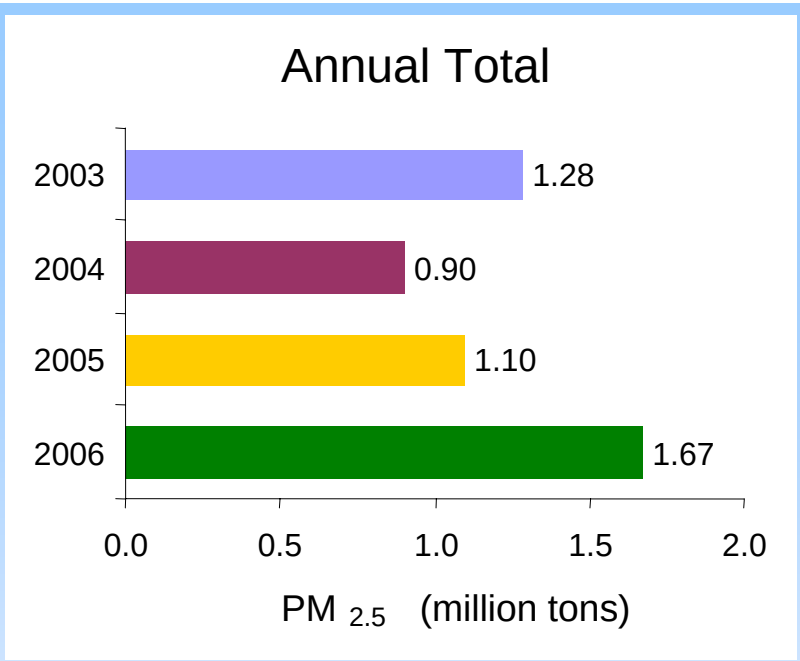
BlueSky Pathway

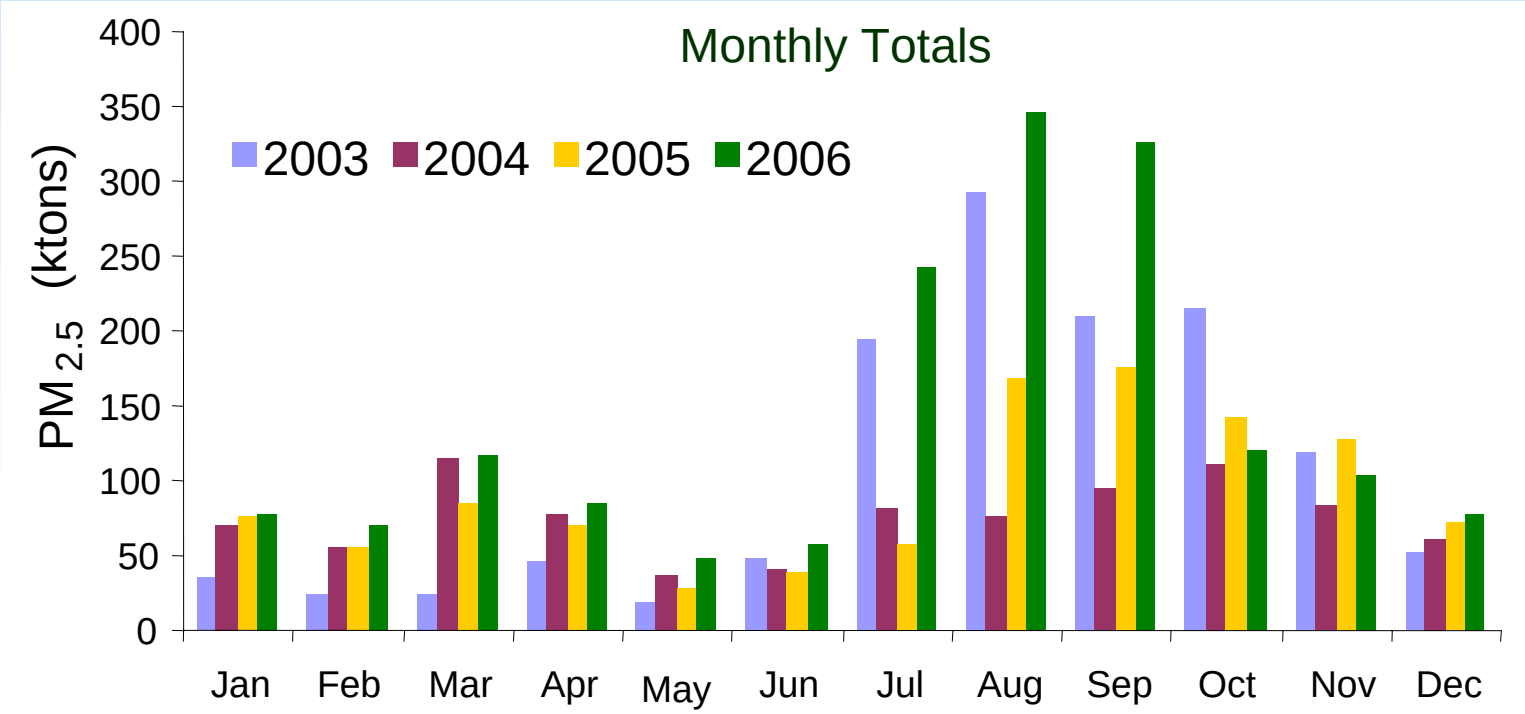
- Fire Information: SMARTFIRE
- Fuel loading: FCCS
- Fuel Consumption: Consume 3.0
- Emissions: FEPS

Data Sources

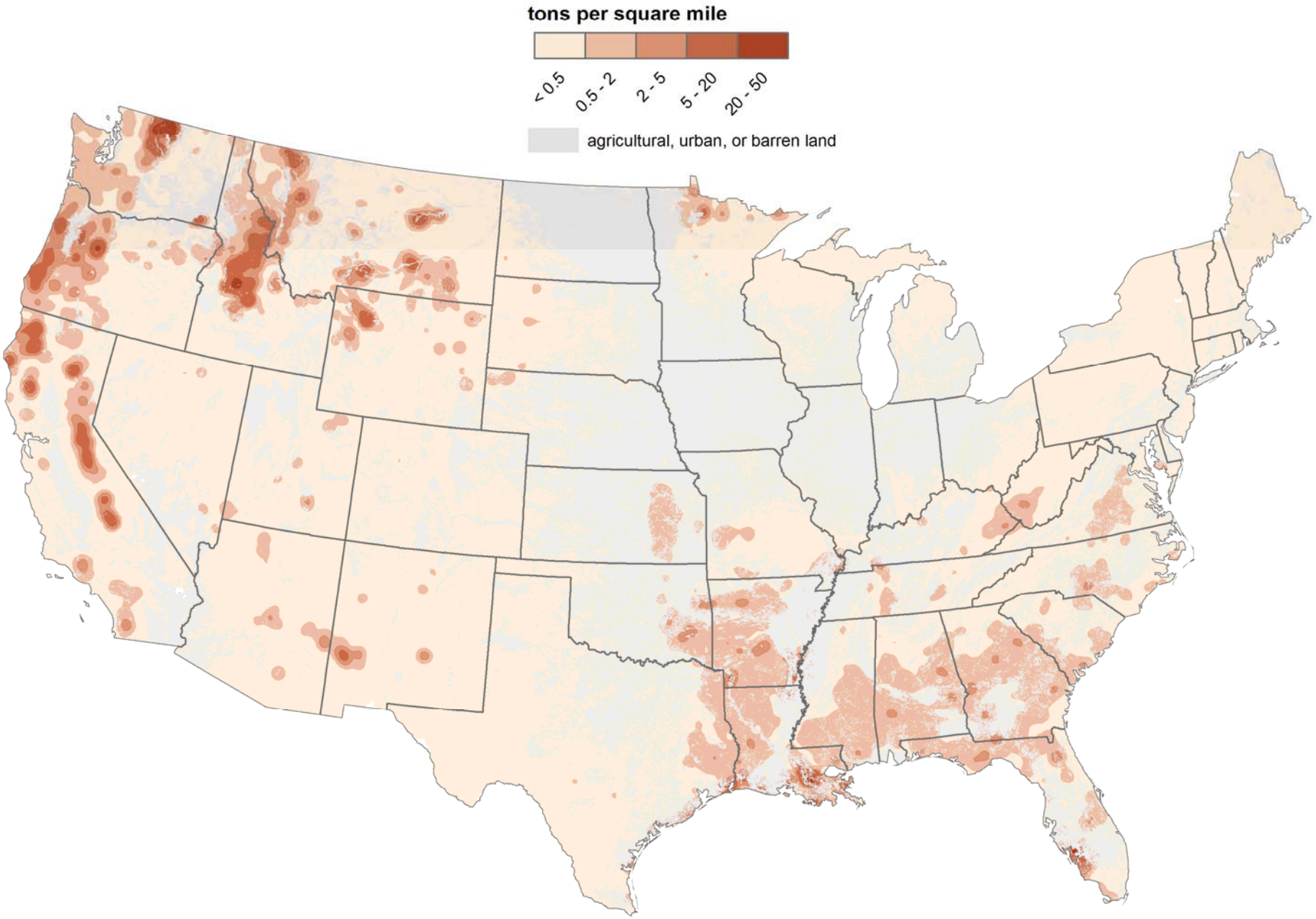
- ICS-209 reports: AirFire, FAMWEB, Tom Pace
- HMS fire detects: NOAA HMS (Mark Ruminski)
- MODIS fire detects: USFS Remote Sensing Applications Center (used to fill gaps in HMS data)
- Fuel moisture: USFS Wildland Fire Assessment System

