Prescribed Fire, Air Quality and Fire Emissions Inventories in the Southeast
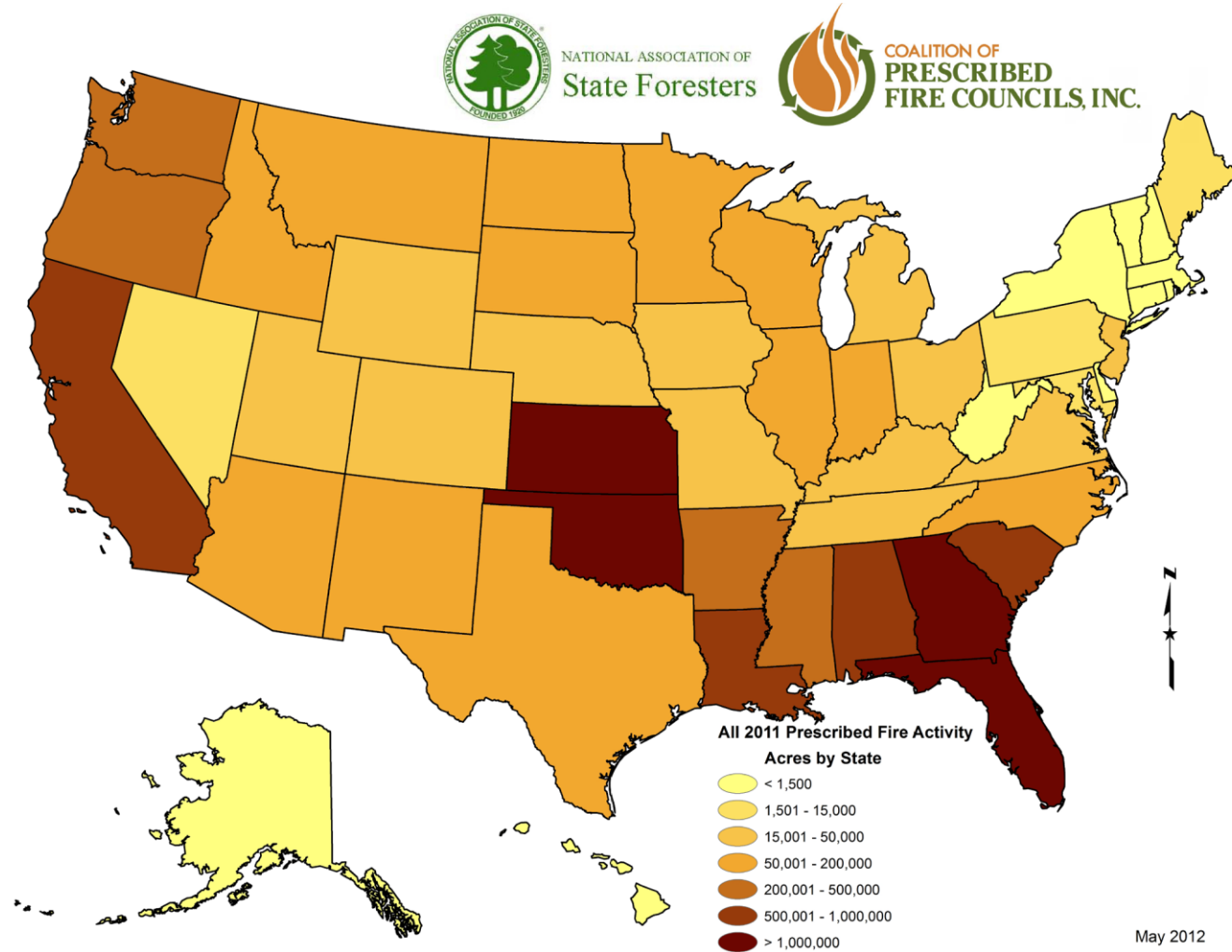
RICK GILLAM

