

The 2015 Wildland Fire Emissions Inventory for the United States, Canada, and Mexico

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We would also like to acknowledge the Canadian Forest Service for providing access to their National Fire Database.

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Background

- EPA needed emissions estimates for 2015 for wildland fires
- First emissions inventory prepared using the SmartFire/BlueSky framework covering the U.S., Canada, and Mexico

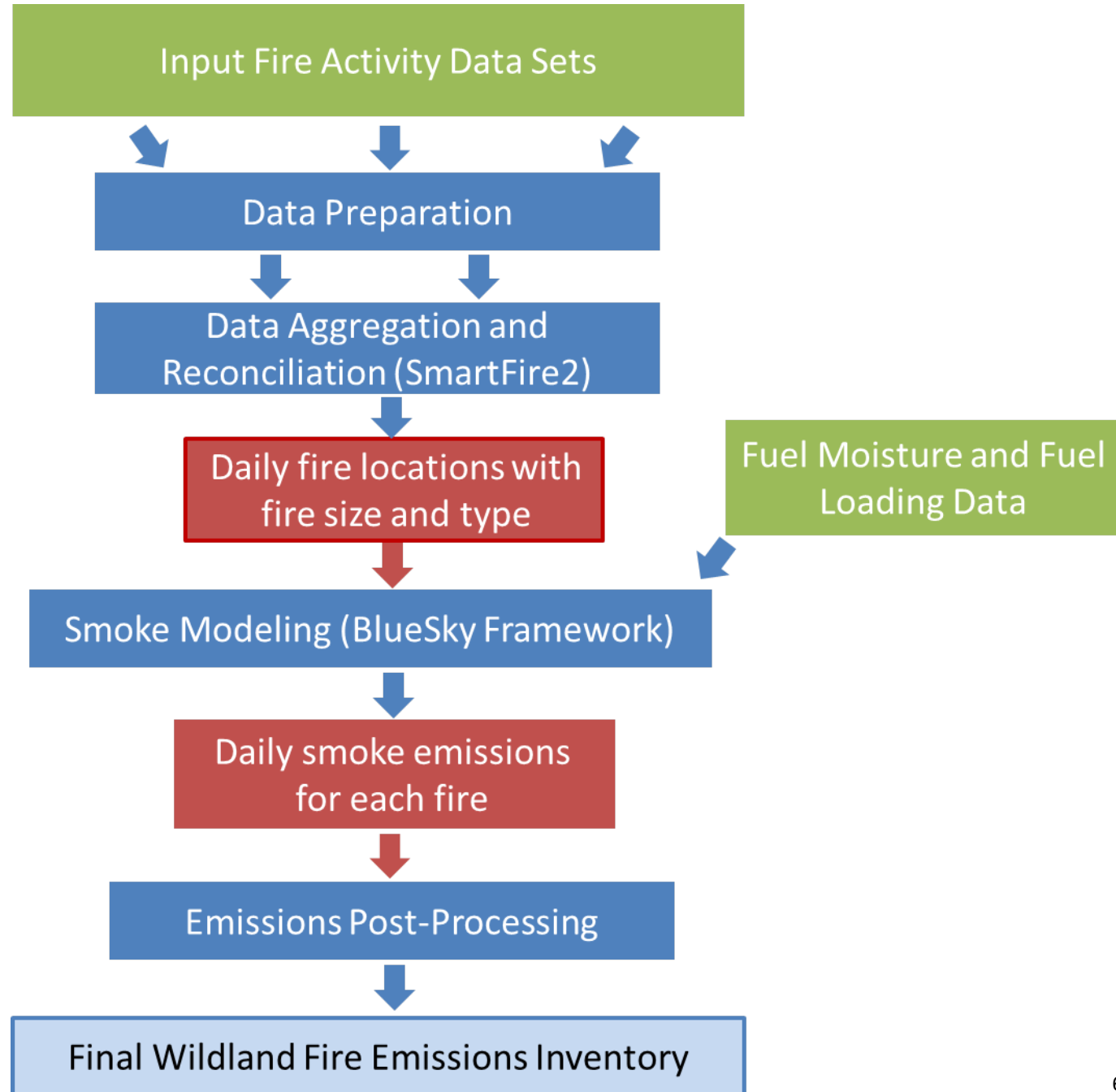
Background

- Data processing was conducted separately for the U.S., Canada, and Mexico
 - U.S.: Similar to 2014 (No SLT data sets)
 - Canada: Satellite data + ground reports
 - Mexico: Satellite data only
- Wildfire (WF) and prescribed fire (Rx)
- Results for Canada and Mexico include agricultural burning

Background

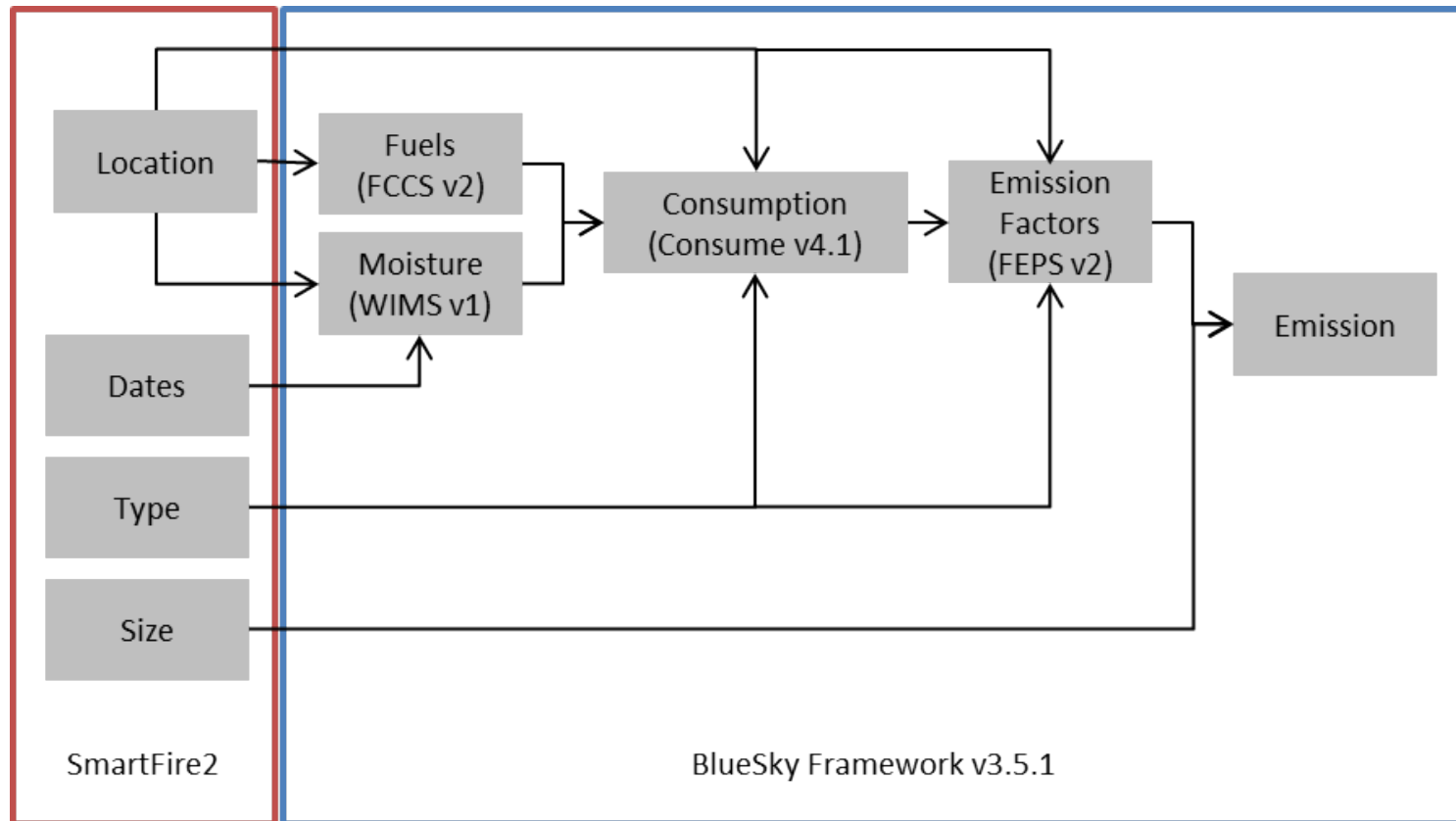
- Emissions calculated include:
 - PM_{2.5} (Including fractions of elemental carbon [EC], organic carbon [OC], SO₄, and NO₃)
 - PM₁₀
 - CO
 - CO₂
 - CH₄
 - NO_x
 - NH₃
 - SO₂
 - Volatile organic compounds (VOCs)
 - 34 hazardous air pollutants (HAPs) (U.S. only)