Annual $PM_{2.5}$ Primary Emissions (2003-2006, Lower 48)

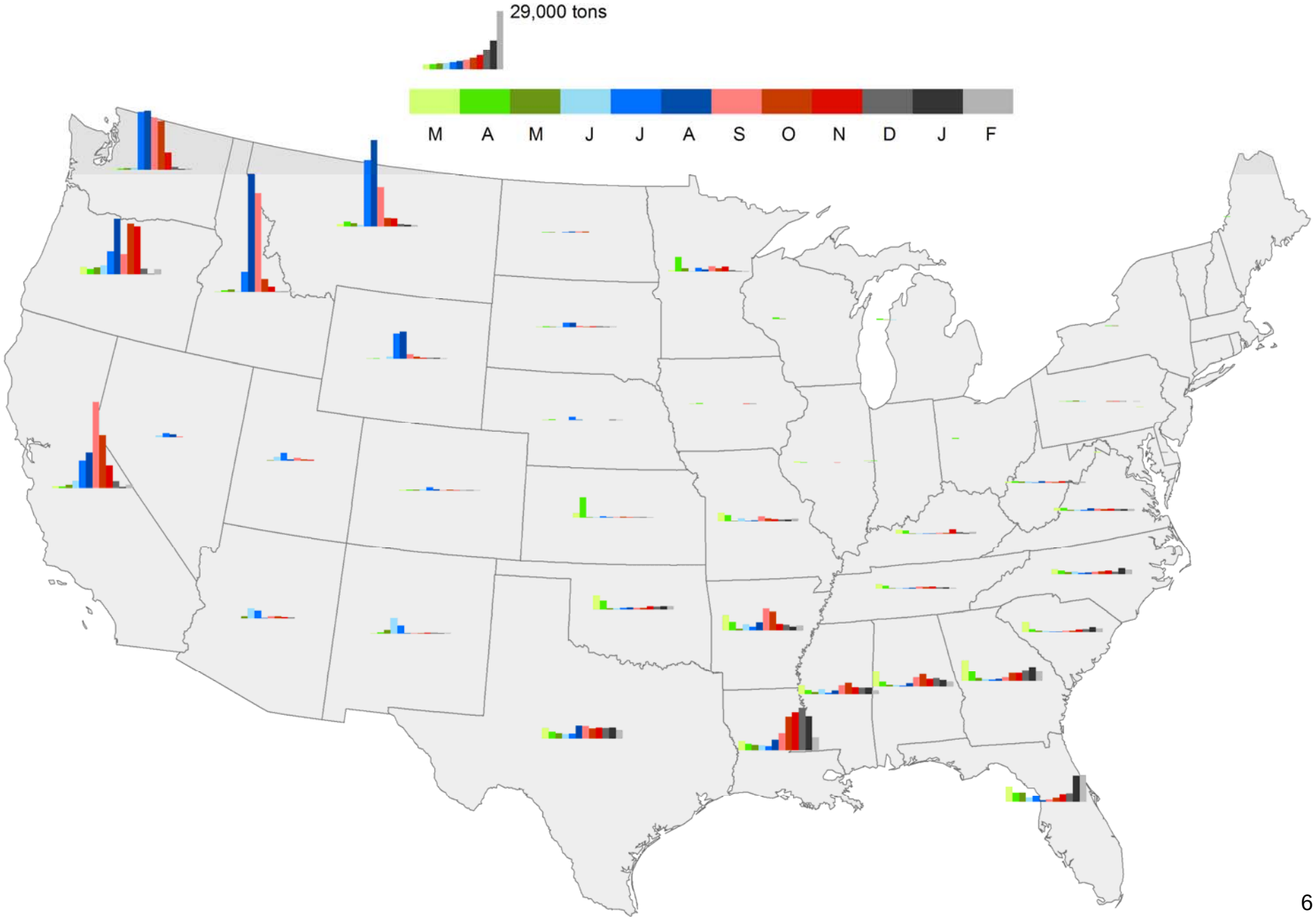


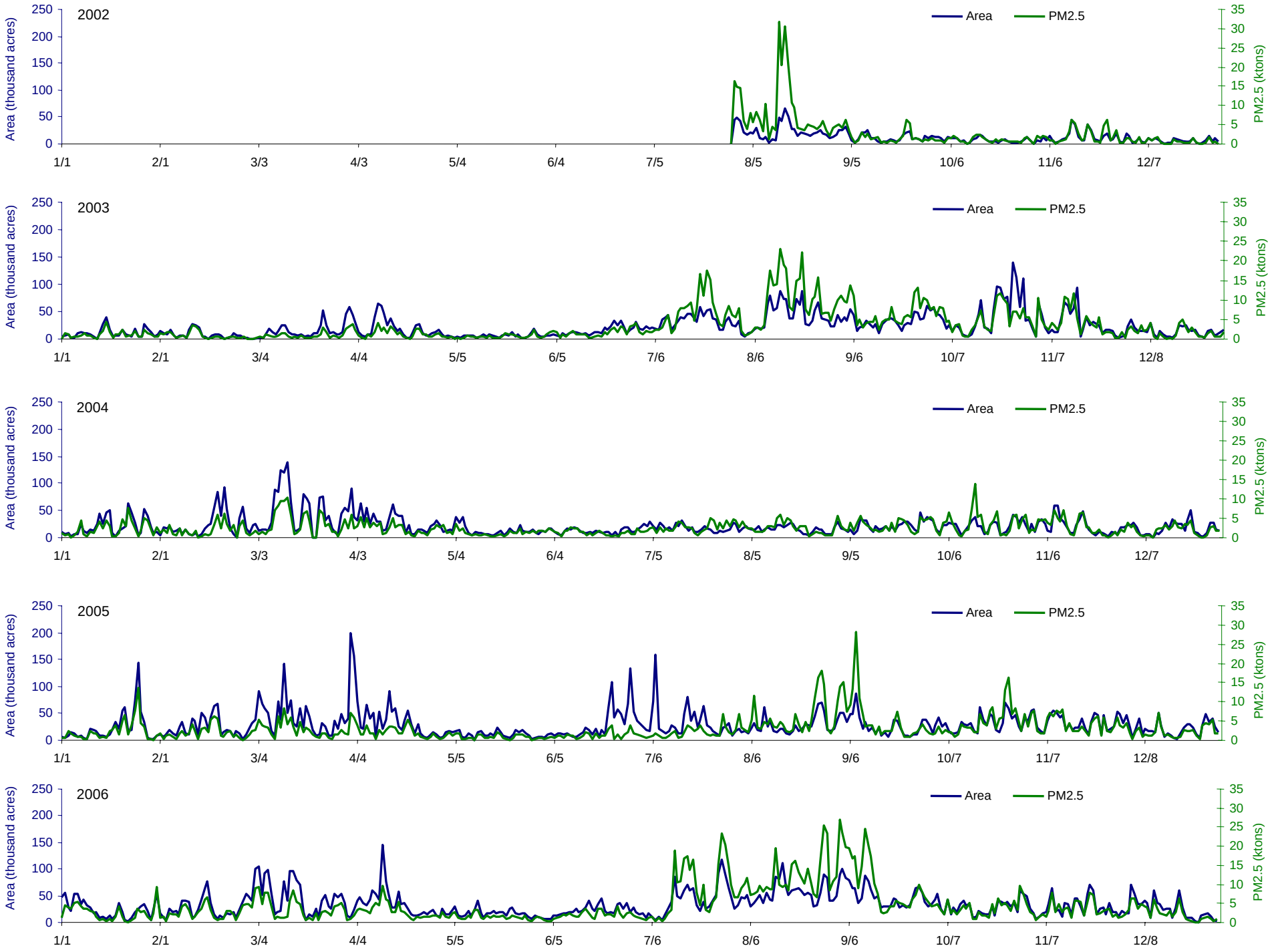


Annual Average $PM_{2.5}$ Wildland Fire Emission Density (2003 - 2006)



Average Monthly Wildland Fire $PM_{2.5}$ Emissions (2003 - 2006)




2002
2003
2004
2005
2006
Area
PM2.5
Area (thousand acres)
PM2.5 (ktons)
0
50
100
150
200
250
5
10
15
20
25
30
35
1/1
2/1
3/3
3/4
4/3
4/4
5/4
5/5
6/4
6/5
7/5
7/6
8/5
8/6
9/5
9/6
10/6
10/7
11/6
11/7
12/7
12/8