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404/562-9049

Southeast Uses the Most Prescribed Fire

All 2011 Prescribed Fire Activity
Acres by State

- < 1,500
- 1,501 - 15,000
- 15,001 - 50,000
- 50,001 - 200,000
- 200,001 - 500,000
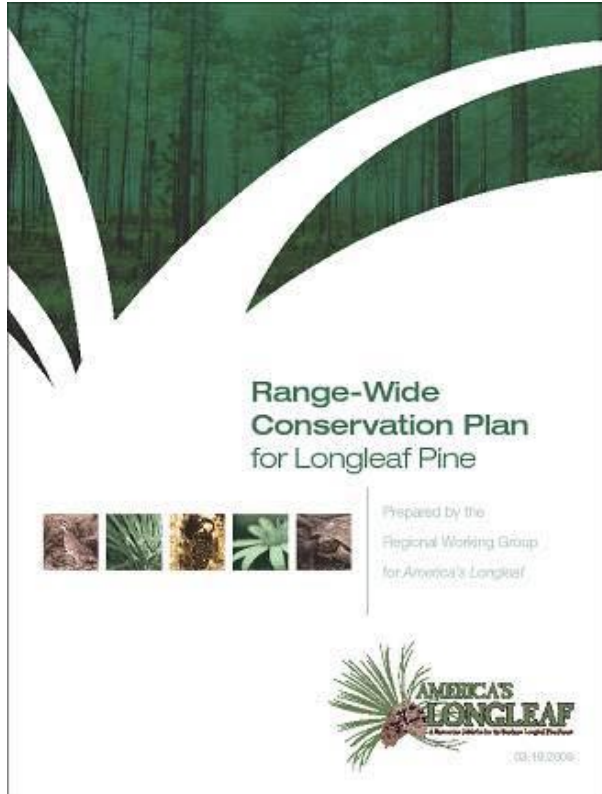- 500,001 - 1,000,000
- > 1,000,000

May 2012

Southeast Embraces EPA's Interim Air Quality Policy on Wildland and Prescribed Fires

▪ Attempts to Integrate 2 Public Policy Goals:

1. To allow fire to function in its natural role in maintaining healthy wildland ecosystems

2. To protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility

▪ Encourages collaboration among fire management agencies and air quality agencies

▪ Available on the following website: http://www.epa.gov/ttn/oarpg/t1/memoranda/firefnl.pdf
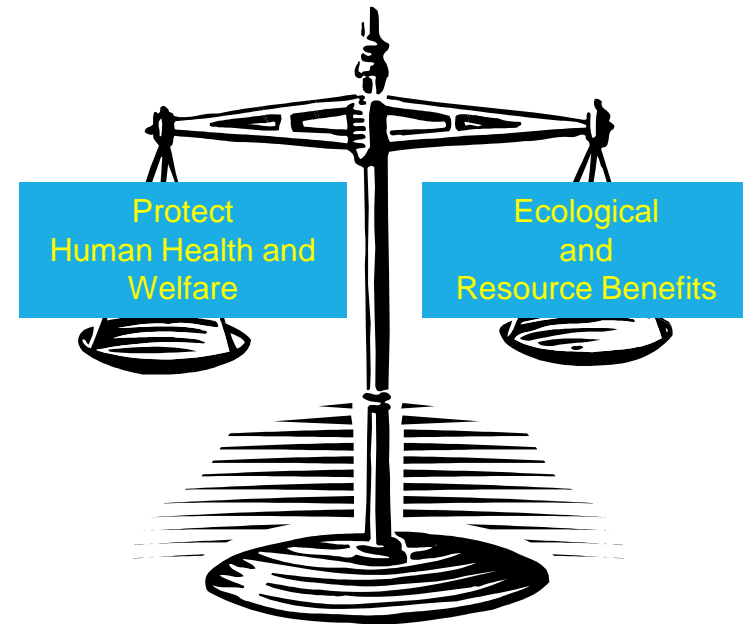
Protect
Human Health and
Welfare

Ecological
and
Resource Benefits

- **2011 Smoke Management Recommendations and Prescribed Fire Tracking Document**
  ◦ http://smokeapp.serppas.org/pdf/SERPPAS_Smoke_Mgt_Recommendations.pdf

- **Prescribed Fire Smoke Management Pocket Guide and Mobile App**
  ➤ http://smokeapp.serppas.org/