Methods



Methods – Modeling Chain

Contiguous U.S. and Alaska



Methods – Modeling Chain

Hawaii, Puerto Rico, Canada, Mexico

Data Type	Model Used	Version Information
Fire activity data	SmartFire2	Version 2.0, Build 42022
Fuel loading	FINN v1	As implemented in BlueSky Framework 3.5.1, revision 47693
Fuel consumption	FINN v1	
Emissions	FINN v1	

Methods – Data Sources

U.S.

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
National Association of State Foresters (NASF)	NASF	State-managed lands
Forest Service Activity Tracking System (FACTS) Perimeters	USFS	Prescribed fires on USFS-managed lands
Geospatial Multi-Agency Coordination (GeoMAC) Perimeters	GeoMAC Group	Wildfire perimeters
U.S. Department of the Interior (DOI)	DOI	Prescribed fires

Methods – Data Sources

Canada

Data Set	Agency	Coverage
Hazard Mapping System (HMS)	NOAA	Satellite fire detections
National Fire Database (NFDB) perimeter and point data	Canadian Forest Service	Wildfire and prescribed fires

Mexico

Data Set	Agency	Coverage
Hazard Mapping System (HMS)	NOAA	Satellite fire detections
MODIS Hotspots (MCD14ML)	National Air and Space Administration	Satellite fire detections

Methods – Data Sources

- Ancillary data sources (Contiguous U.S. and Alaska)
 - Fuel moisture data from the USFS Weather Information Management System
 - Fuel Characteristic Classification System (FCCS) fuel loading data

Methods – Fire Activity Data

General quality control

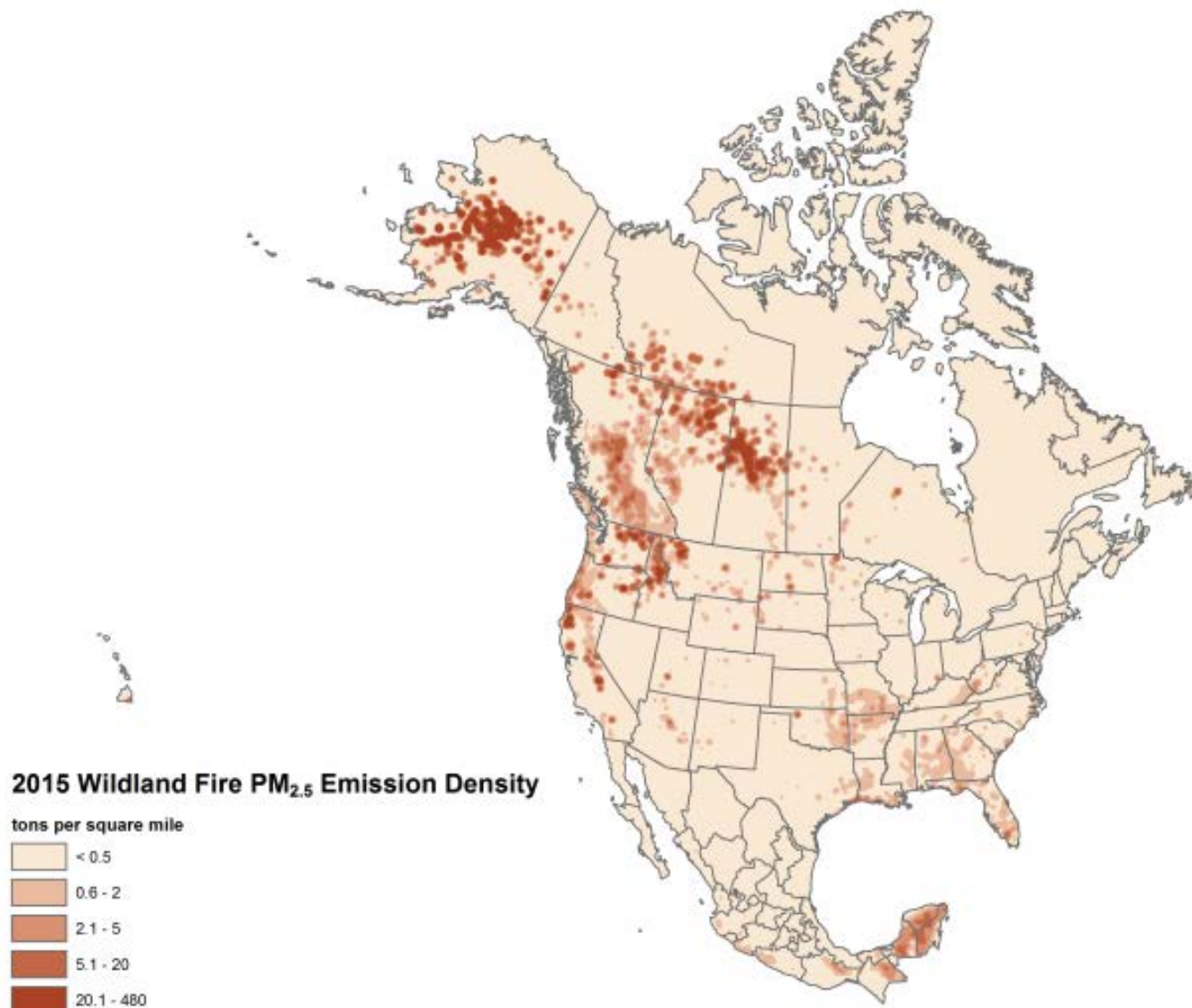
- U.S.
 - As in NEI 2014
- Mexico
 - Fill HMS gaps with MODIS
- Canada
 - Combine NFDB with HMS

Results: 2015 Wildland Fire Emissions Inventory Totals

Parameter	U.S.	Canada	Mexico	Total
Wildfire Area Burned (acres)	11.5 MM	11.0 MM	3.4 MM	25.9 MM
Prescribed Fire Area Burned(acres)	7.4 MM	0.05 MM	*	7.5 MM
Agricultural Fire Area Burned (acres)	*	1.4 MM	0.6 MM	2.0 MM
Total Area Burned (acres)	19.0 MM	12.4 MM	4 MM	35.3 MM
Wildfire PM _{2.5} Emissions (tons)	7,446,000	2,655,000	254,000	10,355,000
Prescribed Fire PM _{2.5} Emissions (tons)	588,000	12,000	*	601,000
Agricultural Fire PM _{2.5} Emissions (tons)	*	28,000	6,000	35,000
Total PM _{2.5} Emissions (tons)	8,034,000	2,696,000	261,000	10,991,000