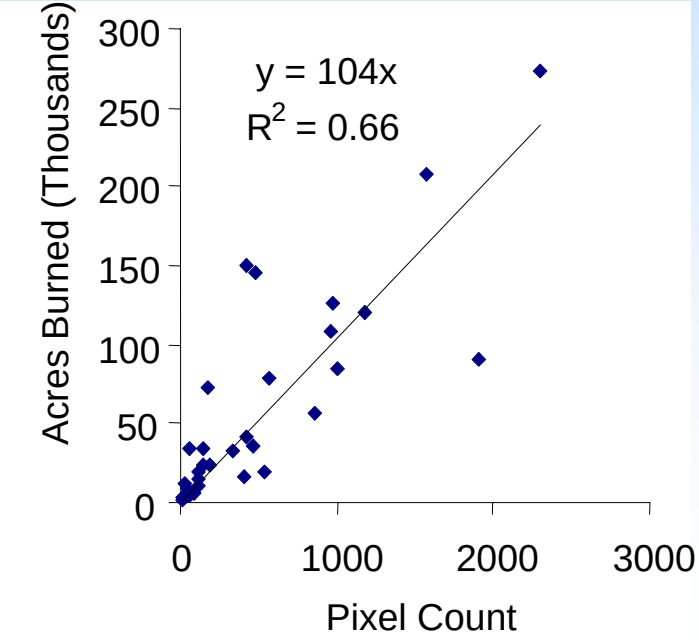
Effect of Different Fire Information Sources

ICS-209s only

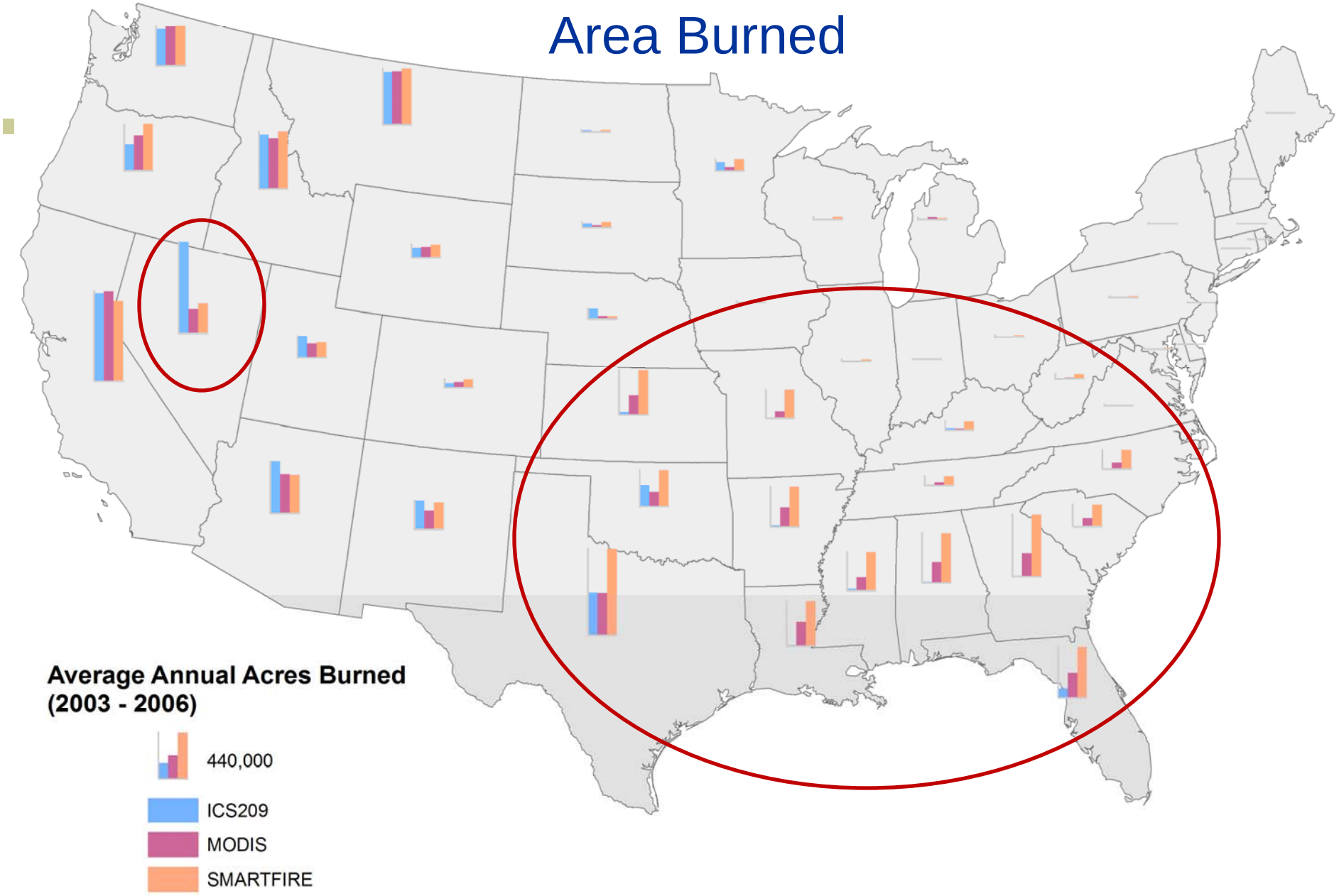
- This was BlueSky's previous data feed.
- ICS-209s report cumulative area burned.
- We subtracted the previous day's area from today's to get the daily area burned.

MODIS Terra and Aqua only

- This is the most commonly used satellite-derived fire data set.
- We developed acres burned per pixel relationship by examining 30 wildfires.
- Used 100 acres per pixel.