- **Work to Develop a Fire Activity and Emissions Tracking System (FAETS)**

- **Communication and Outreach**

**Southeast Regional Partnership for Planning and Sustainability (SERPPAS)
Smoke Management Recommendations
and
Prescribed Fire Tracking**
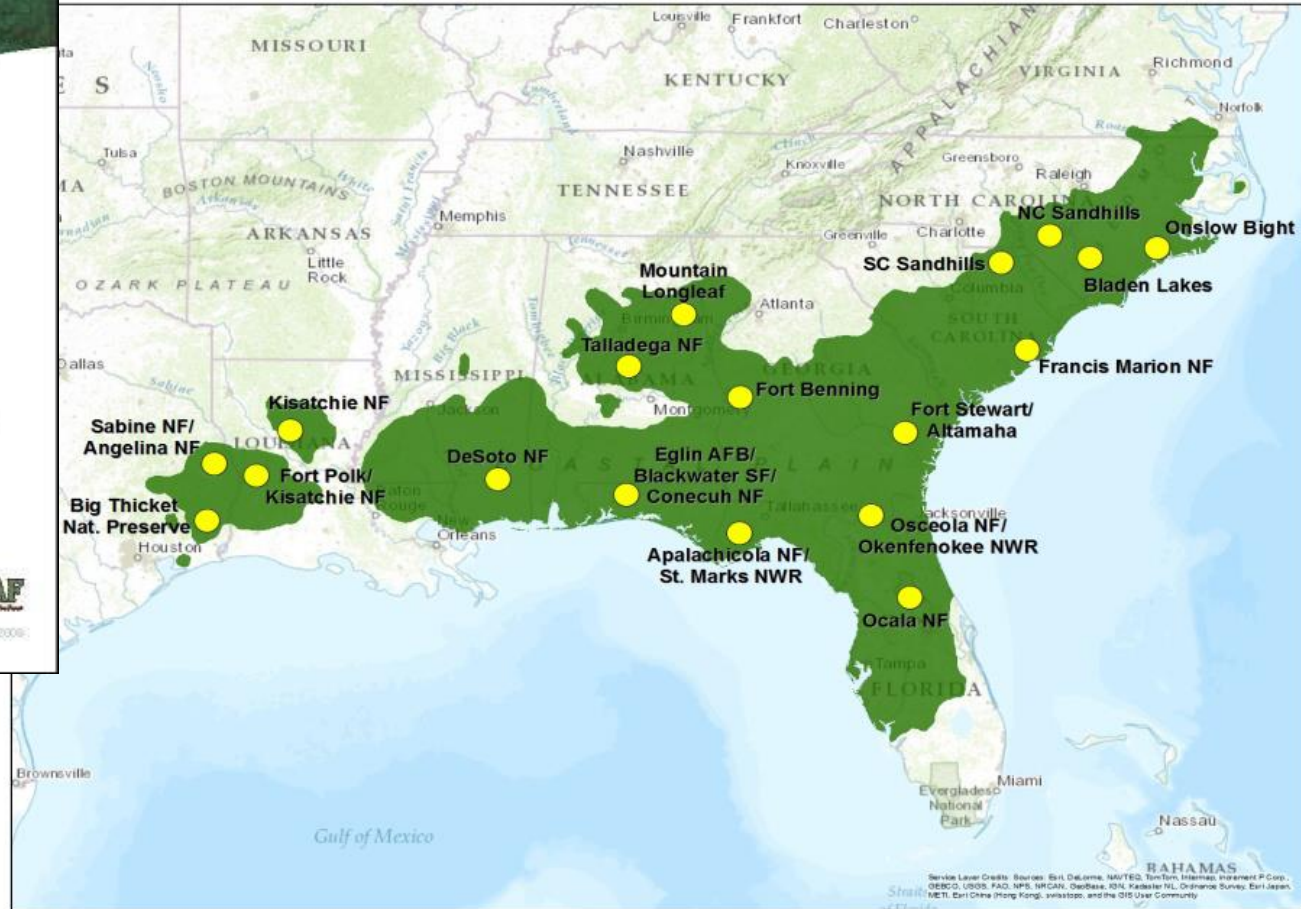
SERPPAS Smoke Management and Air Quality Subcommittee
November 16, 2011

SERPPAS

# Why Do We Need Accurate Prescribed Fire Activity and Emissions Data?

- Important to know how much prescribed fire is being used

- Critical for evaluating potential prescribed fire impacts on air quality and human health
  - Designations of Nonattainment Areas
  - Modeling for State Implementation Plan (SIP) Attainment Demonstrations
  - Air Toxics Risk Assessments - National Air Toxics Assessment (NATA)

- Improvement of EPA and State Air Quality Emissions Inventories
  - **National Emissions Inventory (NEI)**

- Exceptional Events Demonstrations
  - Need to have an archive of fires to be able to show "clear causal relationship" between the fire and the monitored exceedance of a National Ambient Air Quality Standard (NAAQS)

- State Prescribed Fire Permitting
  - Inform burn/no burn decisions

- Others?

NEI Uses

▶ A critical input for many EPA analyses
  ▶ Inputs for detailed air quality and risk modeling at national, regional, and local levels
  ▶ EPA NAAQS-related rules and Regulatory Impact Assessments (RIAs)
  ▶ Planning ambient monitoring network locations
  ▶ Factor in designations of non-attainment areas
  ▶ Large scale summaries and trends assessments
▶ A resource to many outside EPA
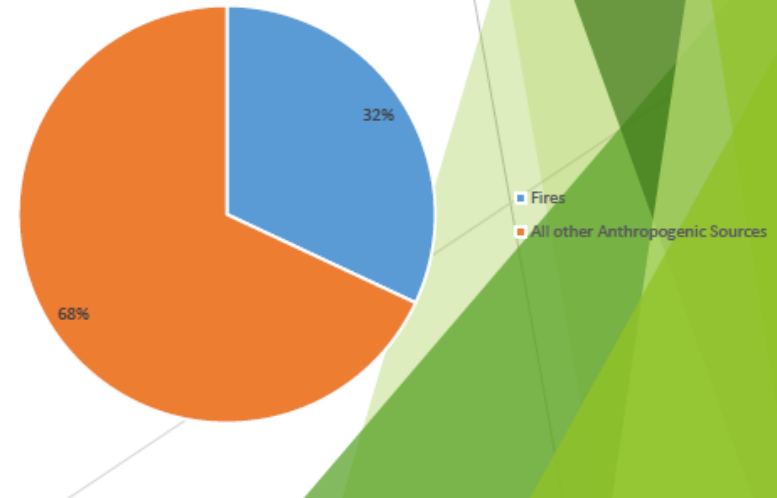 ▶ Upholding international reporting treaties
  ▶ Research

