



# Development of a Year 2016 Fire inventory for United States through a Multi-Agency Inventory Collaboration Effort

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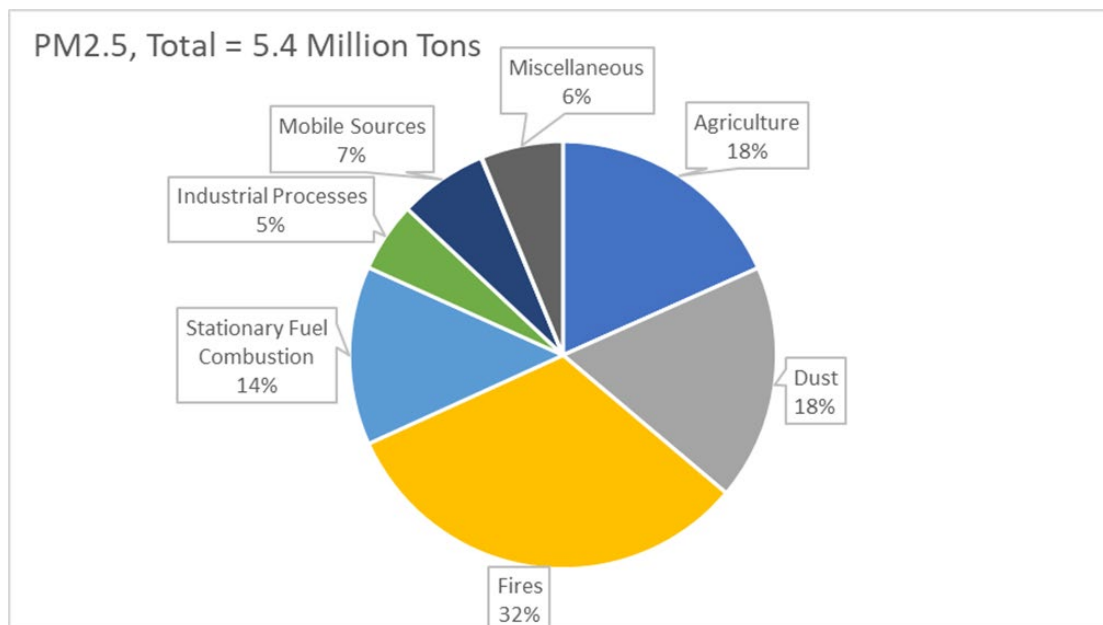
# Acknowledgements

- ▶ The 2016 Fire Workgroup
  - US Forest Service, US National Park Service, USEPA (Regions, OAQPS, ORD) staff
  - WESTAR/Western Regional Air Partnership (WRAP)
  - State agencies: AK, AL, CA, CO, GA, ID, KS, MT, NC, NJ, NM, NV, NY, TX, UT, WA and WY
  - Tribes: Nez Perce (ID) and Kootenai (ID)
  - George Pouliot, EPA ORD (see Crop Residue and Rangeland Burning poster during Poster Session)
  - <http://views.cira.colostate.edu/wiki/wiki/9175>



# Outline

- ▶ Goals of 2016 Fire Workgroup
- ▶ Approach
- ▶ Methods/Tools
- ▶ Data used
- ▶ Results
- ▶ Summary



# Goals of Collaboration Effort



- ▶ Produce a wildfire, prescribed burn and agricultural burn emissions year 2016 inventory for Contiguous U.S. and Alaska for use in Emissions Modeling Platforms
  - Day-specific emissions calculated include:
    - Criteria Air Pollutants (CAPs)
    - 36 hazardous air pollutants (HAPs) (U.S. only)
- ▶ Produce ancillary data needed for using inventory in air quality modeling (e.g. heat flux, profiles)
- ▶ Provide documentation

# 2016 Approach: Similarities to 2014 NEI version2 approach



## ▶ Use existing inventory methods and tools

- Wildfire and Prescribed burns used SmartFire2 and Bluesky Modeling Framework
- Agricultural burns used G. Pouliot (2015) approach
  - [https://www.epa.gov/sites/production/files/2015-08/documents/crop\\_residue\\_burning\\_in\\_2014.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/crop_residue_burning_in_2014.pdf)

## ▶ Input data sources

- National datasets
- Any submitted State/Local/Tribes data

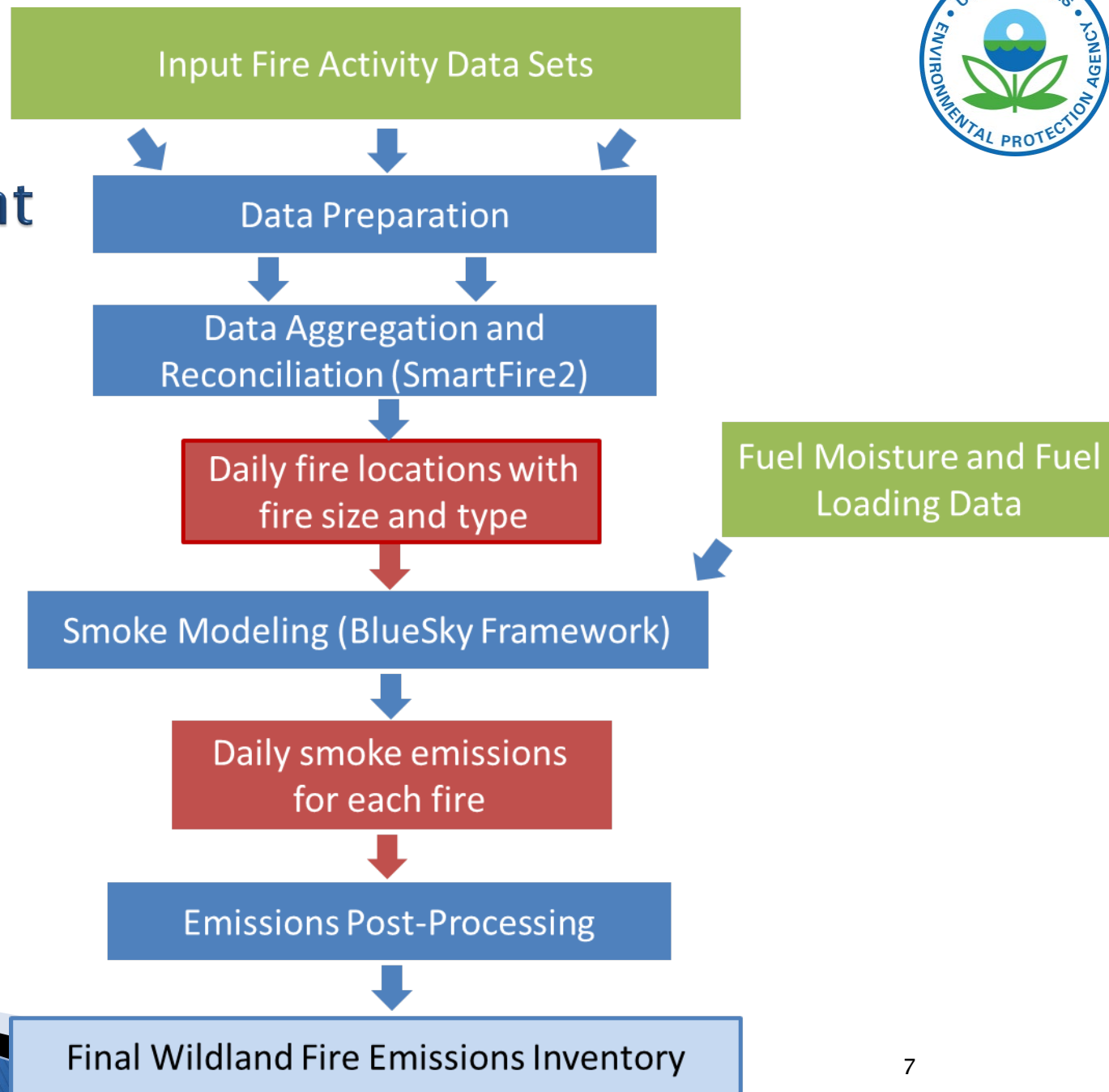
# 2016 Approach: Differences with 2014 NEI v2 approach