* No data are available

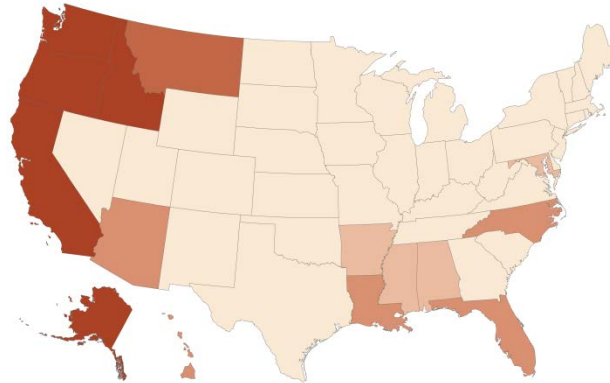
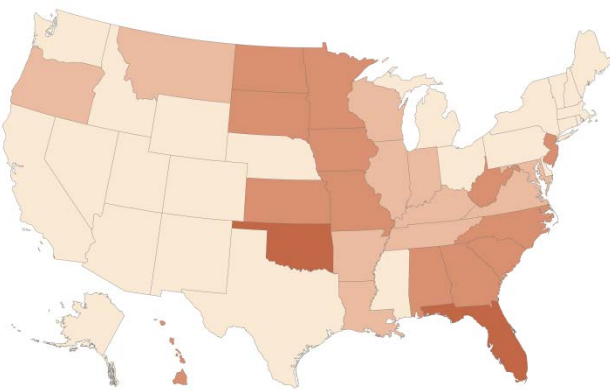
Results: Emissions Density



Results: U.S. Seasonality

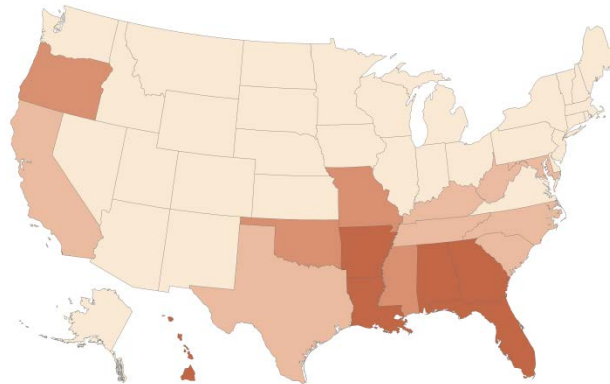
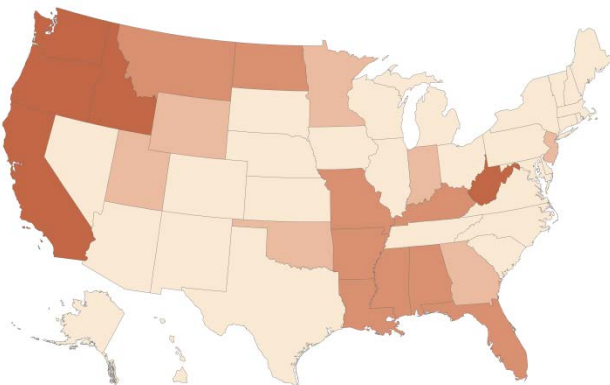
Spring 2015

Summer 2015



Autumn 2015

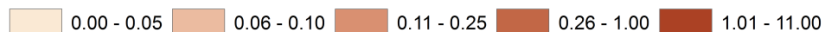
Winter 2015



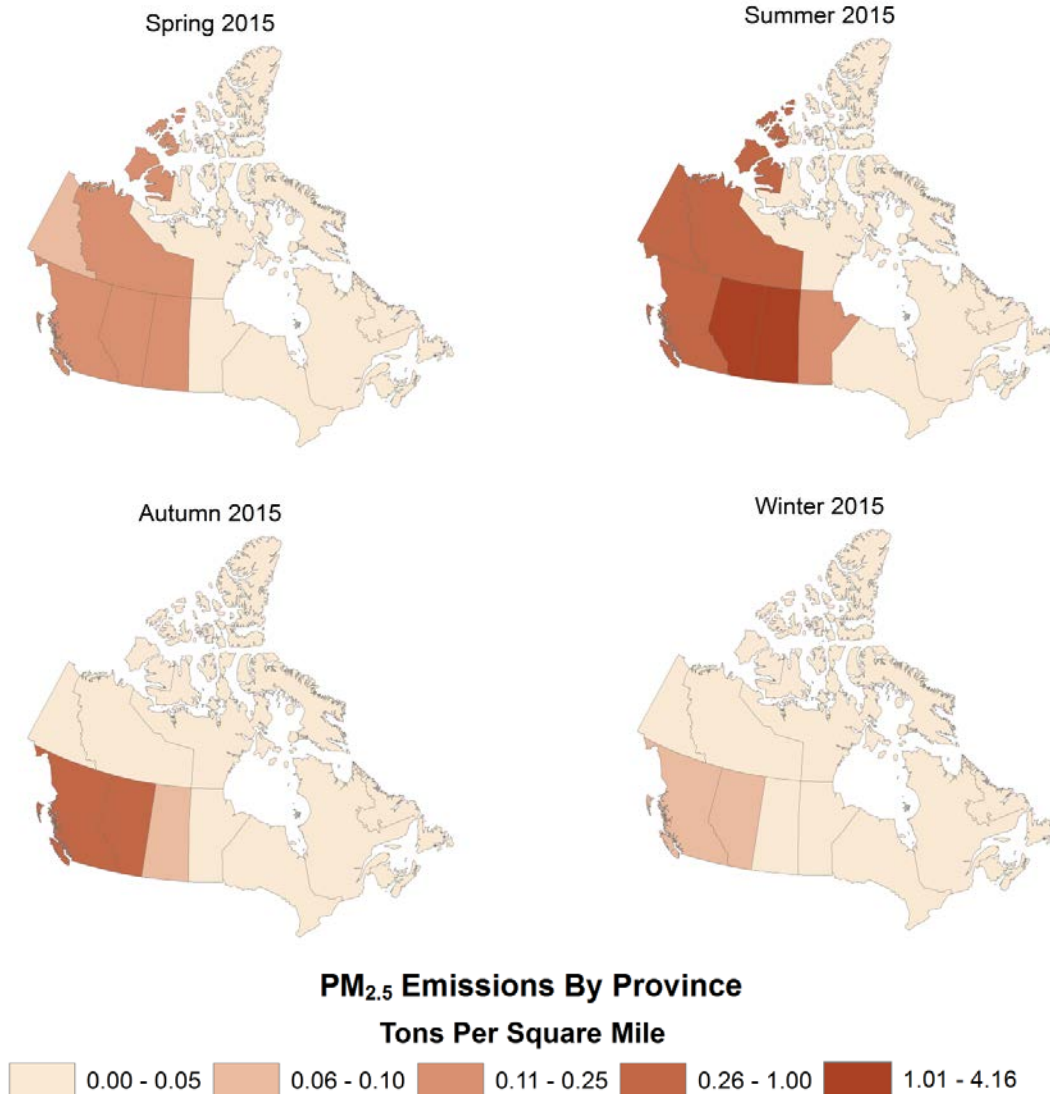
- **Spring:** March, April, and May
- **Summer:** June, July, and August
- **Autumn:** September, October, and November
- **Winter:** January, February, and December