PM2.5 Emissions, 2011 NEI v1

Total PM2.5 Emissions: 6.3 Million Tons

37%

63%
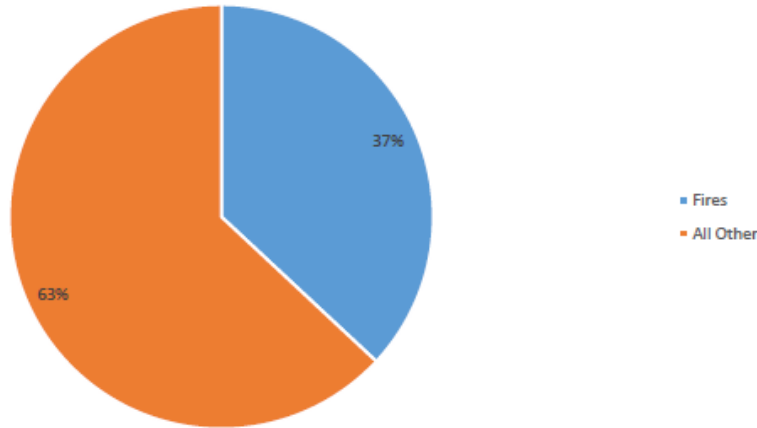
- Fires
- All Other

- Fires significant contributors to PM2.5 emissions, VOC emissions, and several Air Toxics in v1 of the 2011 NEI

VOC Emissions, 2011 NEI v1

32%

68%

- Fires
- All other Anthropogenic Sources

Quantifying Emissions

SEMAP NOX Emissions (TPY)

SEMAP VOC Emissions (TPY)