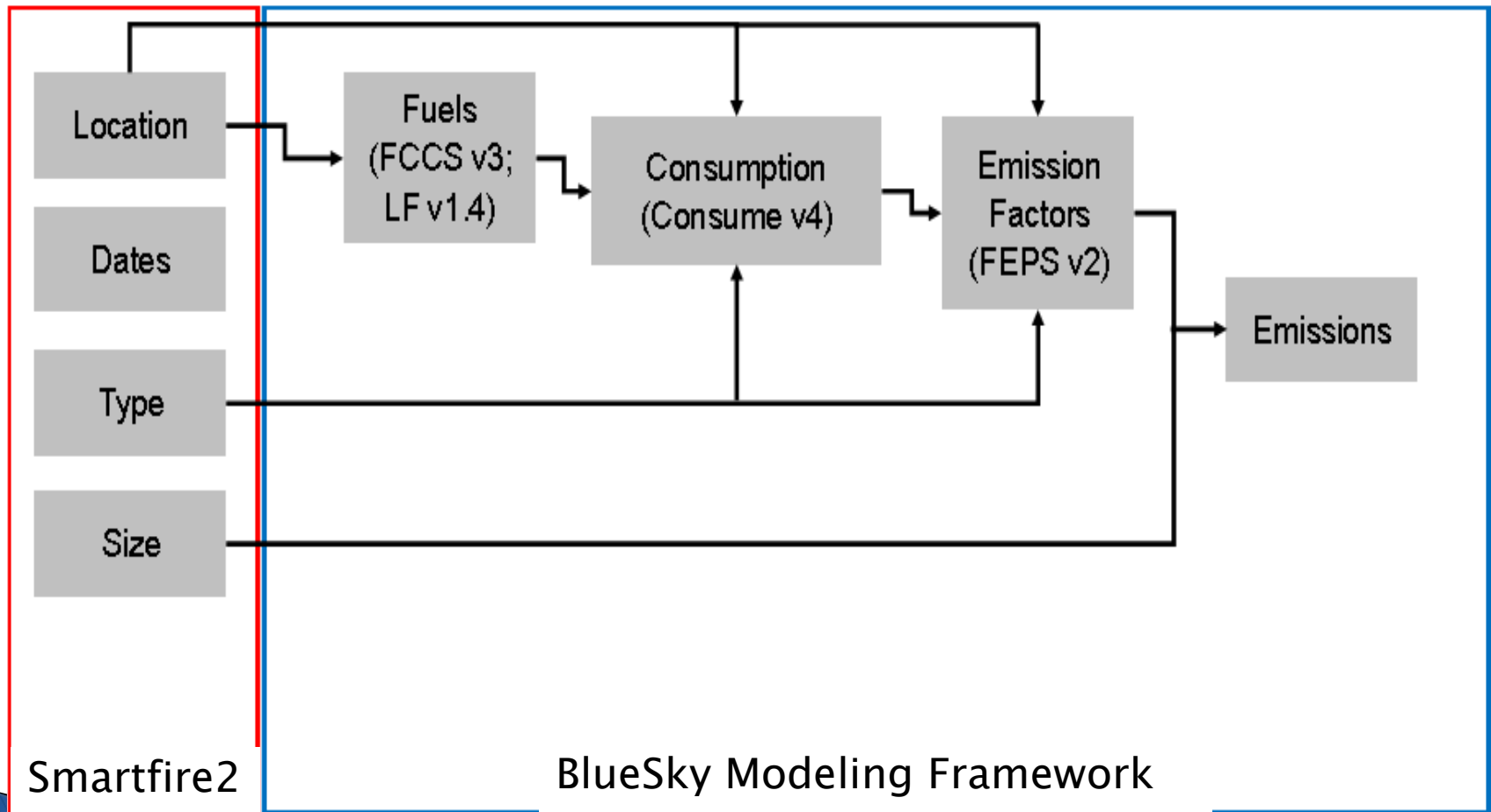
- ▶ **Collaborative Workgroup effort**
- ▶ **Grassland fires**
  - Pouliot approach was used in 2014NEI for all grassland fires
  - In 2016 inventory, grassland fires moves into the SmartFire2–Bluesky Framework processing
  - Largest fire in 2016 (Anderson Creek) involved mainly grassland fuels in Kansas and Oklahoma
- ▶ **Combustion phases for Plume Rise purposes**
  - 2014NEI provided two phases: 1) flaming and 2) smoldering (co-existing smoldering with the flaming and residual smoldering)
  - 2016 provides two phases: 1) flaming (includes the co-existing smoldering) and 2) residual smoldering
- ▶ **New fuel bed data used from Landfire version 1.4**
  - <https://www.landfire.gov/fccs.php>
- ▶ **Inventory Versions**