PM_{2.5} Emissions By State

Tons Per Square Mile



Results: Canada Seasonality



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

Results: Mexico Seasonality

Spring 2015



Summer 2015



Autumn 2015



Winter 2015



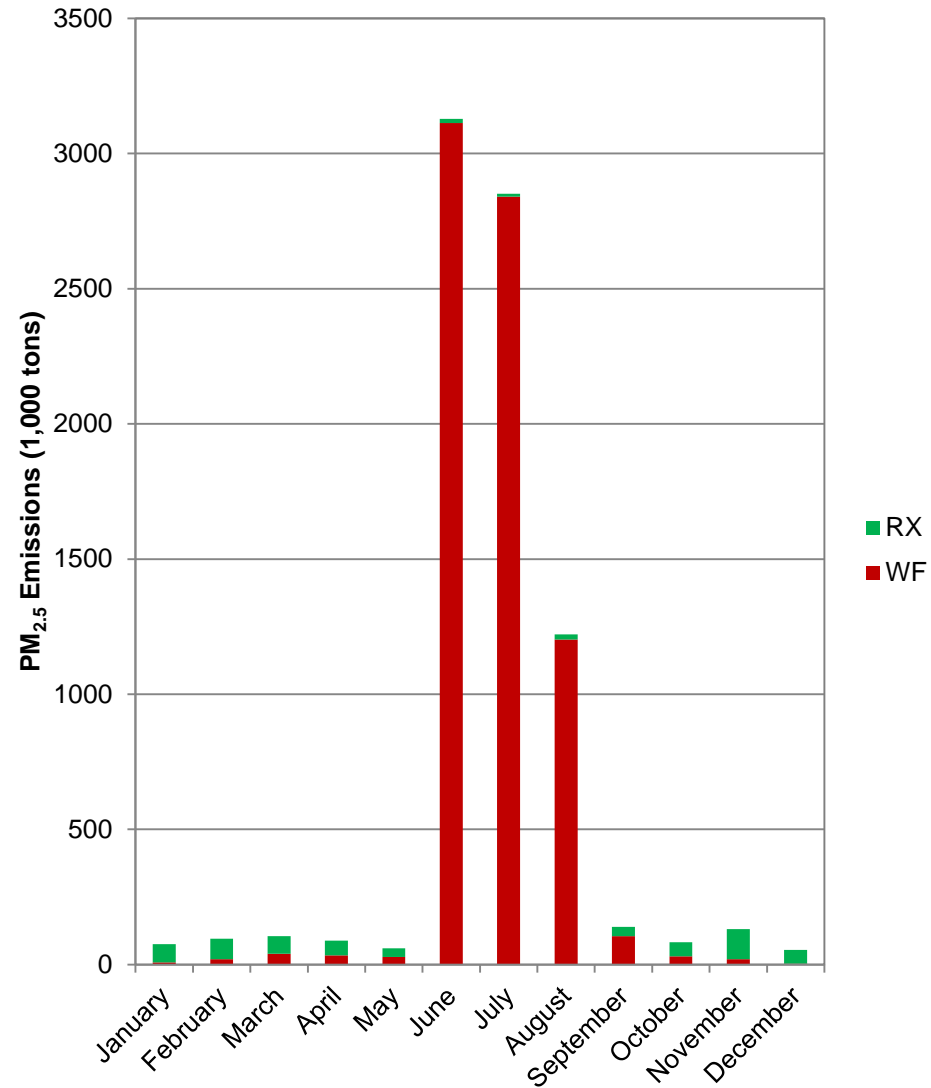
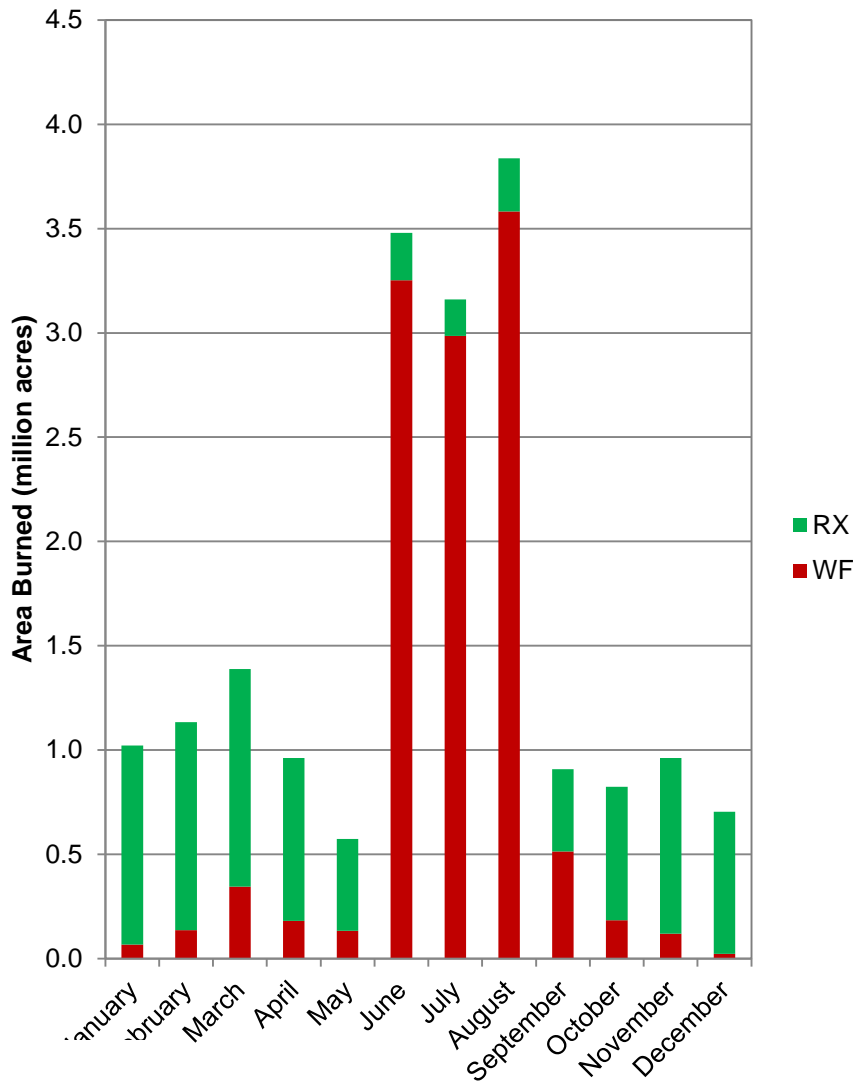
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PM_{2.5} Emissions By State