SEMAP PM2.5 Emissions (TPY)
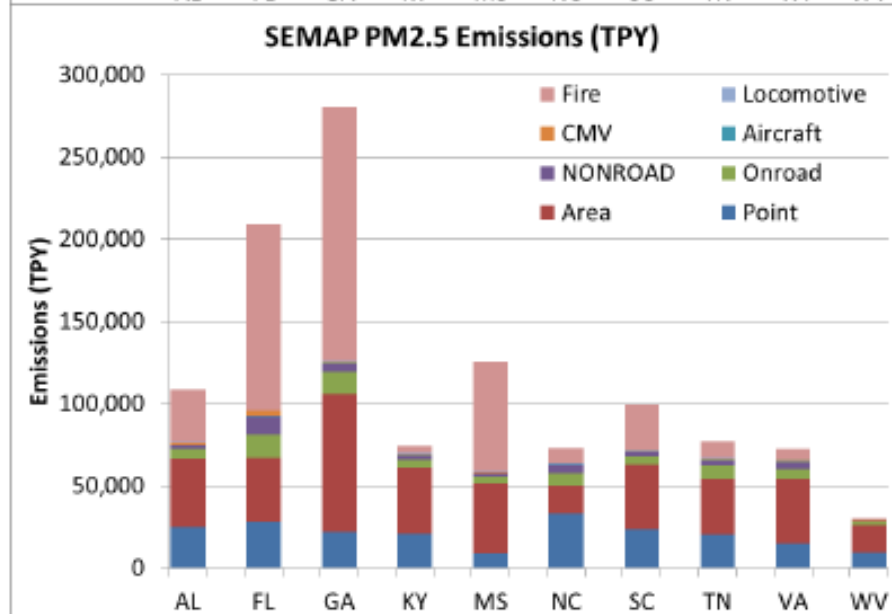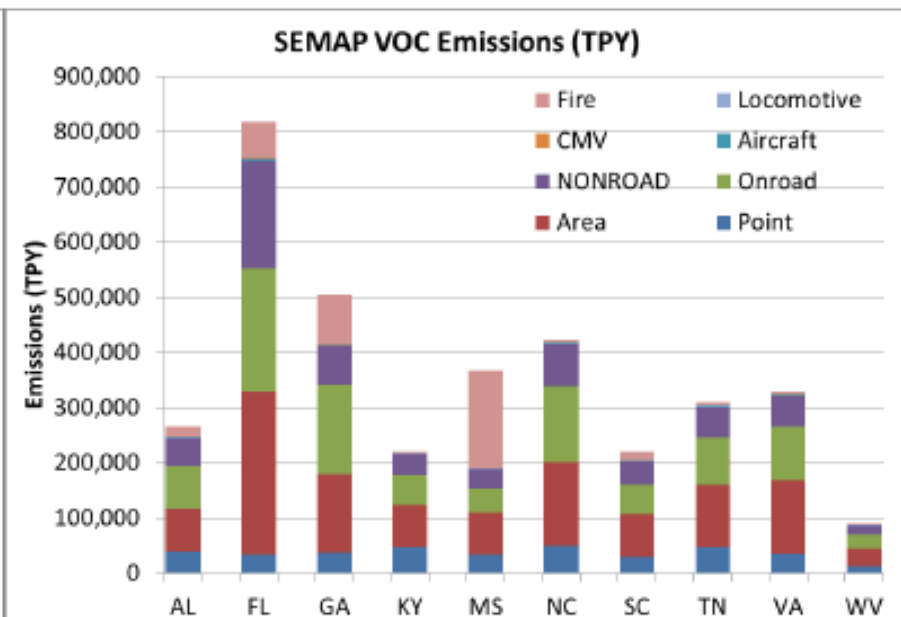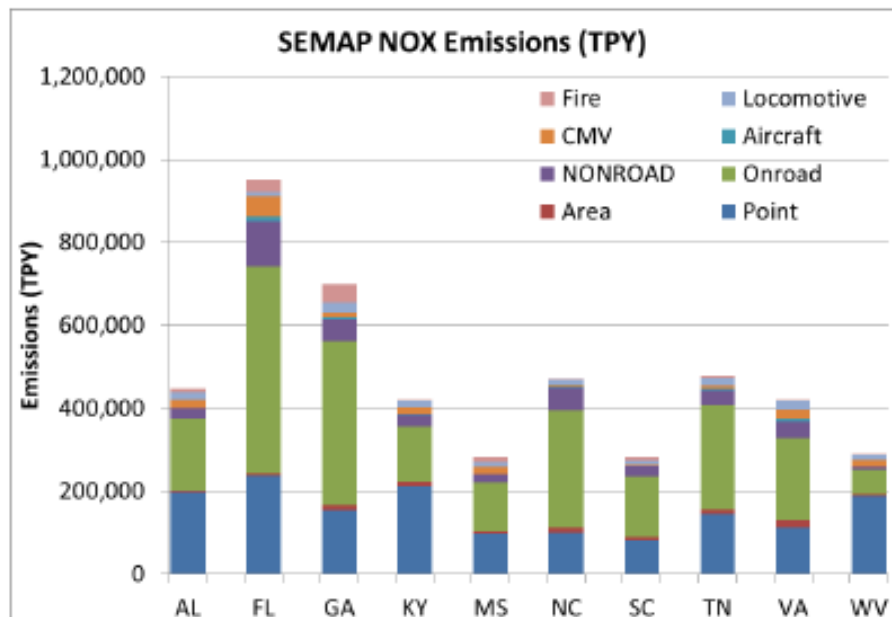
- SEMAP 2007 Emissions Summaries
- Fires emit large amounts of air pollutants
- SEMAP fire emission inventory is developed using fire records collected from state and federal agencies
- GA, FL, AL, SC have large fire emissions
- **SMARTFIRE data are used for MS**

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Spatial Distribution of Wildland Fire Emissions in NEI2011v1