# Fire Inventory Development Method



# Tools: Blue Sky Modeling Framework



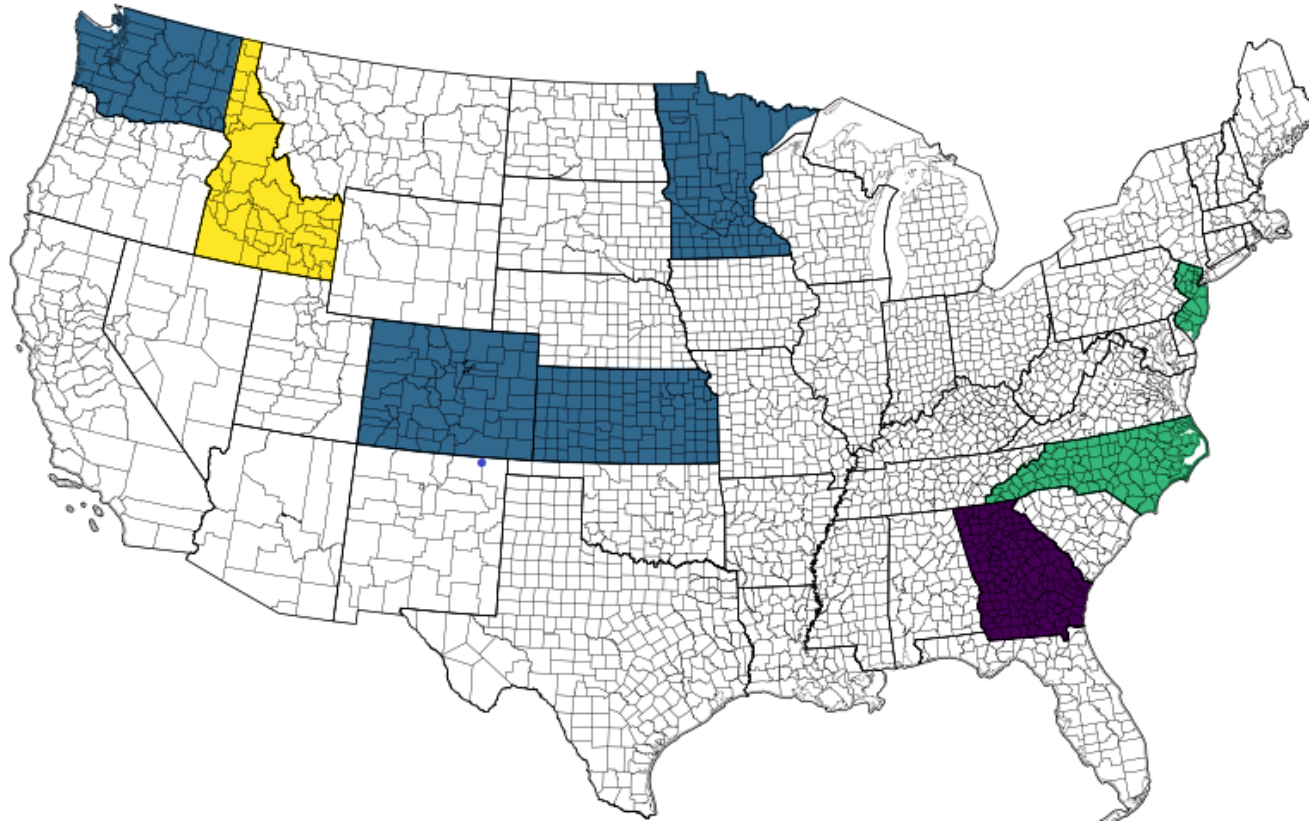


# Input Data Sources: National Fire Activity

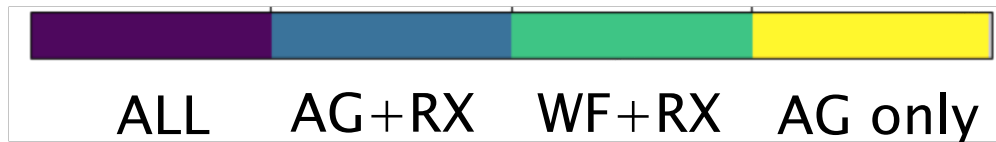


Data Set	Agency	Coverage
Hazard Mapping System (HMS)	National Oceanic and Atmospheric Administration (NOAA)	Satellite fire detections
Incident Status Summary (ICS-209)	National Wildfire Coordinating Group	Wildfire
U.S. Fish and Wildlife Service (USFWS)	USFWS	USFWS-managed lands: wildfire and prescribed
National Association of State Foresters (NASF)	NASF	State-managed lands: wildfires
Forest Service Activity Tracking System (FACTS) Perimeters	USFS	Prescribed fires on USFS-managed lands
Geospatial Multi-Agency Coordination (GeoMAC) Perimeters	GeoMAC Group	Wildfire perimeters
<b>Monitoring Trends in Burn Severity (MTBS)</b>	<b>USGS, USFS</b>	<b>Wildfire and Prescribed perimeters</b>

# Input Data Sources: State/Tribe Submitted Fire Activity Data



Fire Types





# 2016 Inventory Versions

## ▶ 2016 alpha

- HMS detects, ICS209 and GeoMAC shapefiles
- Release March 2018

## ▶ 2016 beta

- Added National Assoc. of State Foresters (NASF), MTBS shapefiles, and state/local agency data
- Released February 2019

## ▶ 2016 version 1 (2016v1)

- Added USFS FACTS prescribed burn database, US Fish and Wildland Service data, and more state agency data
- To be released in September 2019

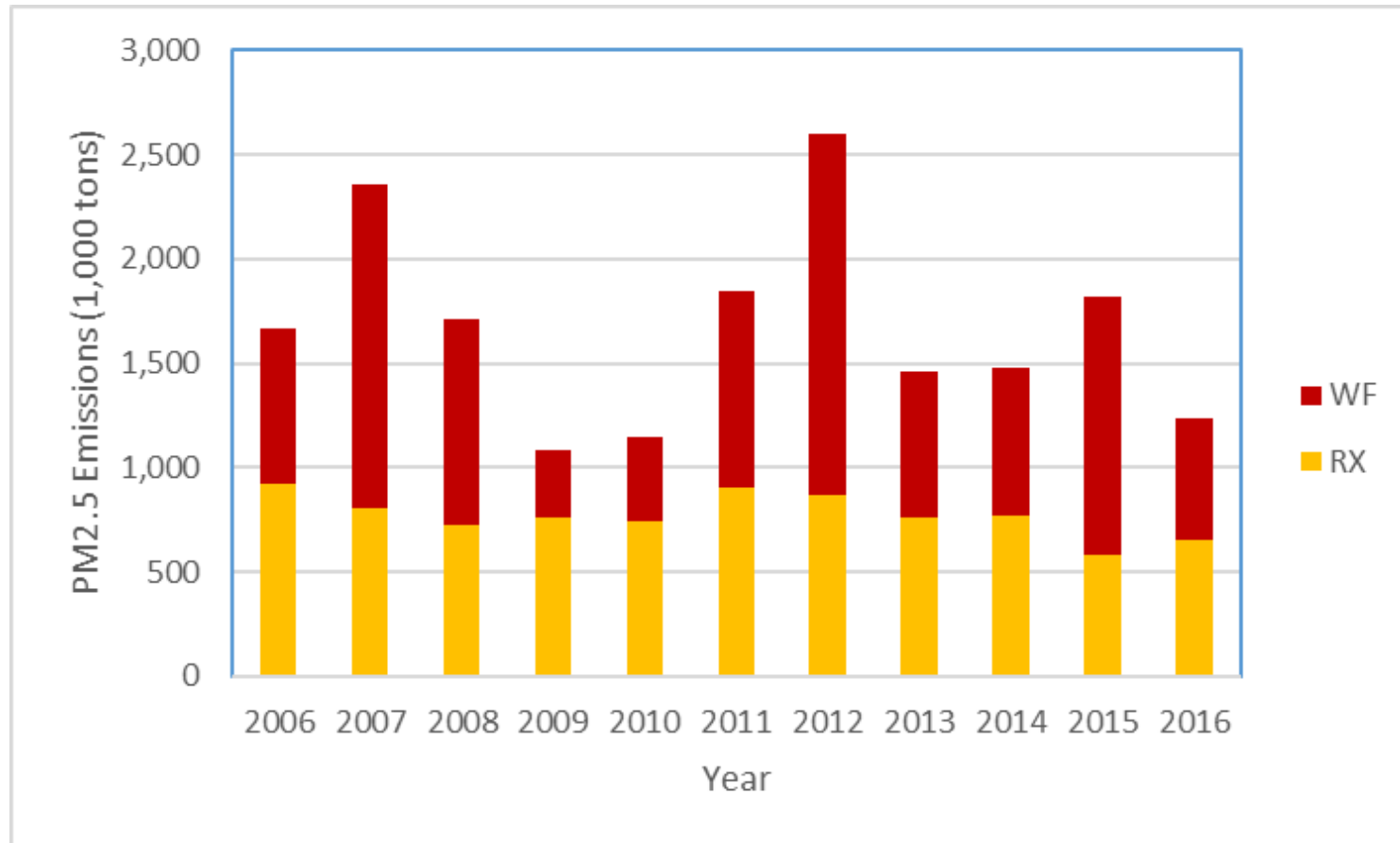
# Results: Sample 2016 Fire Inventory Totals