SMARTFIRE vs. MODIS vs. ICS-209
Area Burned

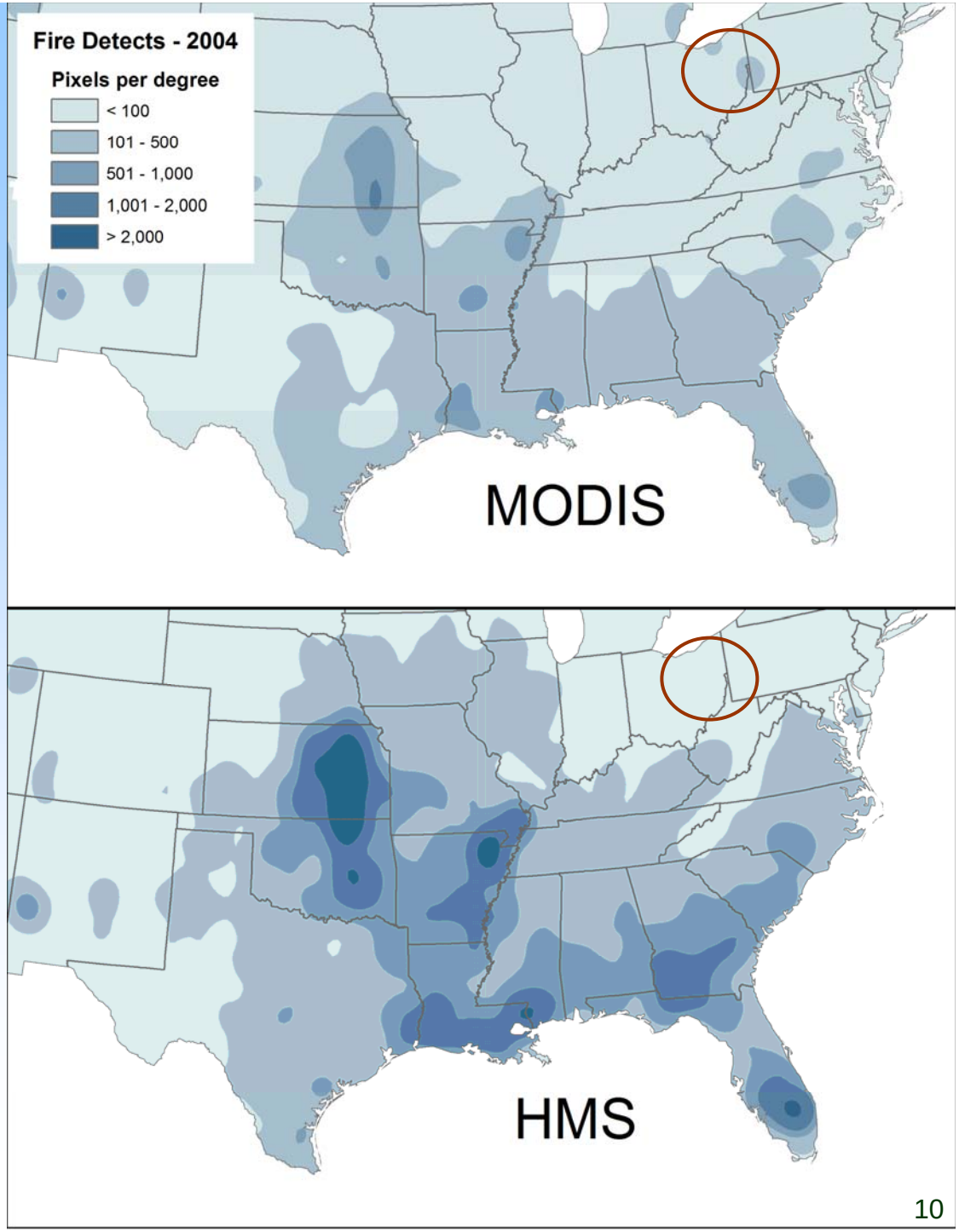


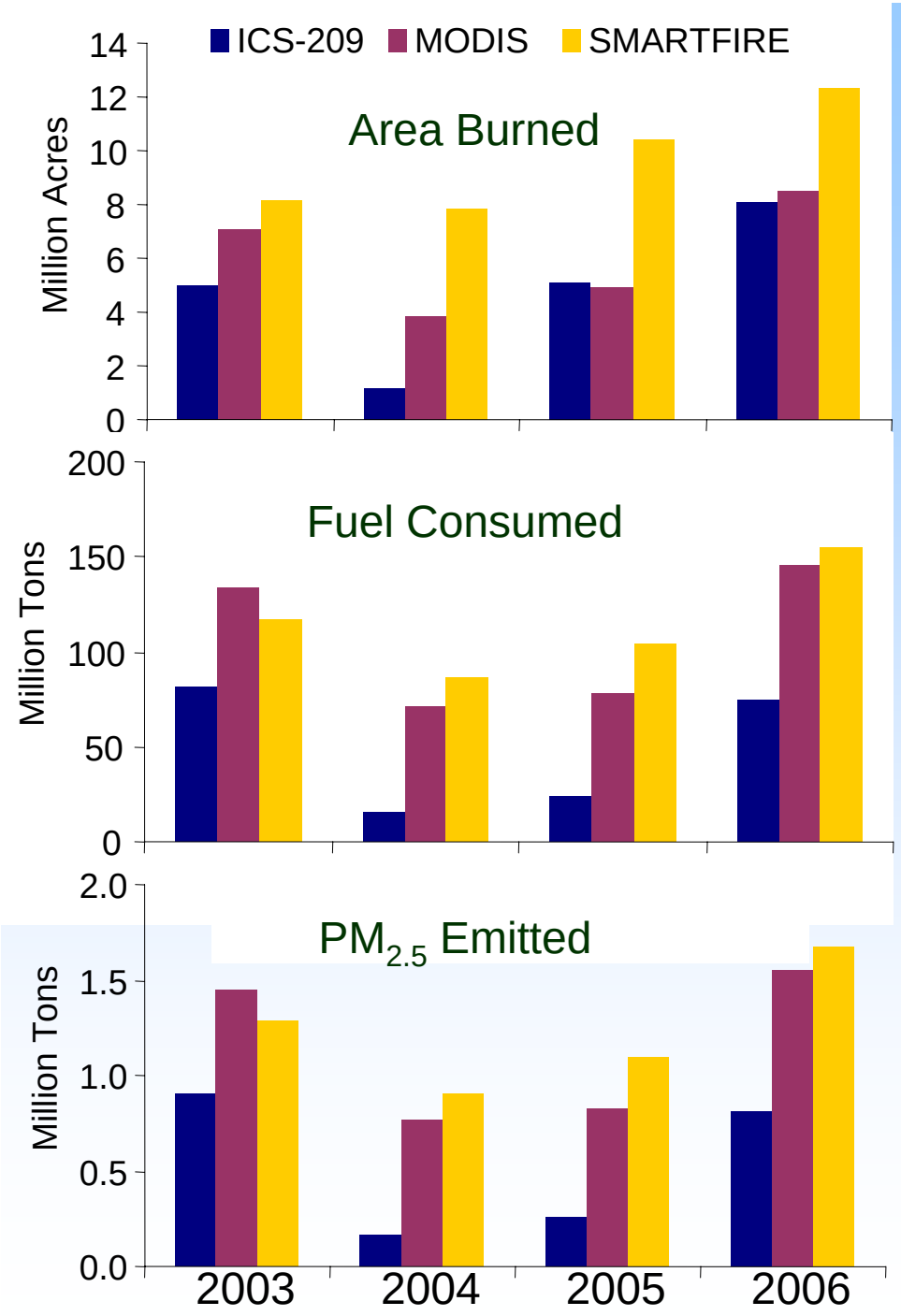
Differences Between MODIS and HMS

Because HMS includes GOES and AVHRR derived fire pixels in addition to MODIS, it detects more fires overall.

This is especially true in the southeast, where fires are often small and/or short lived.

In addition to the increased coverage, HMS provides human quality control.