Prescribed fires
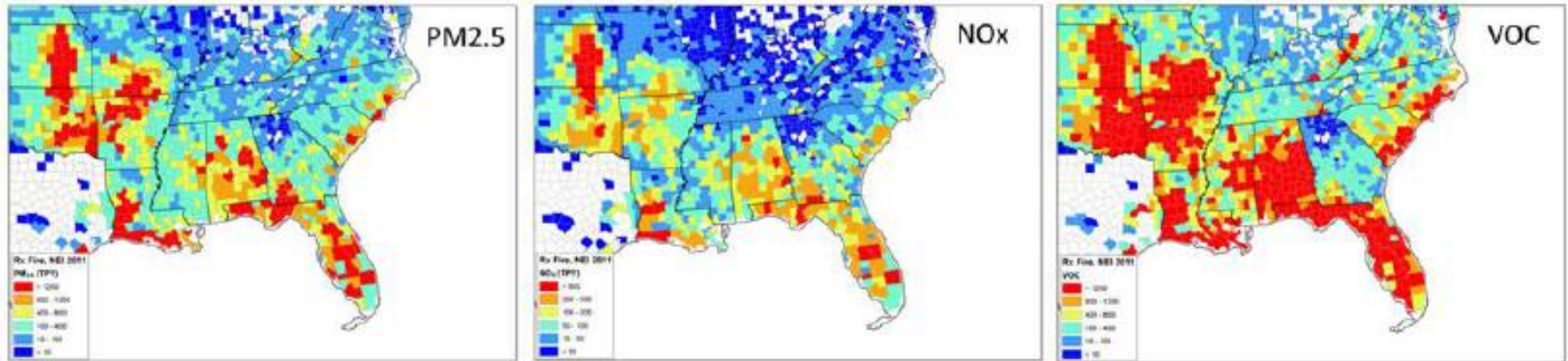
Wildfires
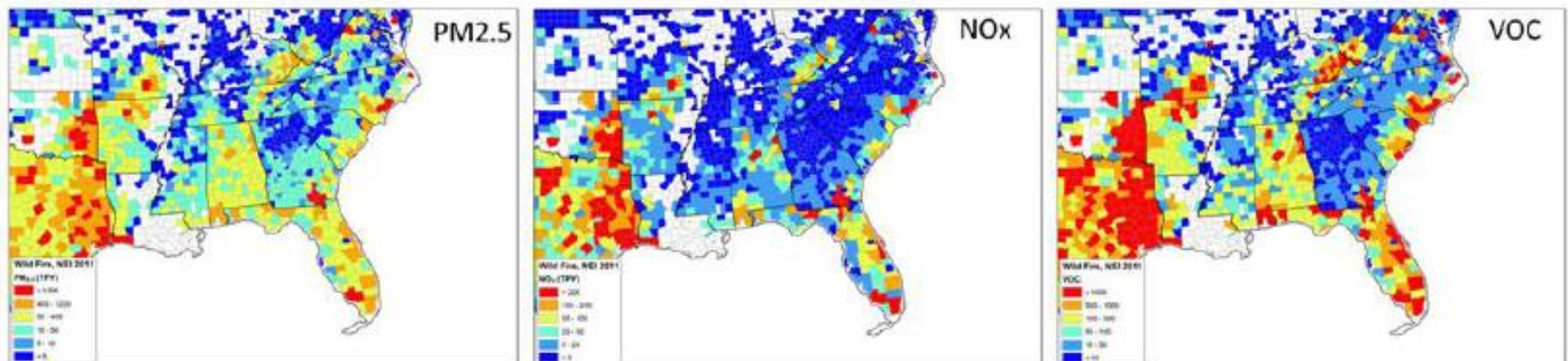
- VOC emissions in NEI2011 look too high in all states except Georgia
- Large difference in PM2.5 and NOx emissions between GA and AL/FL
- Strangely low prescribed fire emissions in TX and low wildfire emissions in LA

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Comparison of SMARTFIRE Estimates and GA EPD Estimates

2011 Prescribed fires in Georgia (tons)

2011 Wildfires in Georgia (tons)
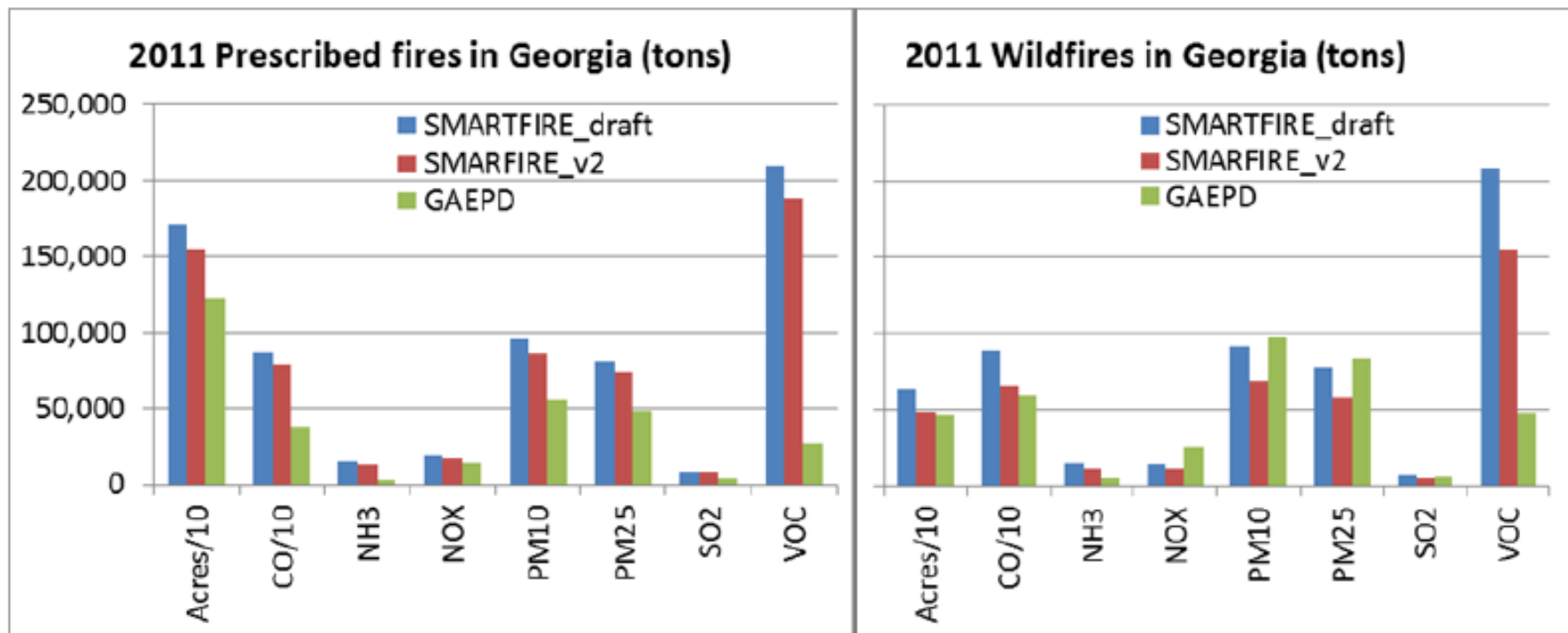
	Emissions (tons/year)			Difference (%)	
	SMARTFIRE_draft	SMARFIRE_v2	GA EPD	SMARTFIRE_draft	SMARFIRE_v2
Acres	2,349,116	2,034,861	1,686,655	39%	21%
CO	1,761,852	1,450,815	981,215	80%	48%
NH3	29,102	23,981	8,154	257%	194%
NOX	33,575	28,530	38,888	-14%	-27%
PM10	187,746	155,390	152,840	23%	2%
PM25	159,107	131,686	132,861	20%	-1%
SO2	16,156	13,574	10,663	52%	27%
VOC	418,337	344,731	74,976	458%	360%