Fire Type	Millions of Acres Burned	PM2.5 (tons)	VOC (tons)	NOX (tons)
CONUS Wildfires *	4.7	580,000	1,562,000	99,900
CONUS Prescribed Fires	11.9	655,000	1,547,000	127,500
CONUS Ag Burns	2.0	24,000	18,300	10,800
Alaska All Fires	0.5	263,000	743,000	30,000
<b>Total</b>	<b>19.1</b>	<b>1,522,000</b>	<b>3,870,300</b>	<b>268,200</b>

\* National Interagency Fire Center (NIFC) indicated 2016 CONUS Wildfire acres burn was ~5M

# Annual Comparison: Contiguous United States



NEI years = 2008, 2011, 2014

EPA generated other years with national inputs 2006–2015



# Results – Top 5 states

Top 5 States for Wildfires				
State	Acres Burned		State	PM2.5 emissions (tons)
CA	646,473		CA	85,167
ID	382,424		ID	71,132
OK	341,772		WY	49,696
KS	337,452		OK	33,991
WA	331,059		AZ	27,325

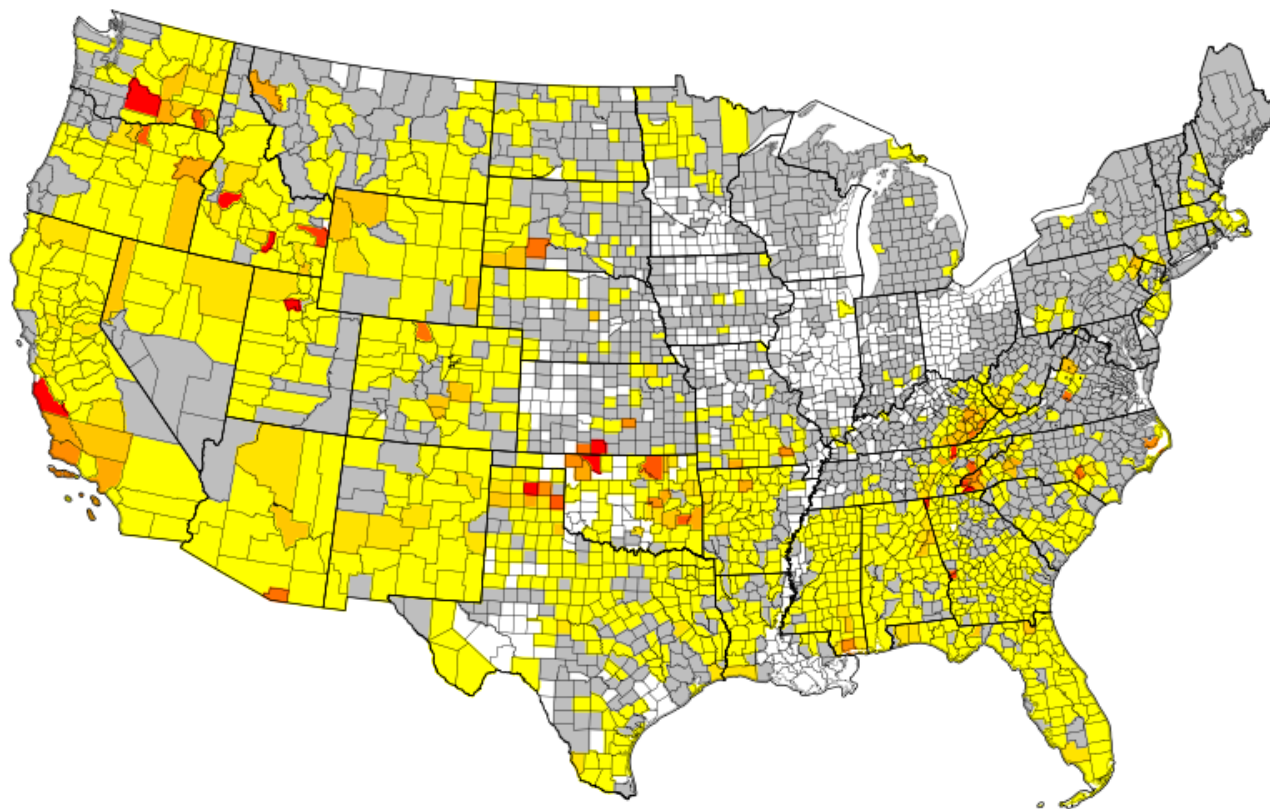
Top 5 States for Prescribed Burns				
State	Acres Burned		State	PM2.5 emissions (tons)
KS	2,788,555		KS	67,760
GA	1,279,432		AR	56,960
TX	1,039,322		MO	52,279
OK	832,484		GA	52,151
FL	696,789		OR	43,973

# Results – Top 10 Wildfires

Fire Name	State(s)	2016v1	NIFC	2016v1-NIFC %diff
Anderson Creek and 350 Complex	KS and OK	432,396	424,900	1.76%
Pioneer	ID	190,127	188,404	0.91%
Range 12	WA	170,441	176,600	-3.49%
Soberanes	CA	129,922	132,127	-1.67%
Hot Pot	NV	119,962	122,292	-1.91%
Tule	NV	59,803	59,727	0.13%
Henrys Creek	ID	52,952	52,972	-0.04%
Erskine	CA	48,027	48,019	0.02%
Chimney	CA	46,921	46,344	1.25%
<b>Total</b>		<b>1,250,552</b>	<b>1,251,385</b>	<b>-0.07%</b>