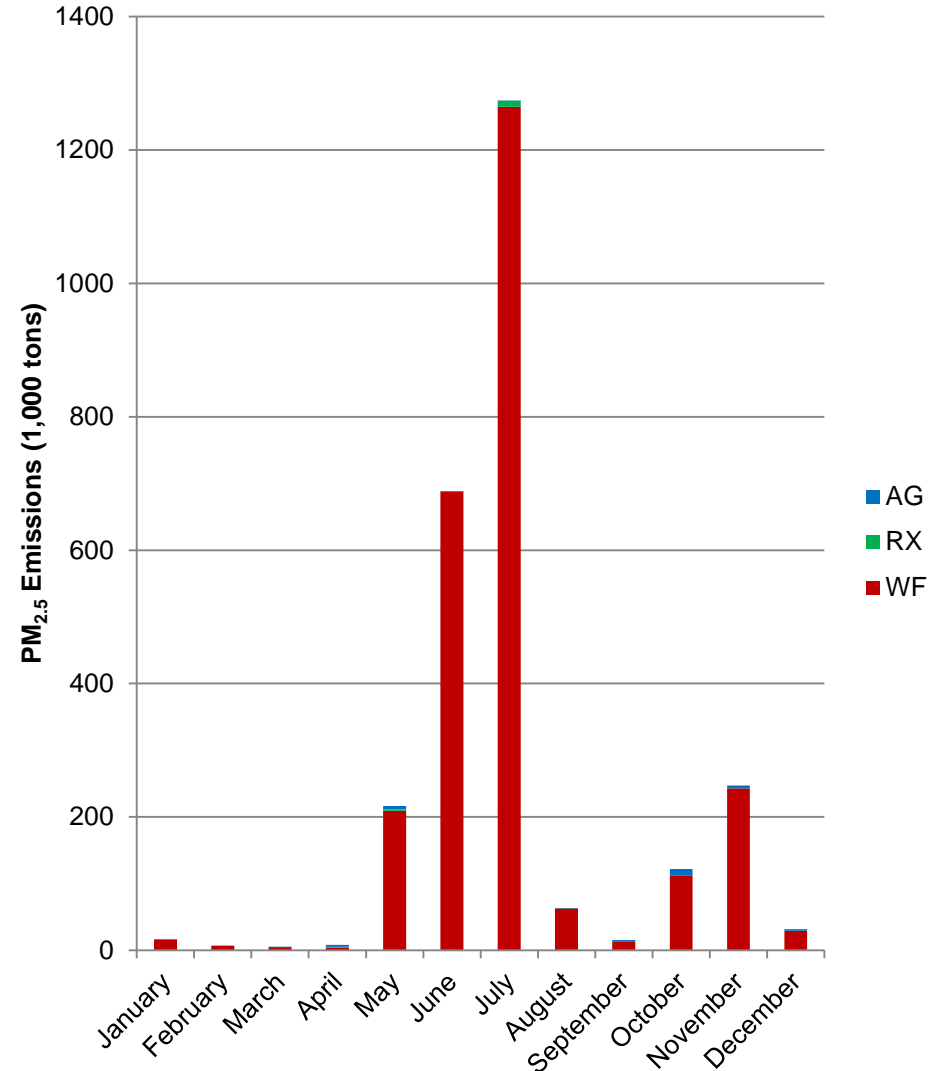
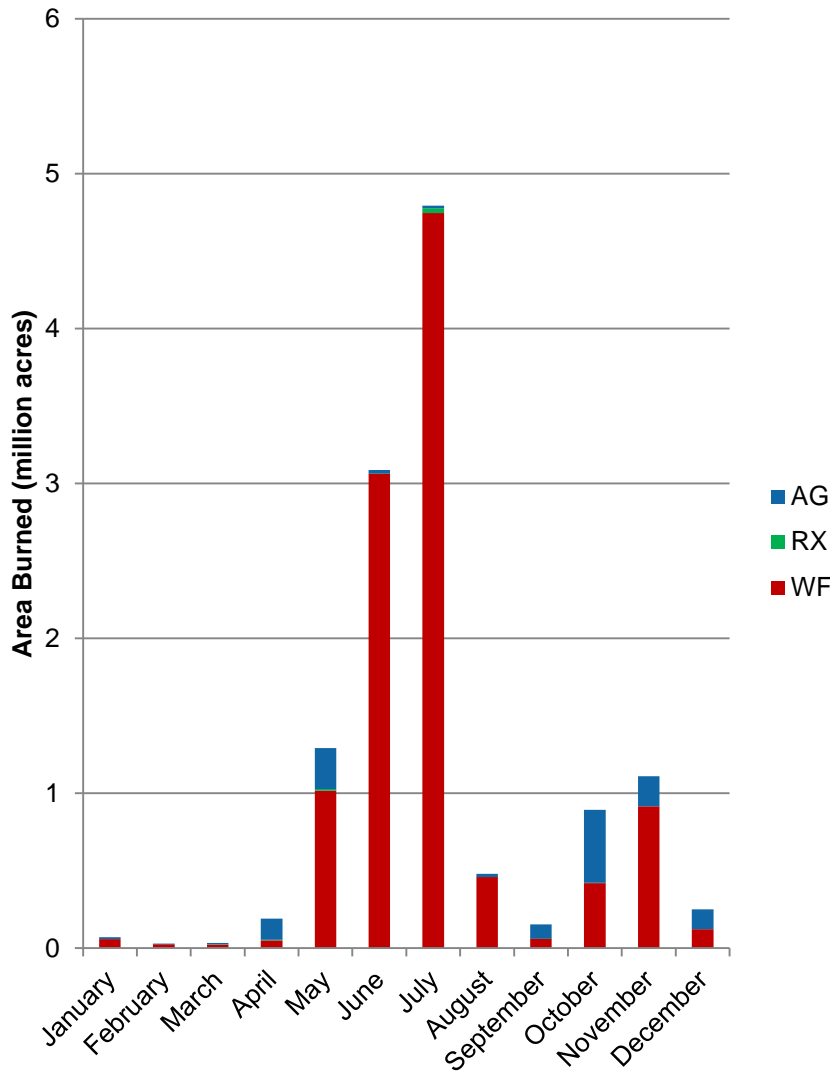
Tons Per Square Mile