How are Fire Emissions Modeled---for the NEI?

Emissions = Area burned * Fuel Load Available * Fuel Consumed (Burn Efficiency) * Emission Factors

Mass of Emissions=

Area burned * (from SF v2)

Fuel Load Available * (updated FCCS map)

Fuel Consumed * (CONSUME3)

Emission factors (FEPS plus HAPs)

Blue Sky Framework

All these terms must be correct to produce correct emission estimates.

EPA 2014 NEI

- EPA will be using Smartfire2/Bluesky (SF2/BS), as in the 2011 NEI, to estimate EPA emissions for wildland (wild and Rx) fires

- EPA is requesting activity data be submitted by states by September 15, 2015:
  - Data needed: Location, Size, Start and End Date, Type, FCCS Fuelbed (optional), Duff depth (optional)
  - http://www.epa.gov/ttn/chief/net/2014nei_files/2014_wlf_activitydatarequest_final.pdf

2014 NEI Plan available at:
  - http://www.epa.gov/ttn/chief/net/2014nei_files/2014_nei_plan.pdf

Maps

2011NEI Prescribed Fire Emissions and Air Quality

PM2.5 Monitors and Nonattainment Areas
Annual NAAQS (12 ug/m3)

Legend

Monitors with 2013 Valid DVs (ug/m3)
- ● 0 - 9.0
- ● 9.1 - 10.0
- ○ 10.1 - 11.0
- ● 11.1 - 12.0
- ● 12.0 - 13.6

Monitors with 2013 Invalid DVs (ug/m3)
- ▲ 0 - 9.0
- △ 9.1 - 10.0
- △ 10.1 - 11.0
- ▲ 11.1 - 12.0
- ▲ 12.1 - 13.8

- ☆ Monitors with Data Quality Issues
- 1997 Annual PM2.5 Nonattainment & Maintenance
- 2012 Annual PM2.5 Nonattainment & Defferred

2011 NEI Rx PM2.5 Emissions (Tons)
- 0 - 100
- 100.1 - 500
- 500.1 - 1000
- 1000.1 - 5000
- 5000.1 - 21814

Map Created by: Rick Gillam
U.S. EPA Region 4, ADAS
February 9, 2015

PM2.5 Monitors and Nonattainment Areas
24-hr NAAQS (35 ug/m3)

Legend

Monitors with 2013 Valid 24-hr DVs (ug/m3)
- ● 0 - 20
- ● 21 - 25
- ● 26 - 30
- ● 31 - 35
- ● 36 - 37

Monitors with 2013 Invalid 24-hr DVs (ug/m3)
- ▲ 0 - 20
- ▲ 21 - 25
- ▲ 26 - 30
- ▲ 31 - 35
- ▲ 36

- ☆ Monitors with Data Quality Issues
- 24-hr PM2.5 Maintenance Area
- 24-hr PM2.5 Nonattainment Areas