# Wildfires: acres burned per square mile

Acres Burned Density: wildfire 2016 v1 inventory

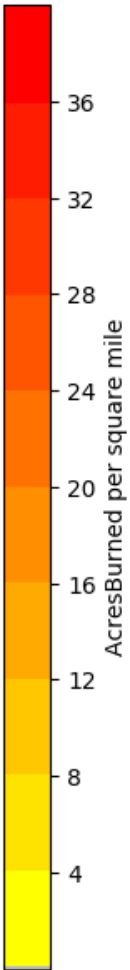
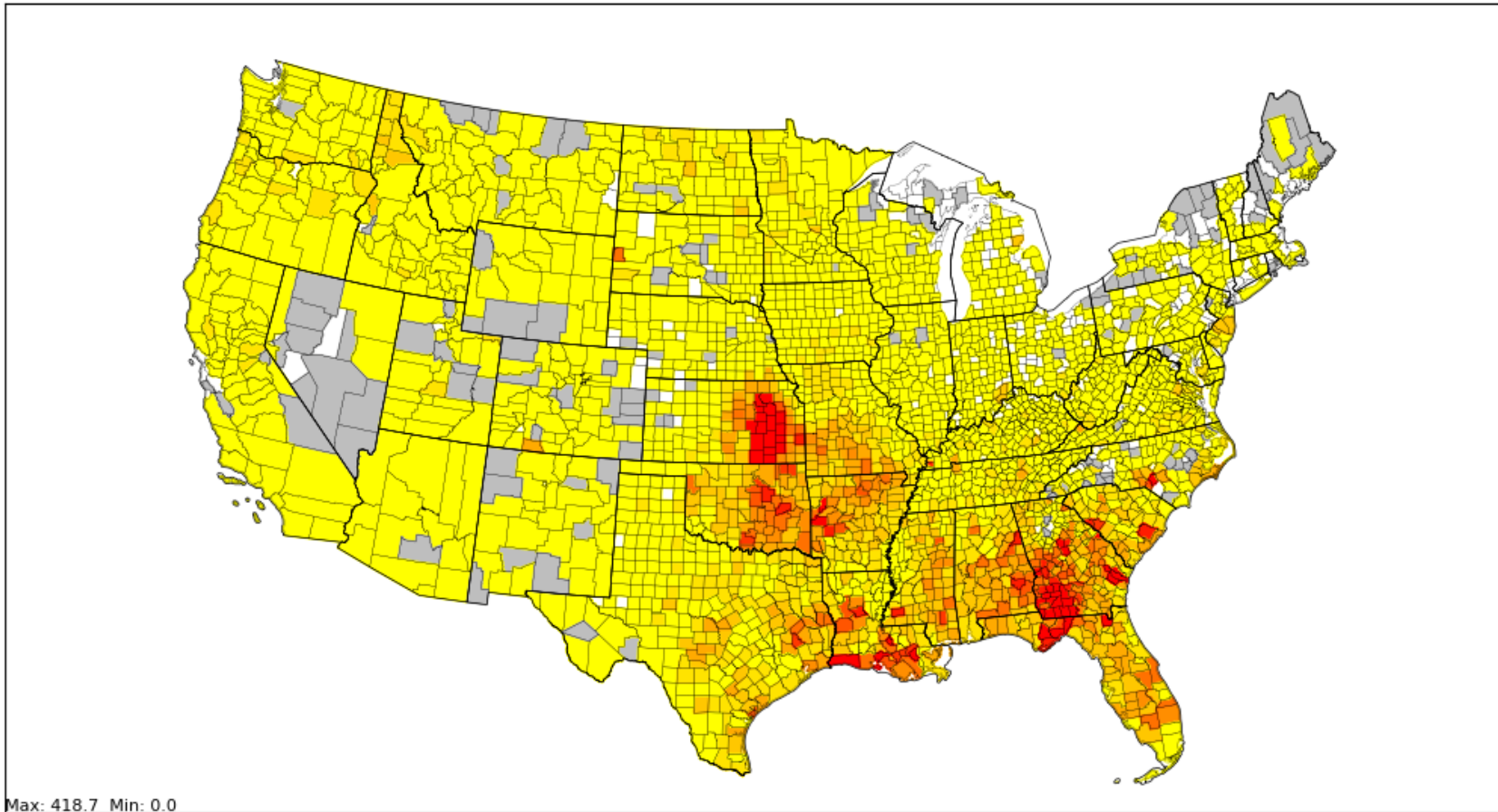