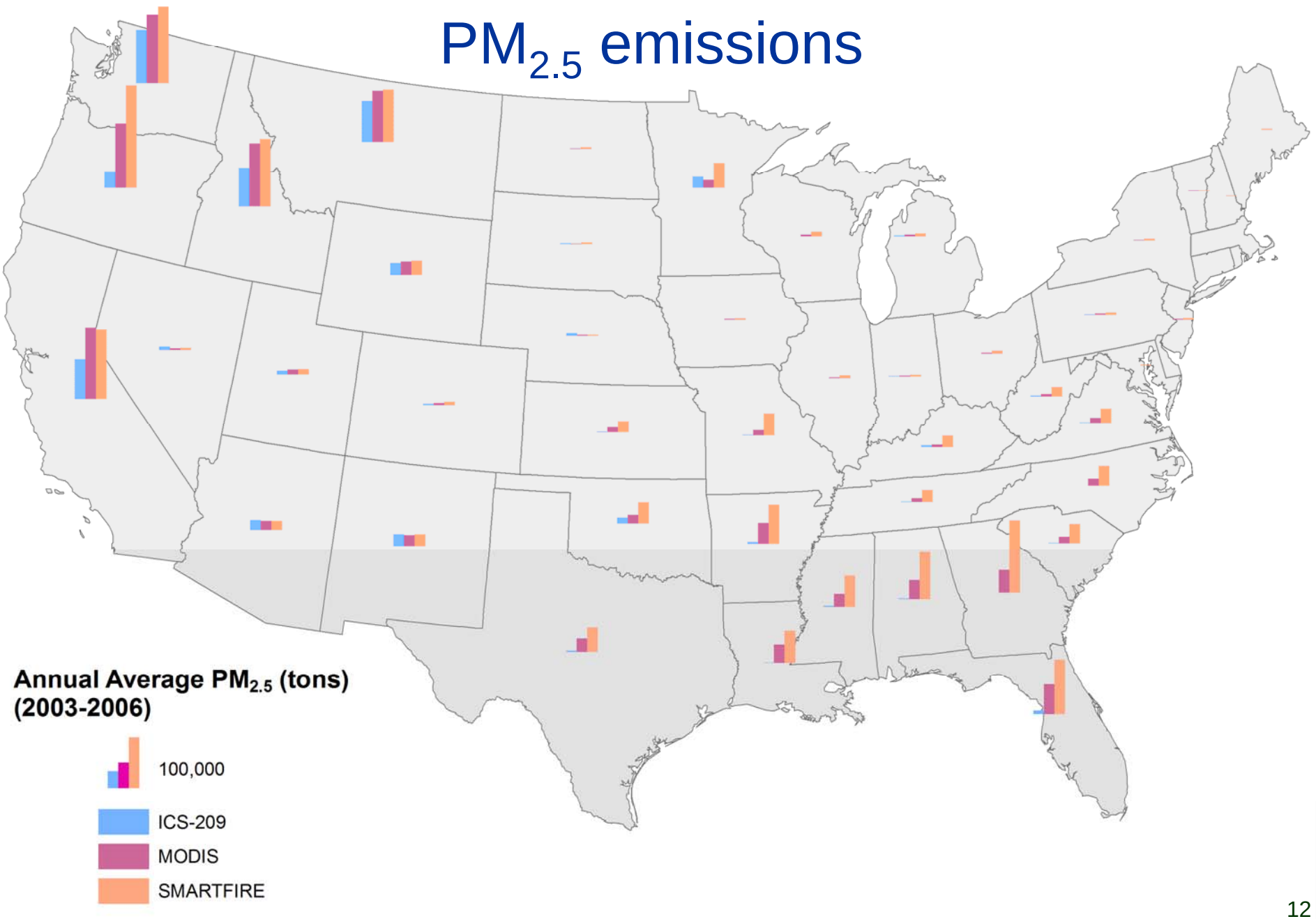
Yearly Totals

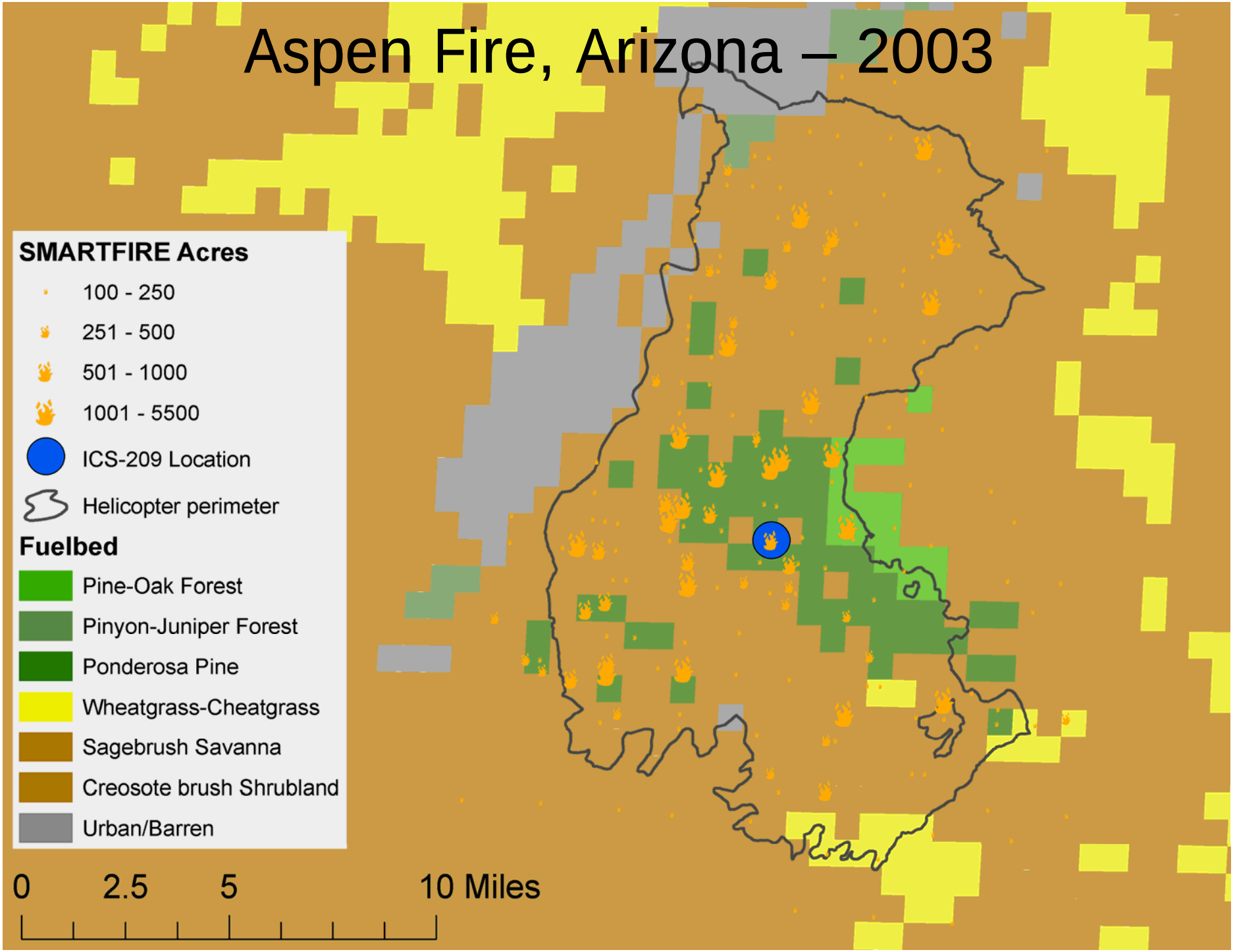
Overall Consumption Rate (tons/acre)	
ICS-209	10.0
MODIS	17.6
SMARTFIRE	11.9

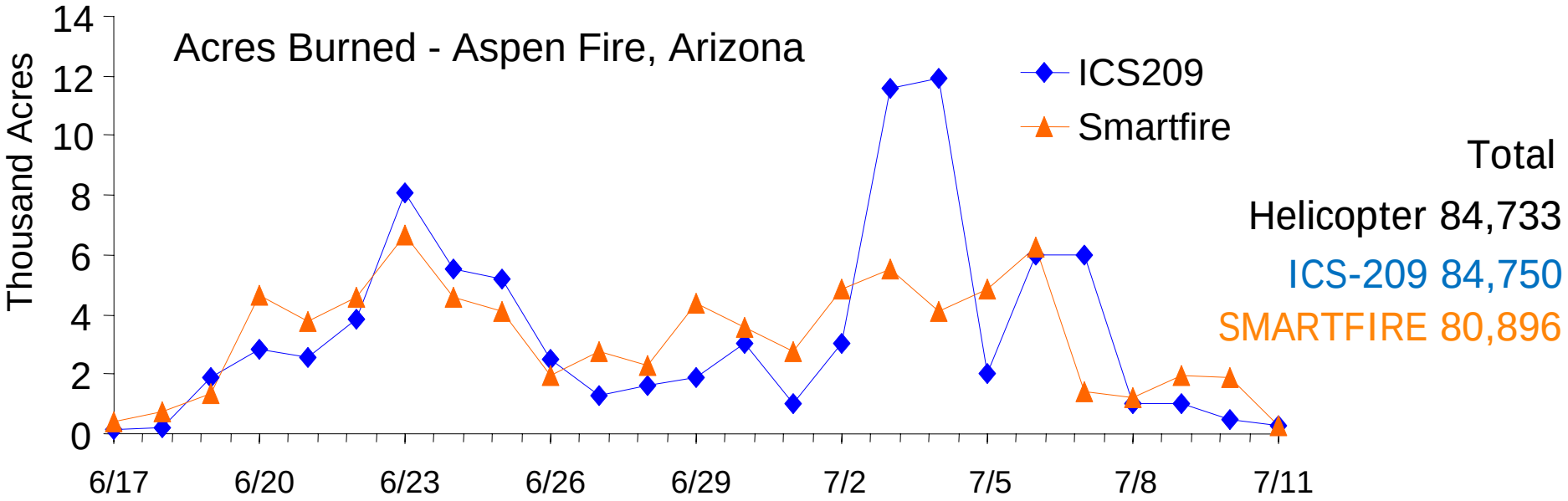
MODIS consumption rate is much higher than the other two.

Why?

SMARTFIRE vs. MODIS vs. ICS-209 $PM_{2.5}$ emissions




Aspen Fire, Arizona – 2003
SMARTFIRE Acres
100 - 250
251 - 500
501 - 1000
1001 - 5500
ICS-209 Location
Helicopter perimeter
Fuelbed
Pine-Oak Forest
Pinyon-Juniper Forest
Ponderosa Pine
Wheatgrass-Cheatgrass
Sagebrush Savanna
Creosote brush Shrubland
Urban/Barren
0
2.5
5
10 Miles