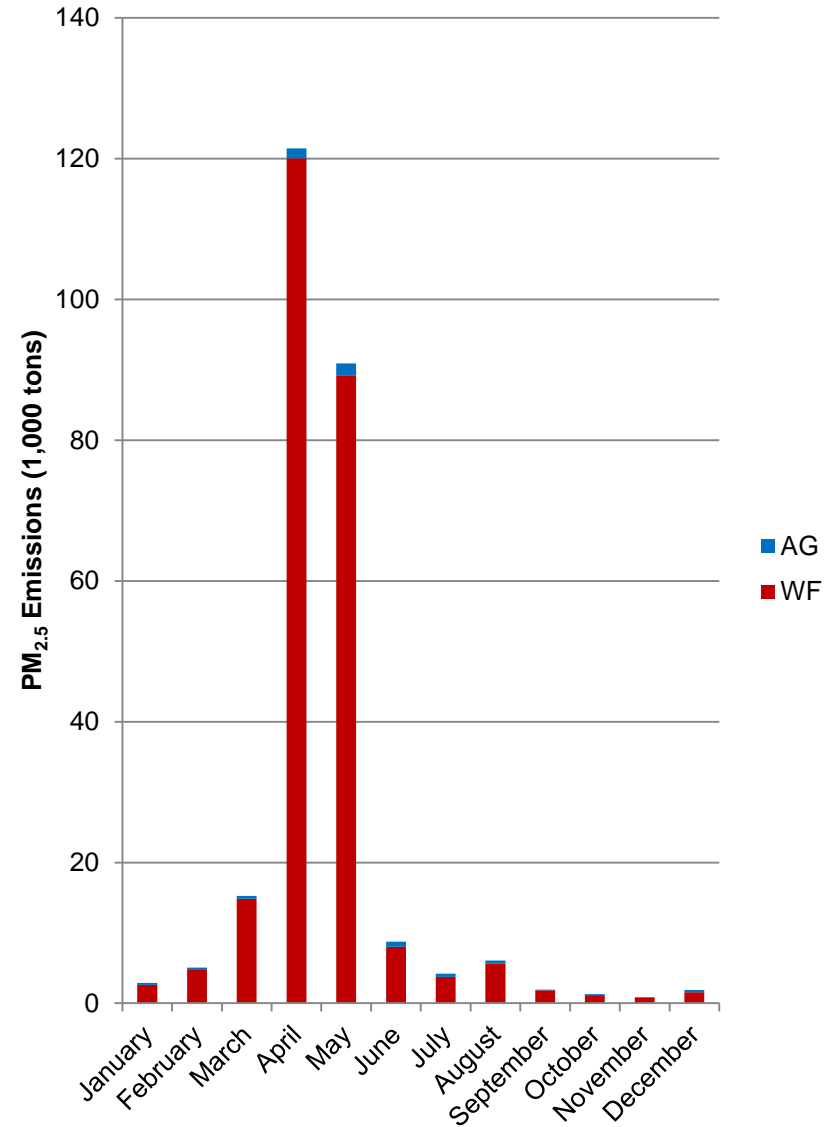
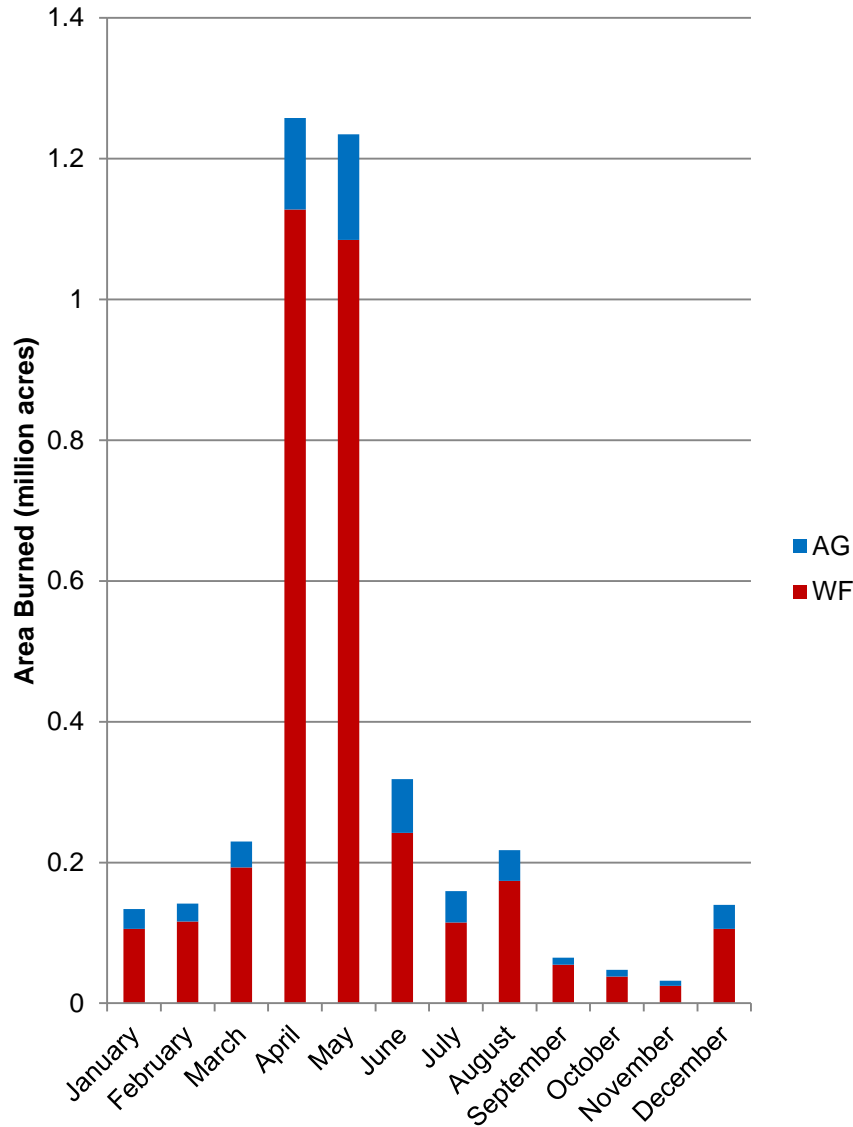
Results: U.S. Type Monthly