2011 NEI Rx PM2.5 Emissions (Tons)
- 0 - 100
- 100.1 - 500
- 500.1 - 1000
- 1000.1 - 5000
- 5000.1 - 21814
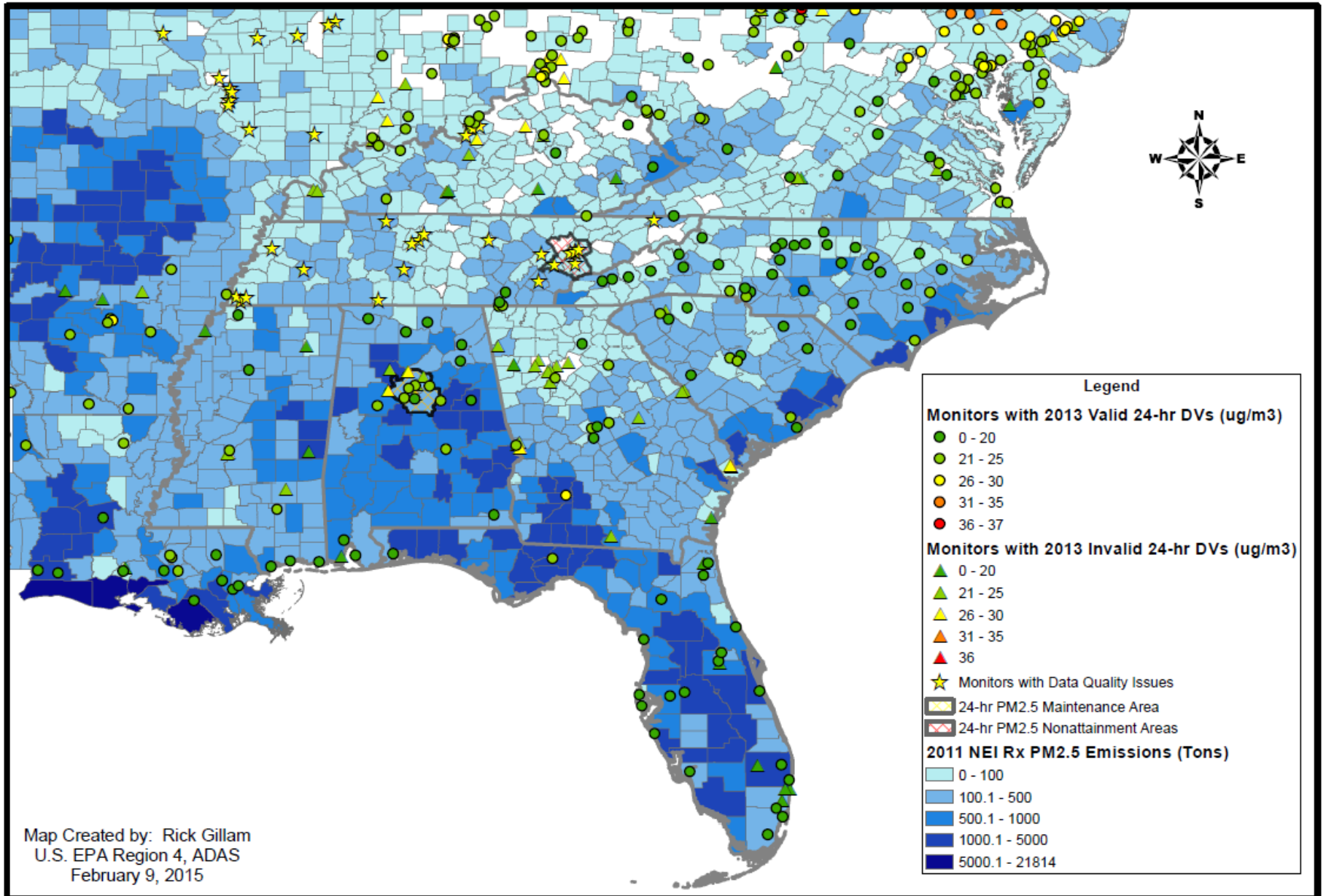
Map Created by: Rick Gillam
U.S. EPA Region 4, ADAS
February 9, 2015

Ozone Monitors and Nonattainment Areas
2008 8-hr NAAQS (0.075 ppm)

Legend

Monitors with Valid 2013 DVs (ug/m3)
- 0 - 0.060
- 0.0601 - 0.065
- 0.0651 - 0.070
- 0.0701 - 0.075
- 0.0751 - 0.087

Monitors with Incomplete 2013 DVs (ug/m3)
- 0 - 0.060
- 0.0601 - 0.065
- 0.0651 - 0.070
- 0.0701 - 0.075
- 0.0751 - 0.080

- 2008 8-hrOzone Nonattainment Areas
- 1997 8-hr Ozone Maintenance Areas

2011 NEI Rx PM2.5 Emissions (Tons)
- 0 - 100
- 100.1 - 500
- 500.1 - 1000
- 1000.1 - 5000
- 5000.1 - 21814

Map Created by: Rick Gillam
U.S. EPA Region 4, ADAS
February 12, 2015

Possible Research Questions

- Are emissions from Prescribed Fires significantly impacting air quality in the Southeast?

- How do the emissions from frequent prescribed fires compare to emissions from infrequent uncontrolled large wildfires?

- Are there new and innovative ways to fill data gaps and improve prescribed fire emissions inventories?