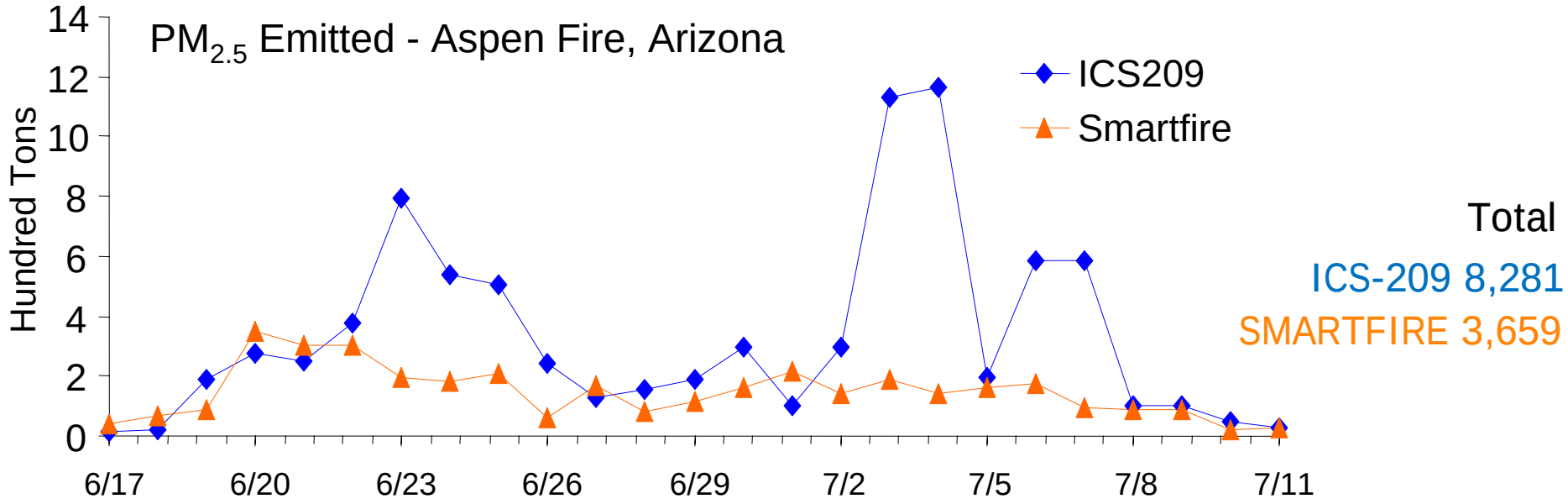


Total

Helicopter 84,733

ICS-209 84,750

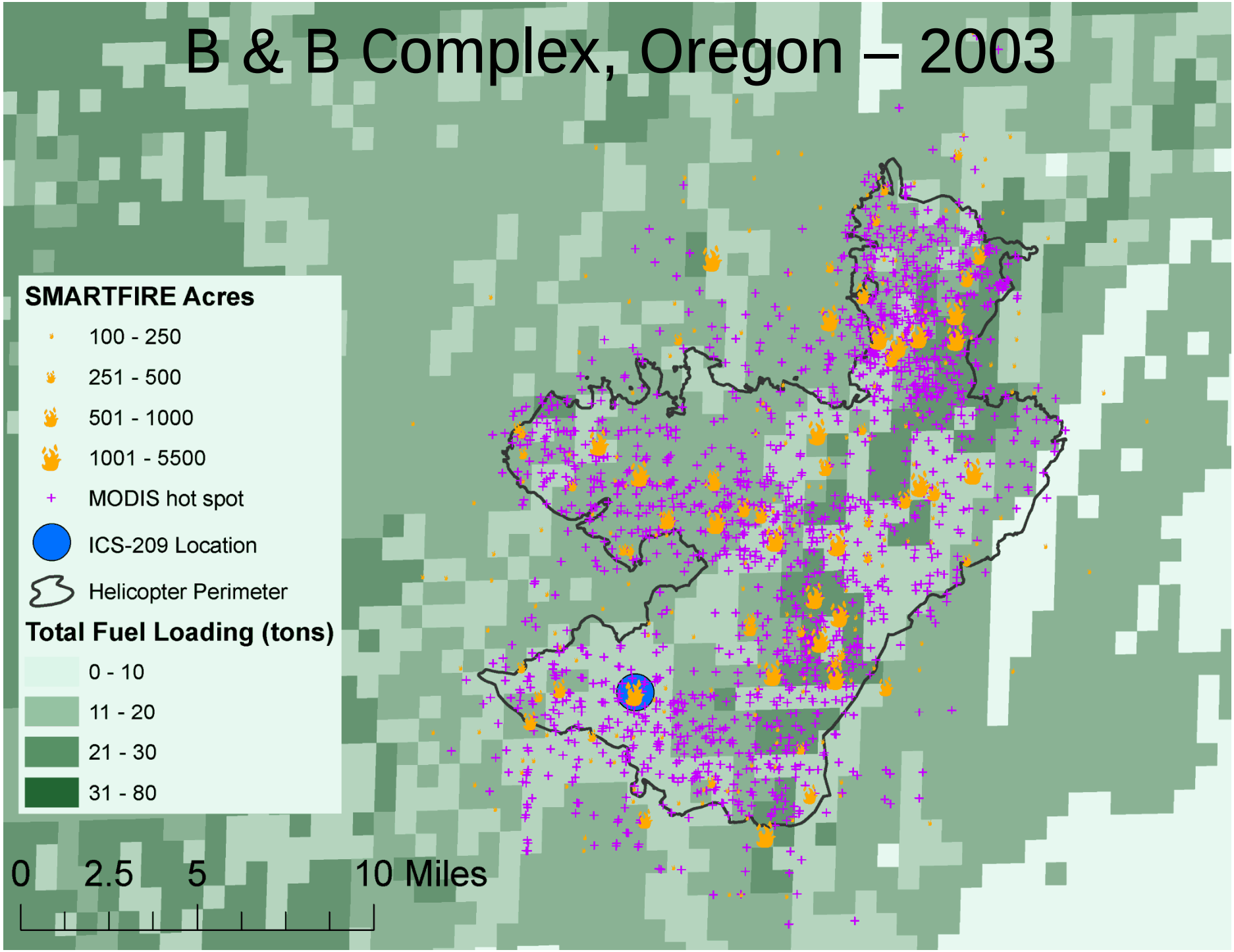
SMARTFIRE 80,896

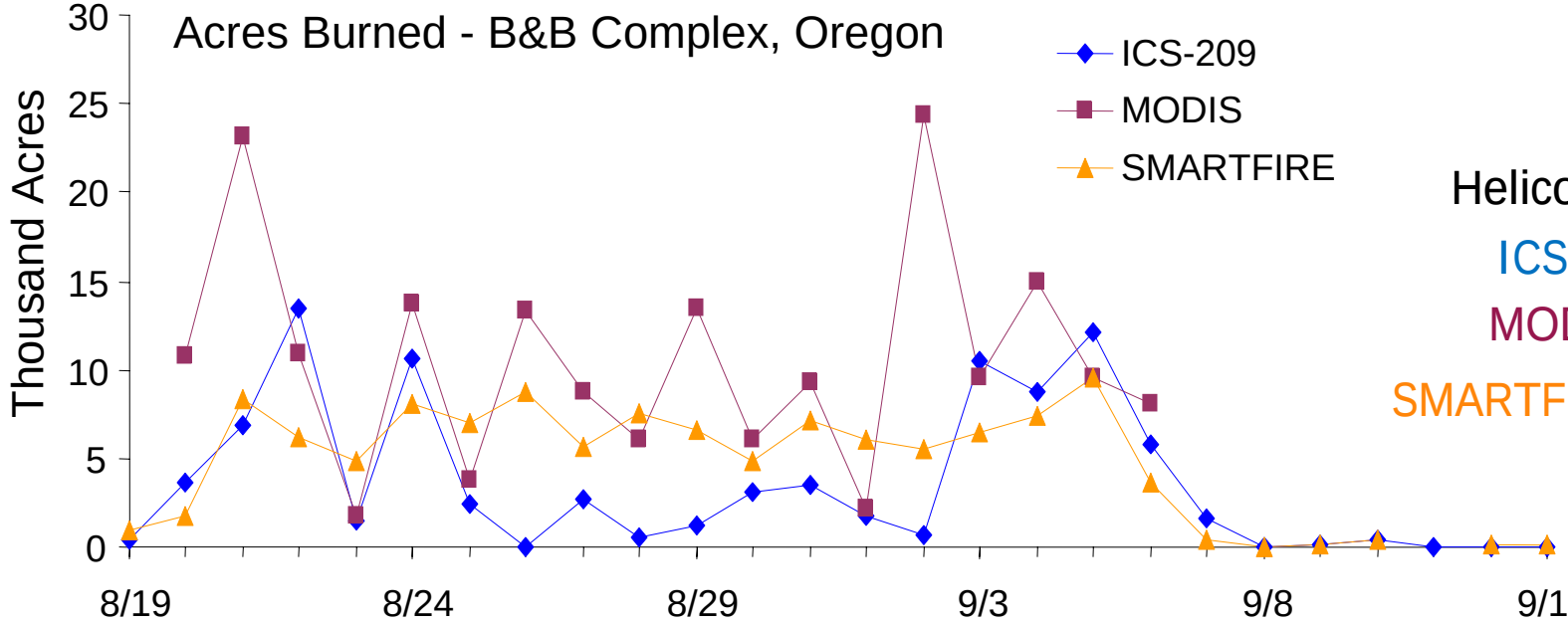


Total

ICS-209 8,281

SMARTFIRE 3,659


B & B Complex, Oregon – 2003
SMARTFIRE Acres
100 - 250
251 - 500
501 - 1000
1001 - 5500
MODIS hot spot
ICS-209 Location
Helicopter Perimeter
Total Fuel Loading (tons)
0 - 10
11 - 20
21 - 30
31 - 80
0
2.5
5
10 Miles