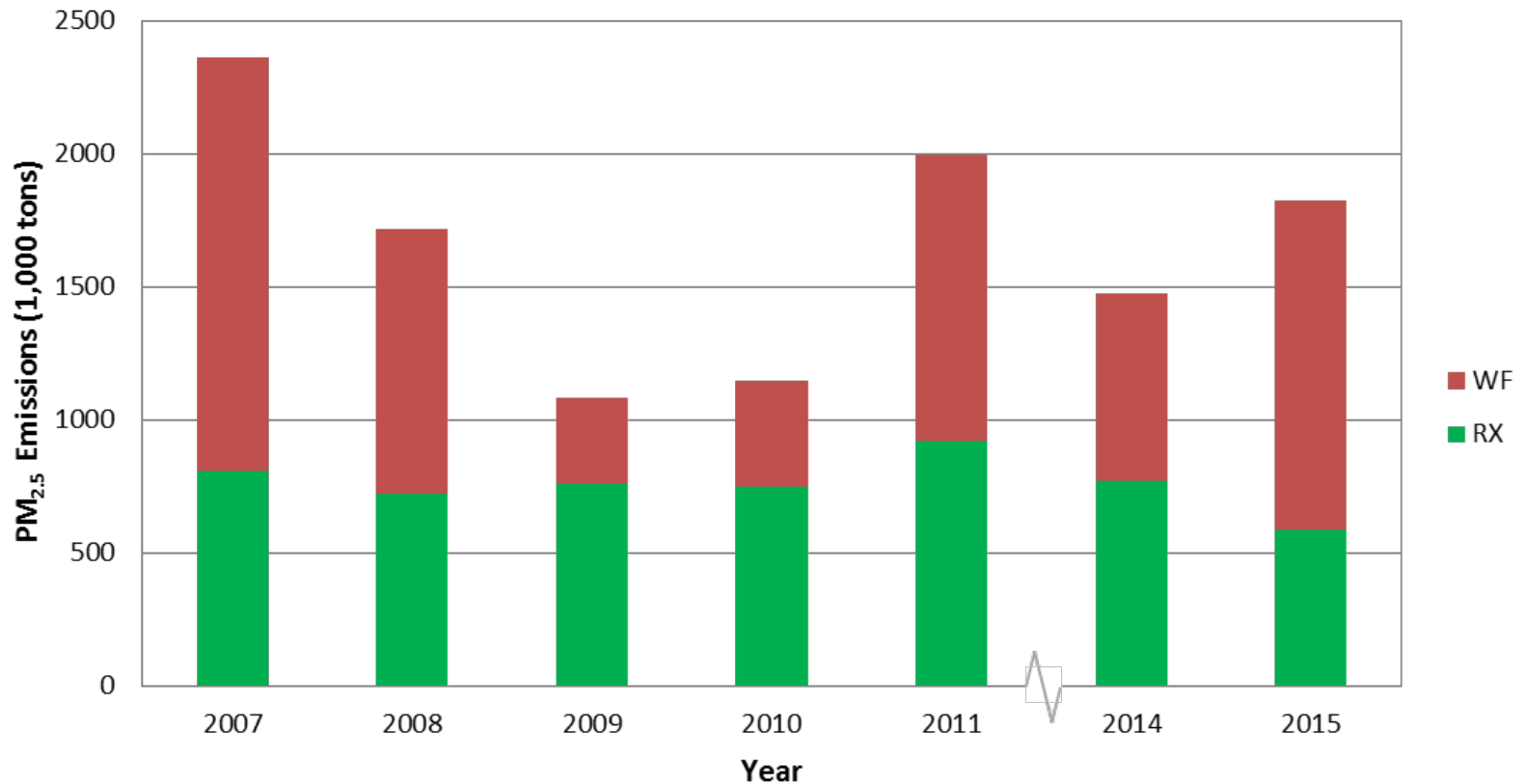
Results: Canada Type Monthly



Results: Mexico Type Monthly

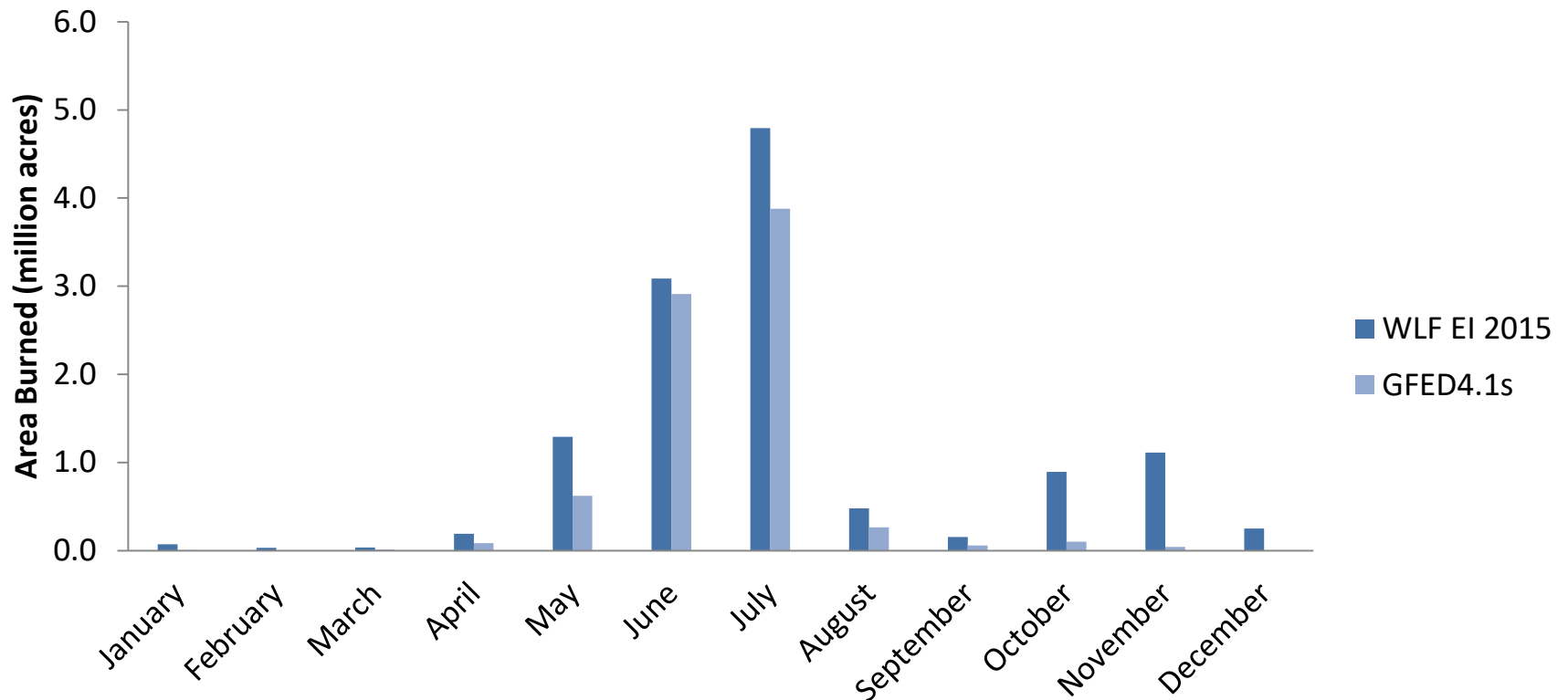


Annual Comparison: Contiguous United States



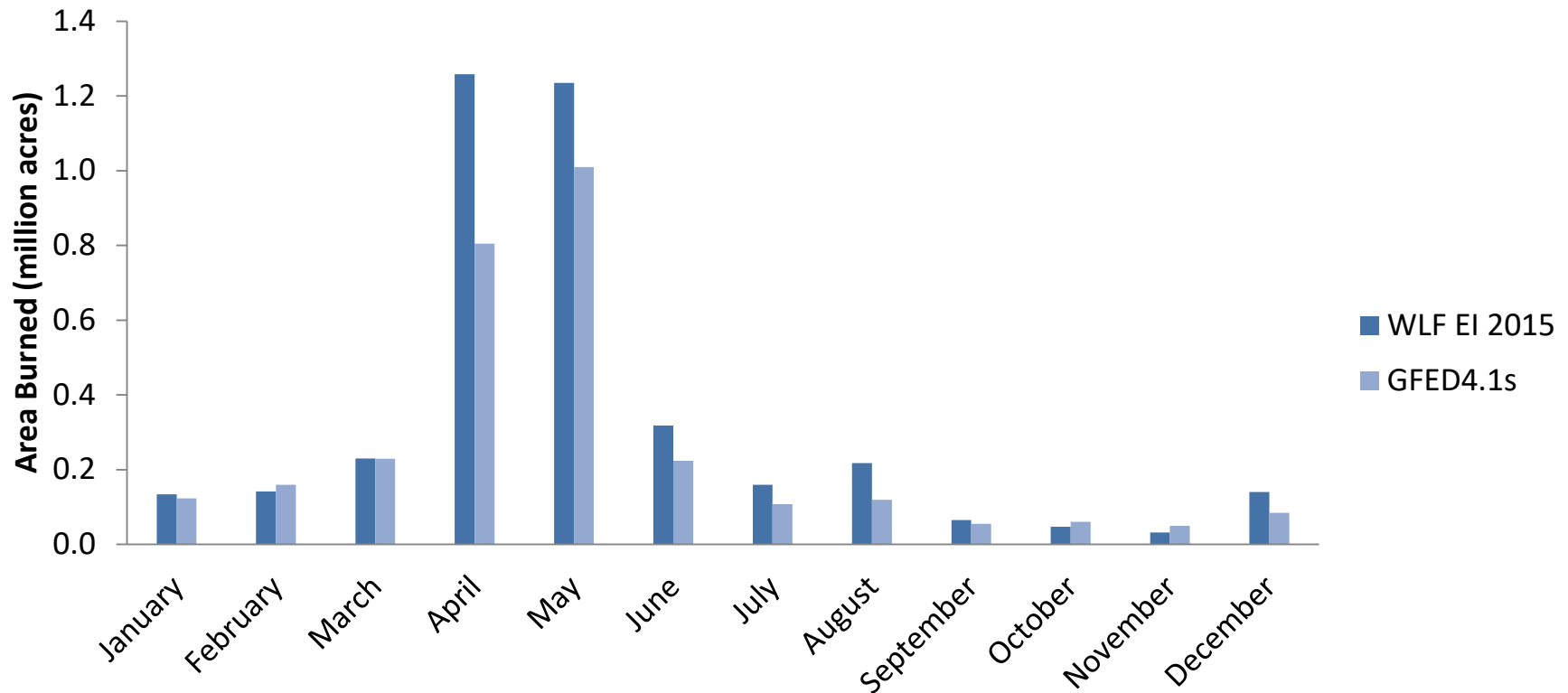
Inventory Comparison: Canada

Global Fire Emissions Database 4.1s



Inventory Comparison: Mexico

Global Fire Emissions Database 4.1s



Conclusions

- 2015 WLF EI is the first inventory for North America created using the Smartfire/BlueSky pathway
- Canada and Mexico make substantial impact on air quality in North America