Max: 260.484 Min: 0.0

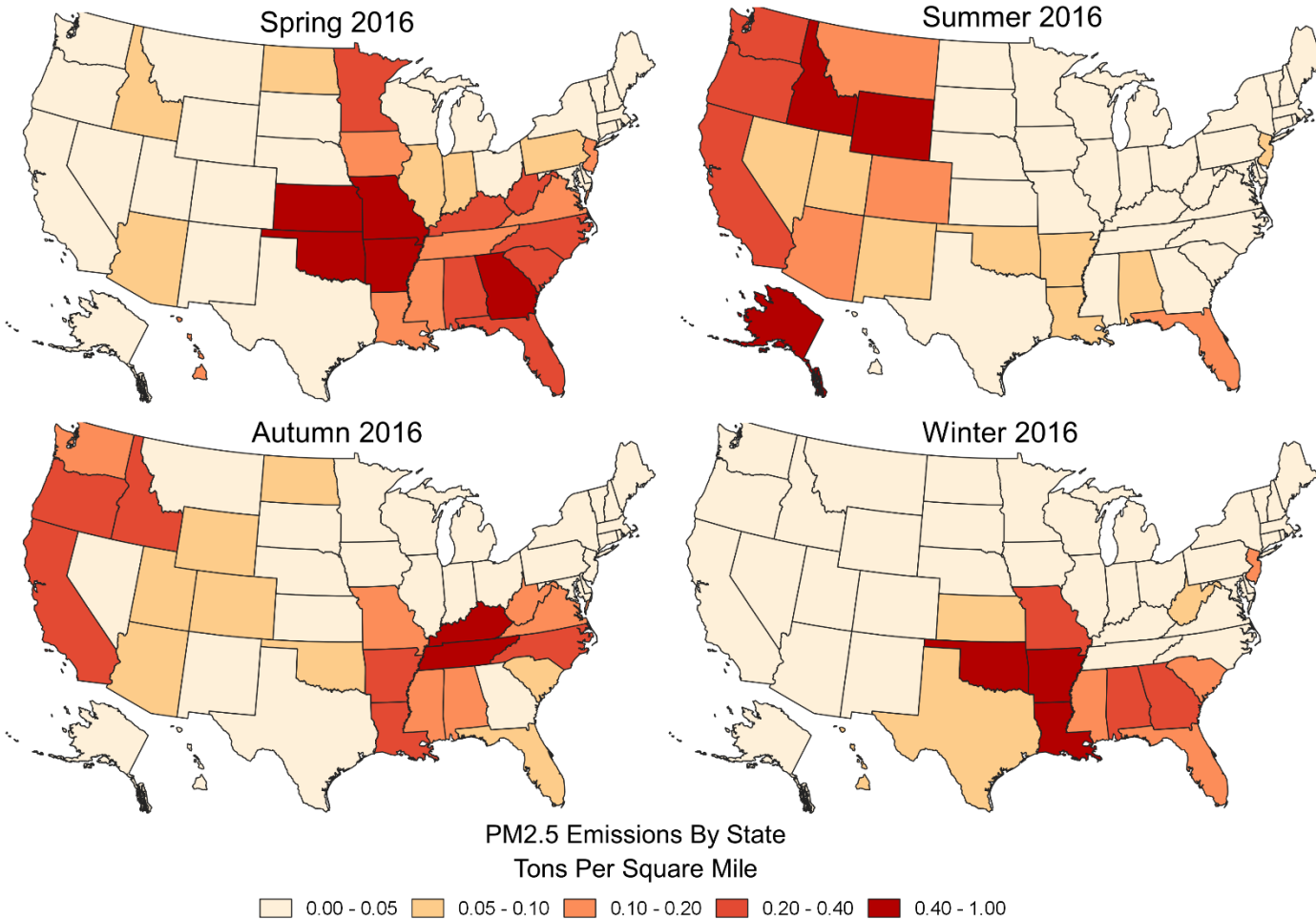


# Prescribed burns: acres burned per square mile

Acres Burned Density: prescribed\_fire 2016 v1 inventory

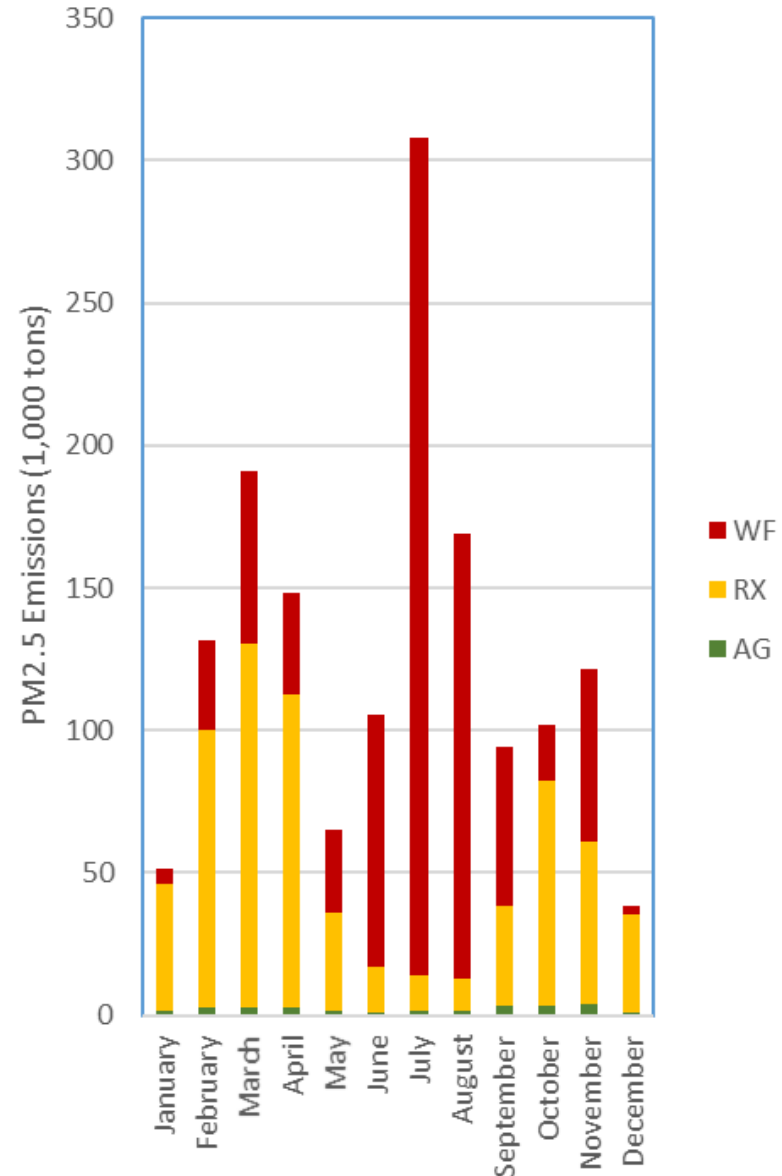
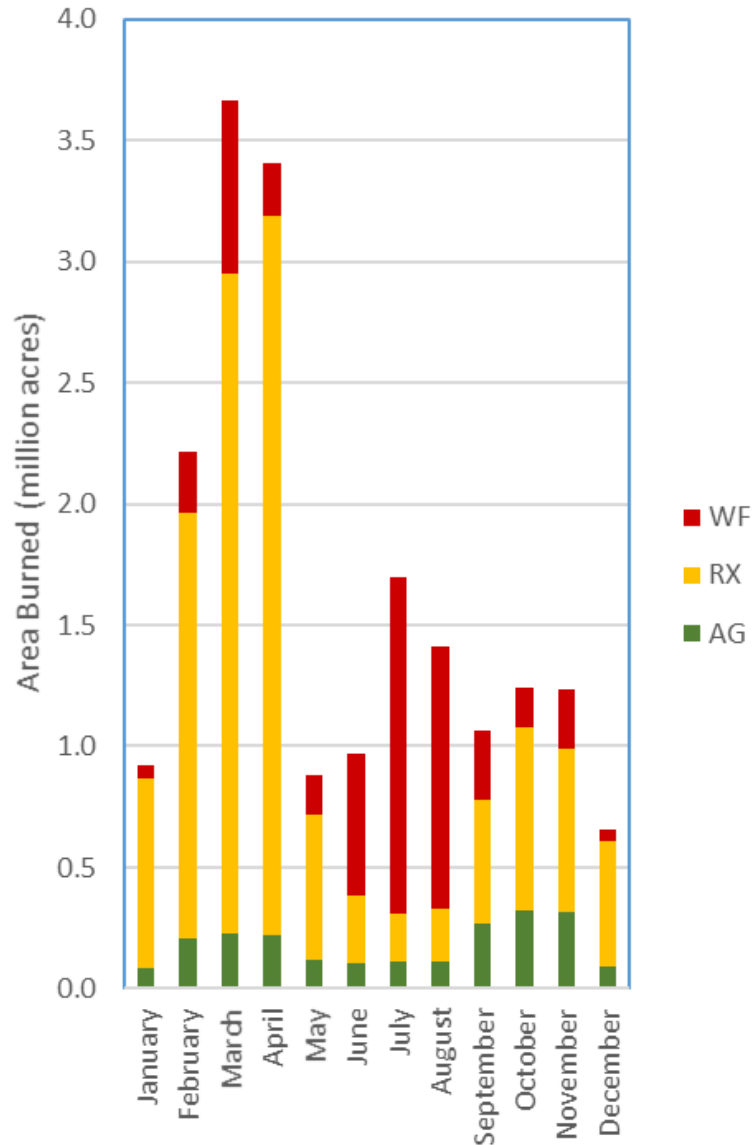