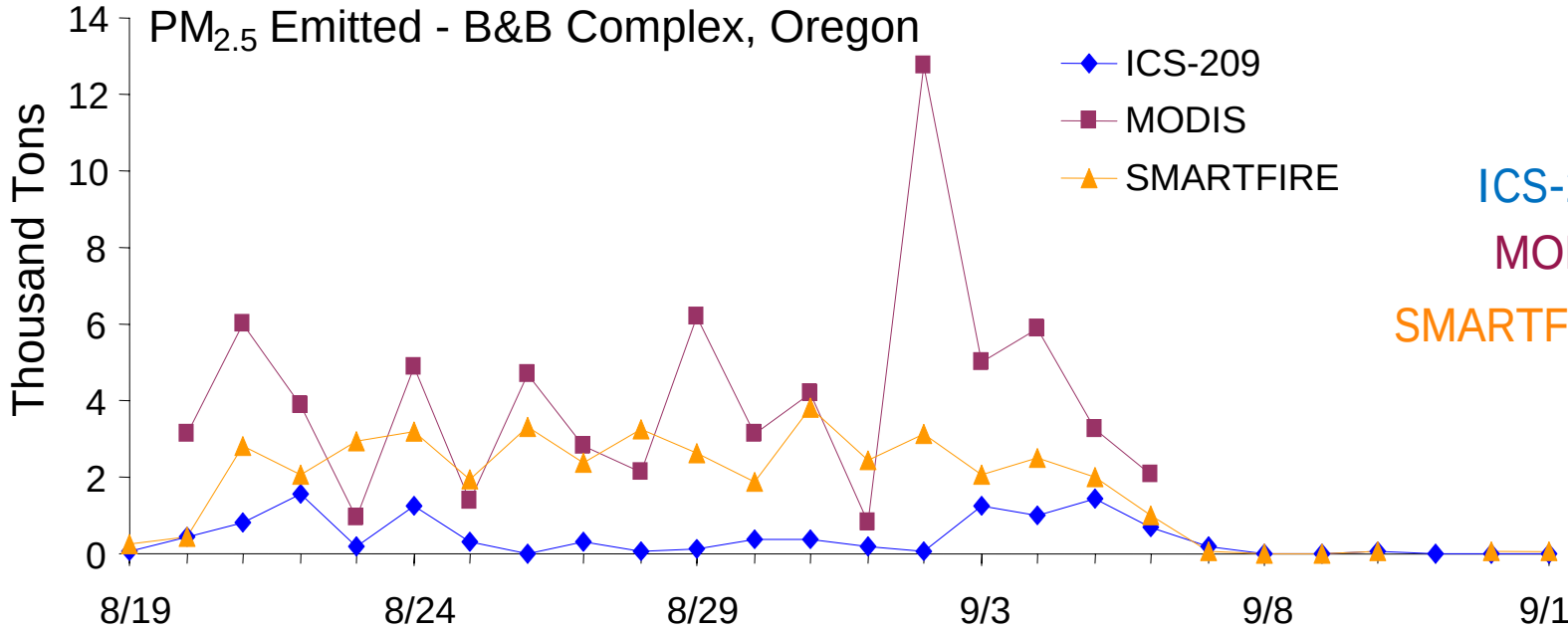
Total

Helicopter 90,800

ICS-209 91,500

MODIS 189,800

SMARTFIRE 117,100



Total

ICS-209 10,700

MODIS 73,100

SMARTFIRE 44,200

Future Work

- Continued validation and improvement of fire size parameters
- Further exploration of fuel consumption rate estimates
- Differences with high resolution fuel loading data (LANDFIRE)
  - 30-m spatial resolution is finer scale than the satellite fire information
  - Will use helicopter flown perimeters or high resolution satellite burn scars to determine area burned

Acknowledgments

- Funding from National Fire Plan, USFS, Joint Fire Science Program, EPA, DOI, and NASA ROSES DSS
- Our many collaborators and partners
- Tom Pace (EPA)
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- Mark Ruminski and John Simko (NOAA NESDIS)
- Roger Ottmar and Susan Pritchard (USFS)

Thank you!

www.getbluesky.org/smartfire

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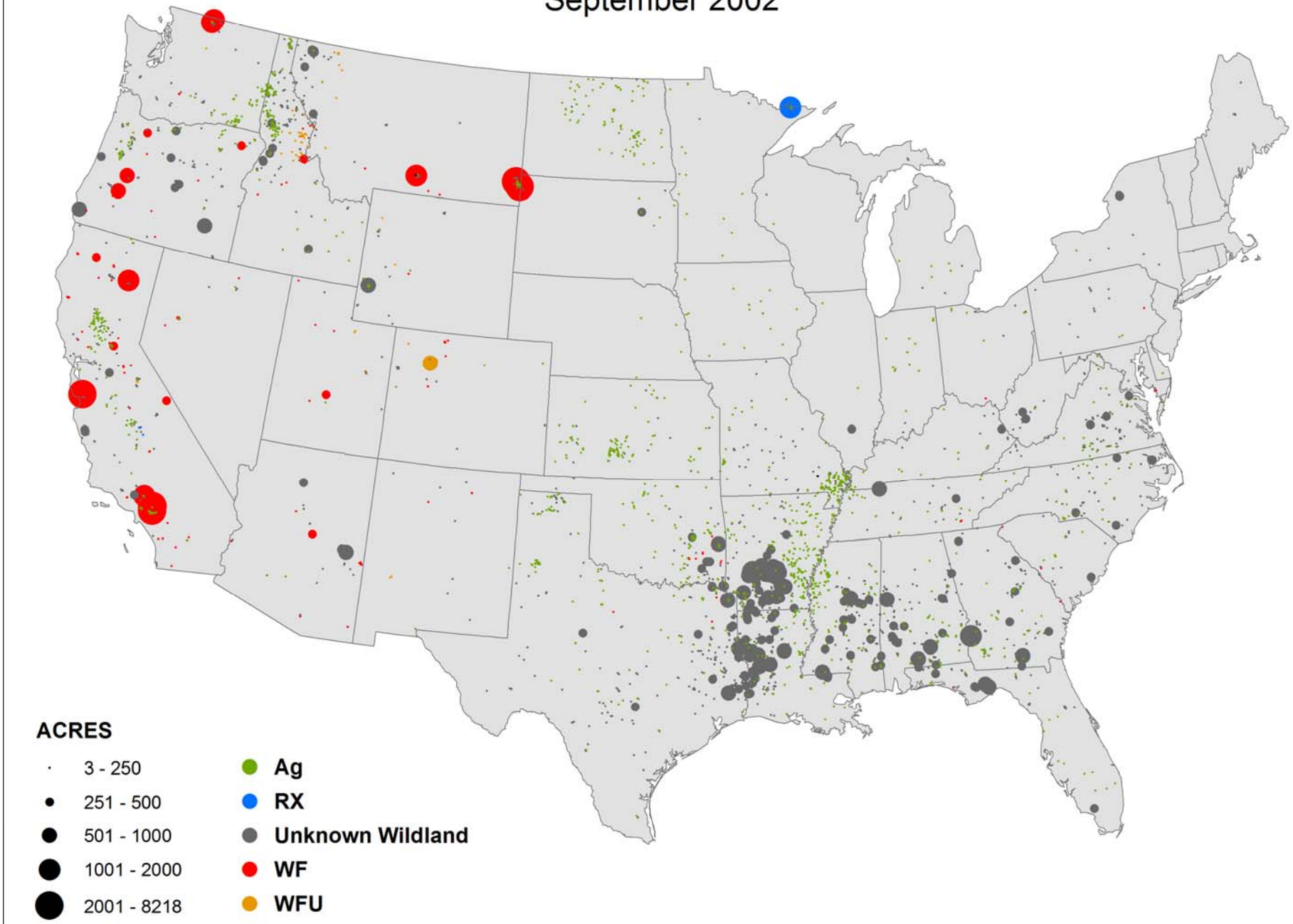
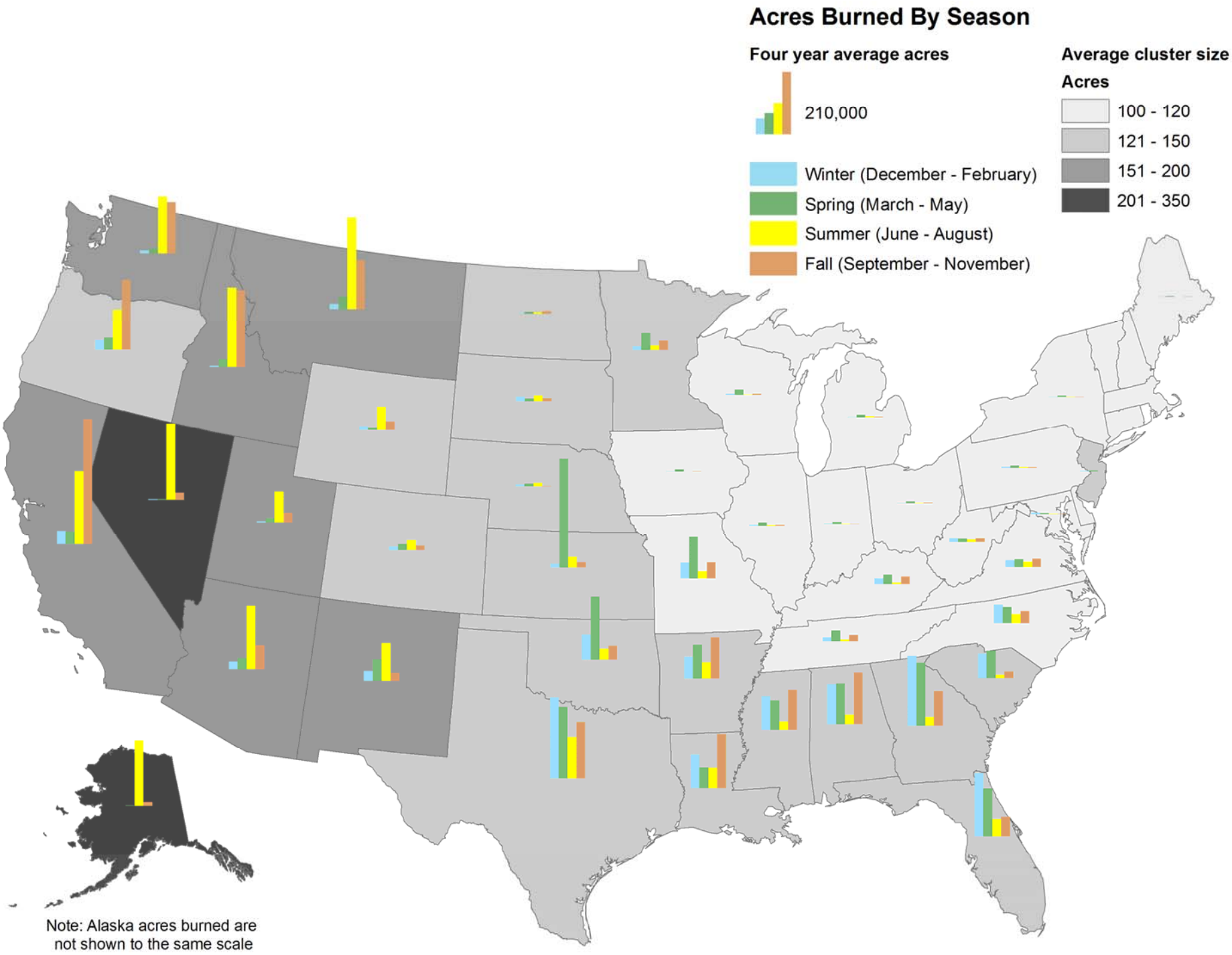
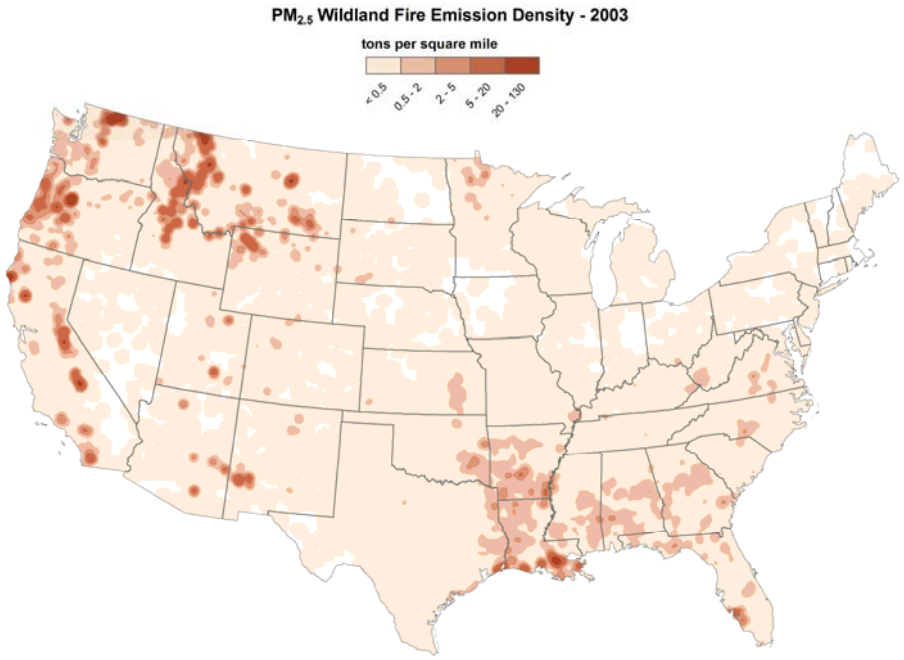
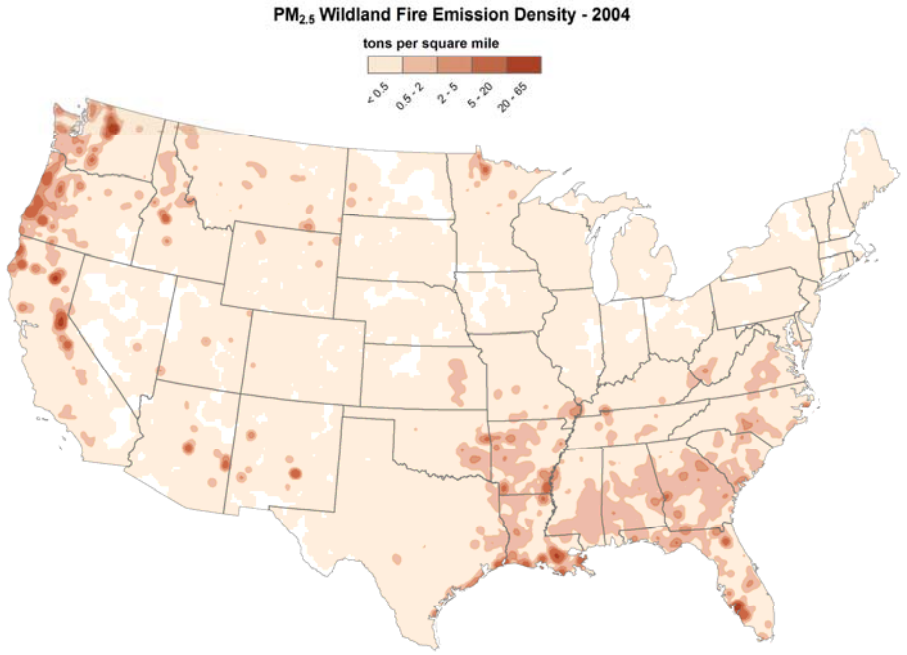
Extra slides below here

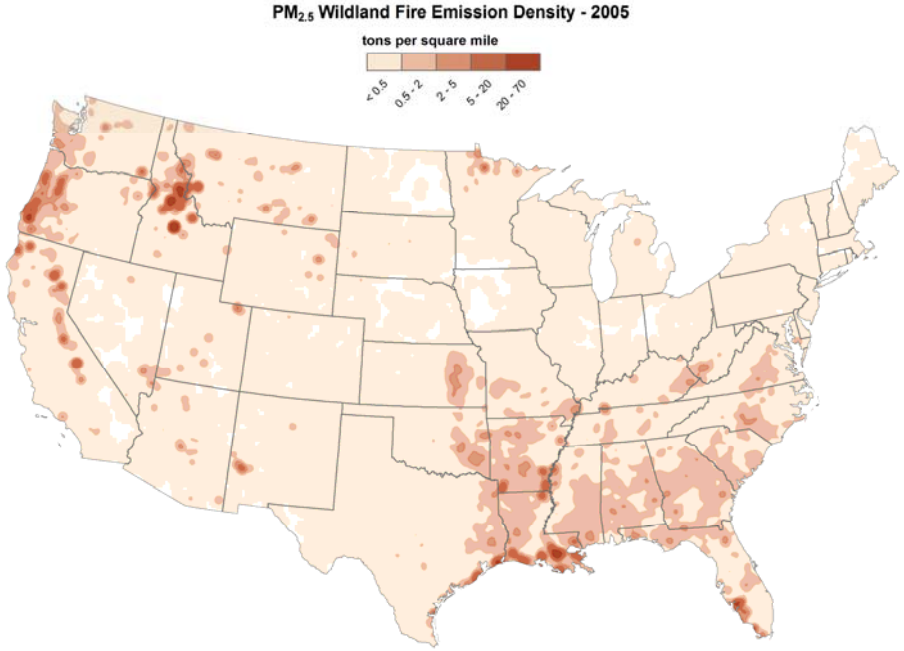
Fire Size By Type
September 2002

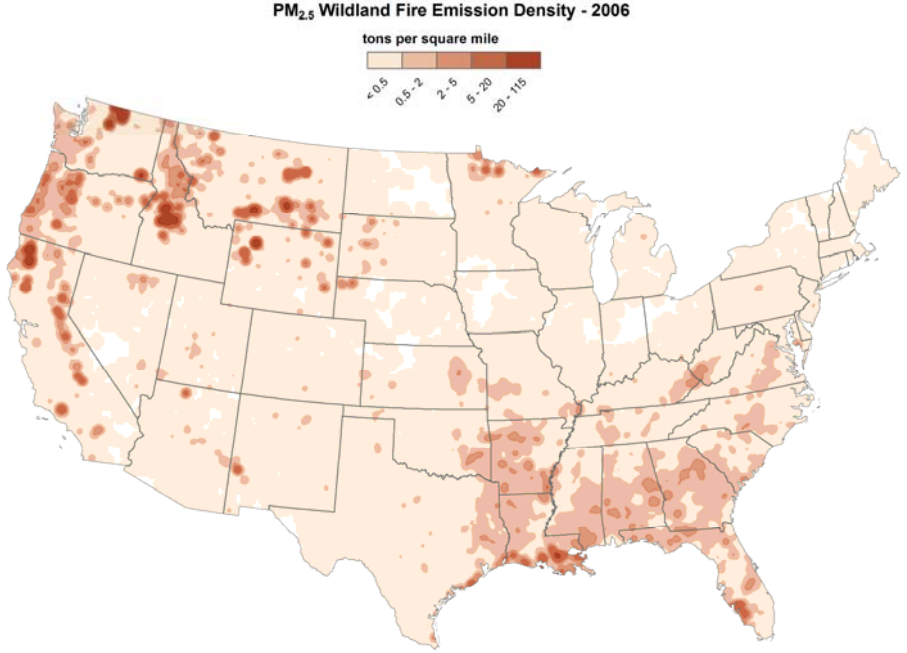



Acres Burned By Season
Four year average acres
210,000
Winter (December - February)
Spring (March - May)
Summer (June - August)
Fall (September - November)
Average cluster size
Acres
100 - 120
121 - 150
151 - 200
201 - 350
Note: Alaska acres burned are not shown to the same scale


PM2.5 Wildland Fire Emission Density - 2003
tons per square mile
< 0.5
0.5 - 2
2 - 5
5 - 20
20 - 130


PM2.5 Wildland Fire Emission Density - 2004
tons per square mile
< 0.5
0.5 - 2
2 - 5
5 - 20
20 - 65


PM2.5 Wildland Fire Emission Density - 2005
tons per square mile
< 0.5
0.5 - 2
2 - 5
5 - 20
20 - 70


PM2.5 Wildland Fire Emission Density - 2006
tons per square mile
< 0.5
0.5 - 2
2 - 5
5 - 20
20 - 115