# Results: U.S. Seasonality for Wildfires and Prescribed Burns



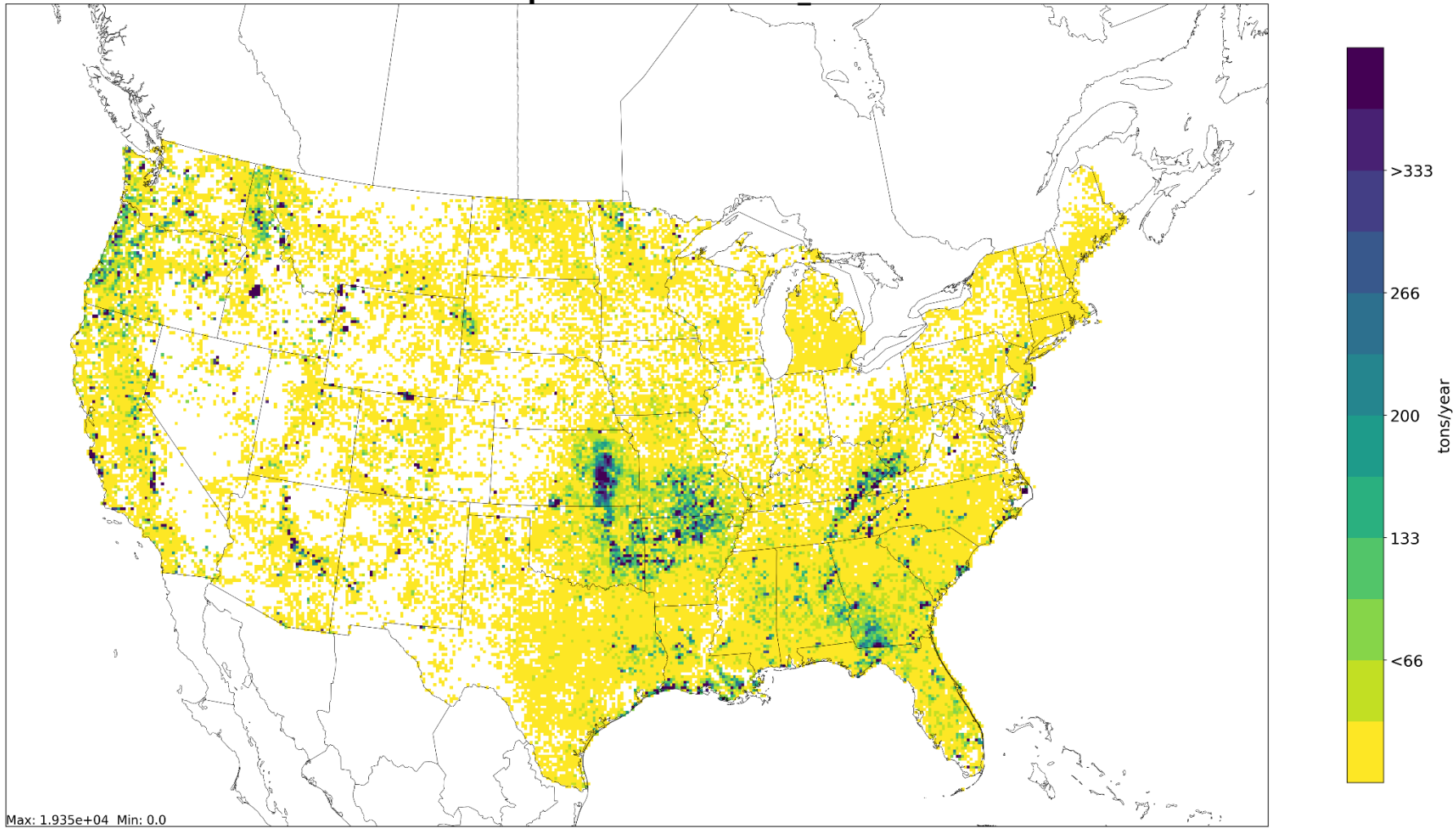
- ▶ **Spring:** March, April, and May
- ▶ **Summer:** June, July, and August
- ▶ **Autumn:** September, October, and November
- ▶ **Winter:** December, January and February

# Results: U.S. Type Monthly



# Gridded Annual PM2.5: 12km resolution

2016 ptfire Annual PM2.5

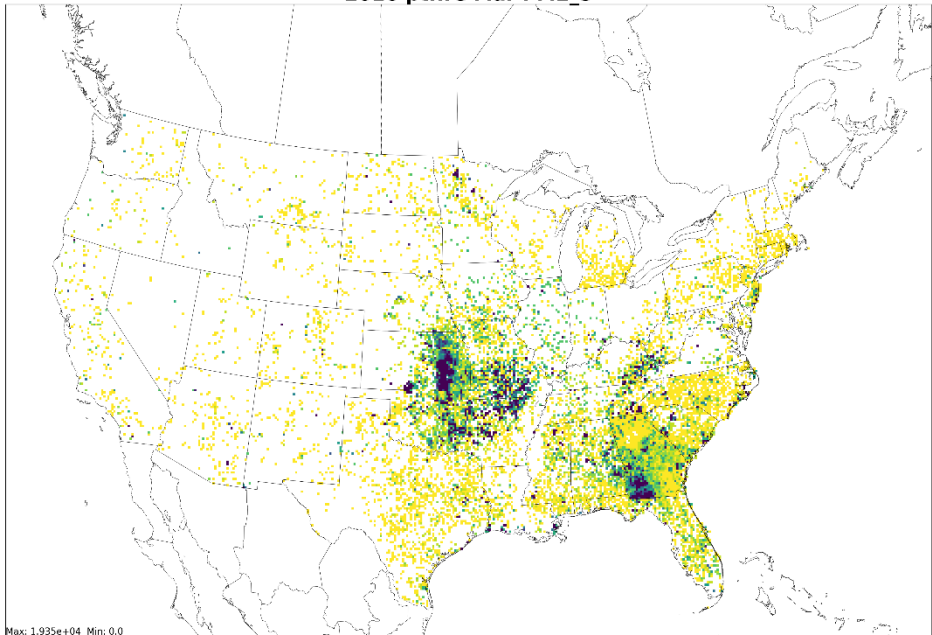


Includes wildfires and prescribed burns

# Gridded Monthly PM2.5: 12km resolution

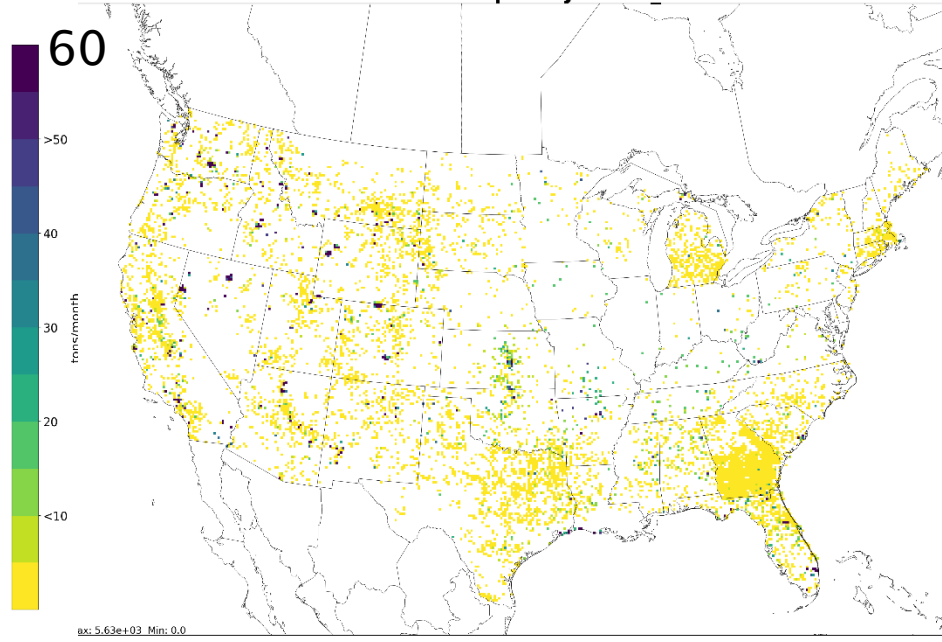
March

2016 ptfire Mar PM2\_5



July

2016 ptfire Jul PM2\_5



Includes wildfires and prescribed burns



# Summary

- ▶ Multi-agency Collaborative over a 1.5 year period has been successful in producing a wildfire, prescribed burn and agricultural burn day-specific emissions inventory for Contiguous U.S. and Alaska for use in Emissions and Air Quality Modeling Platforms
- ▶ Input data and tools used similar to NEI efforts, with updates to fuel bed information
- ▶ Large wild grassland fires in Spring 2016 played a role in changing approach for all grassland fires
- ▶ Acres burned for top fire events in 2016 were captured

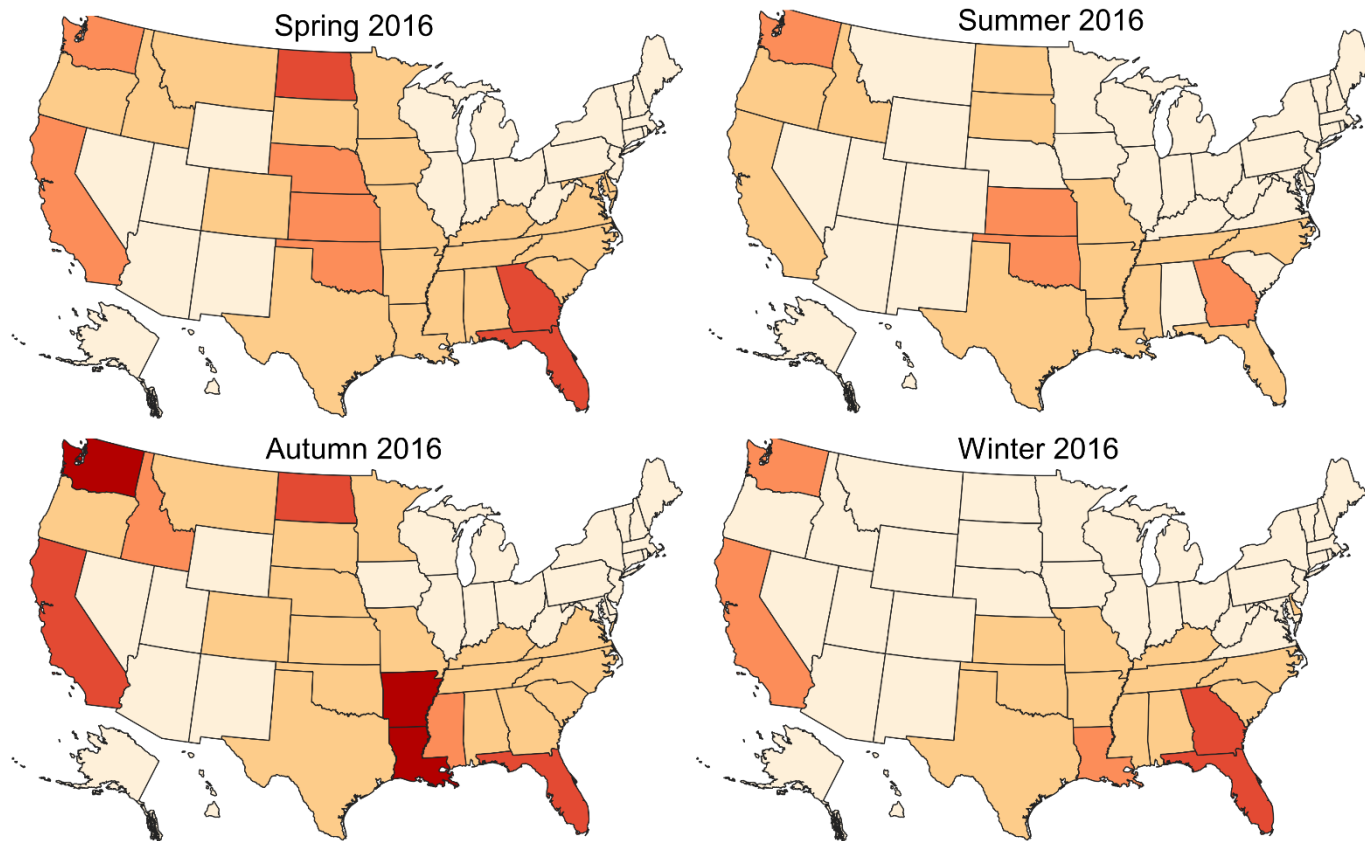
# Extra Slides







# Results: U.S. Seasonality for Agricultural Burns



- ▶ **Spring:** March, April, and May
- ▶ **Summer:** June, July, and August
- ▶ **Autumn:** September, October, and November
- ▶ **Winter:** January, February, and December

PM2.5 Emissions By State  
Tons Per Square Mile

0.0000 - 0.0005   0.0005 - 0.0035   0.0035 - 0.0100   0.0100 - 0.0180   0.0180 - 0.0320