Uses of the 2015 Inventory

- Modeling platform development
- Plume rise research
- Exceptional event demonstrations
- In future, expanded air quality modeling domain will include Canada and Mexico
- EPA air quality modeling (maybe)
- ORD CMAQ runs (maybe)

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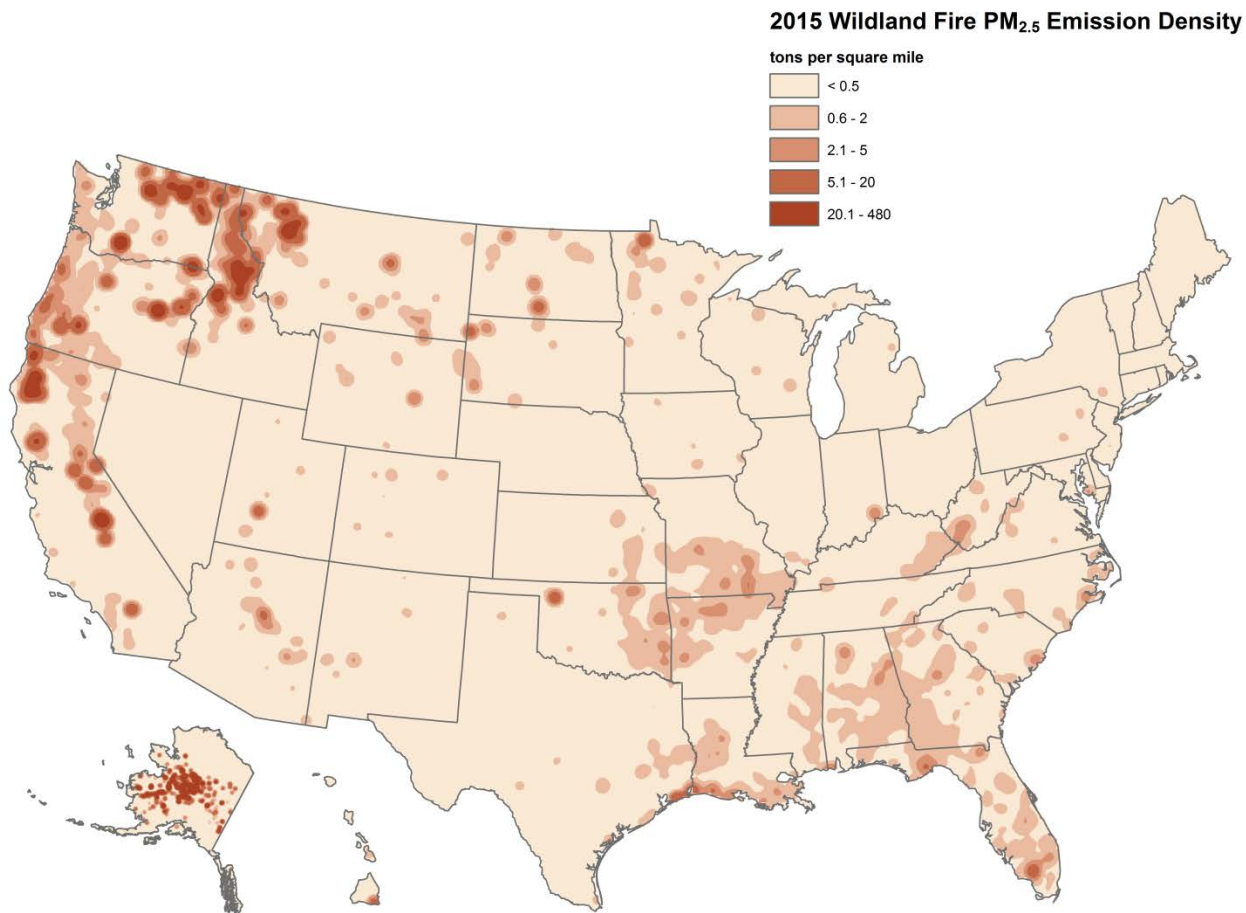
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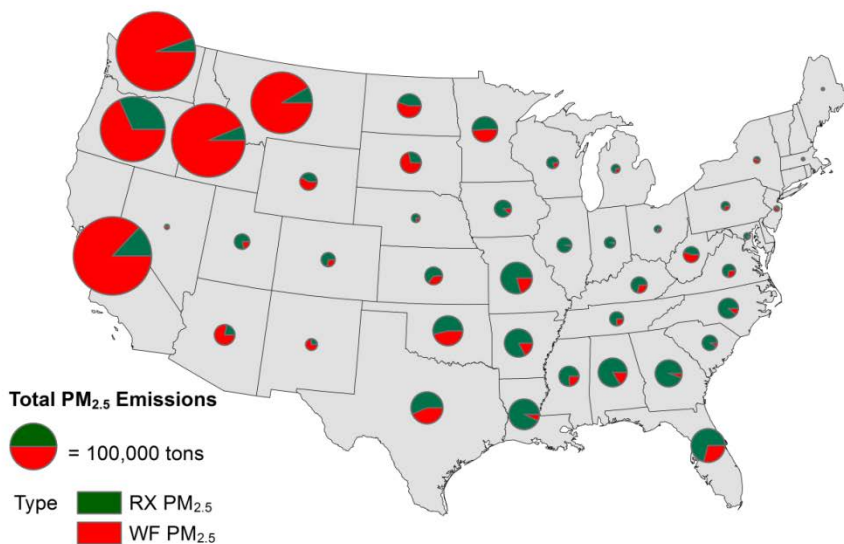
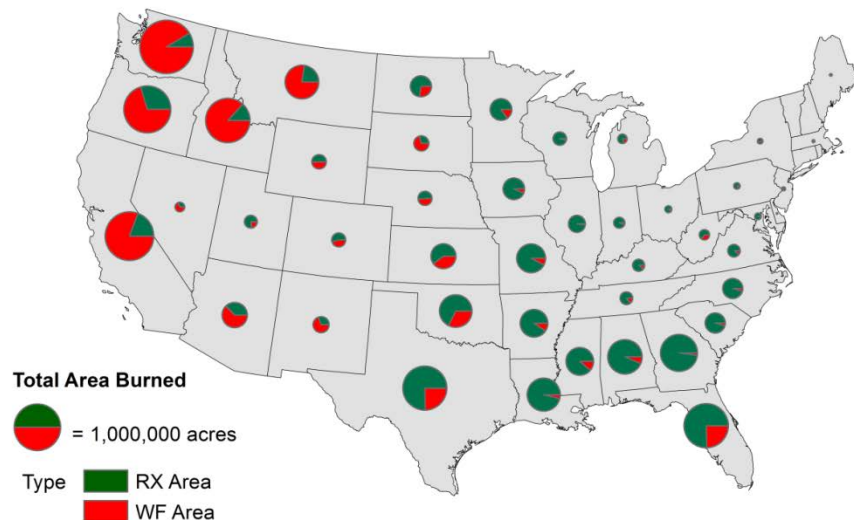
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Additional Slides

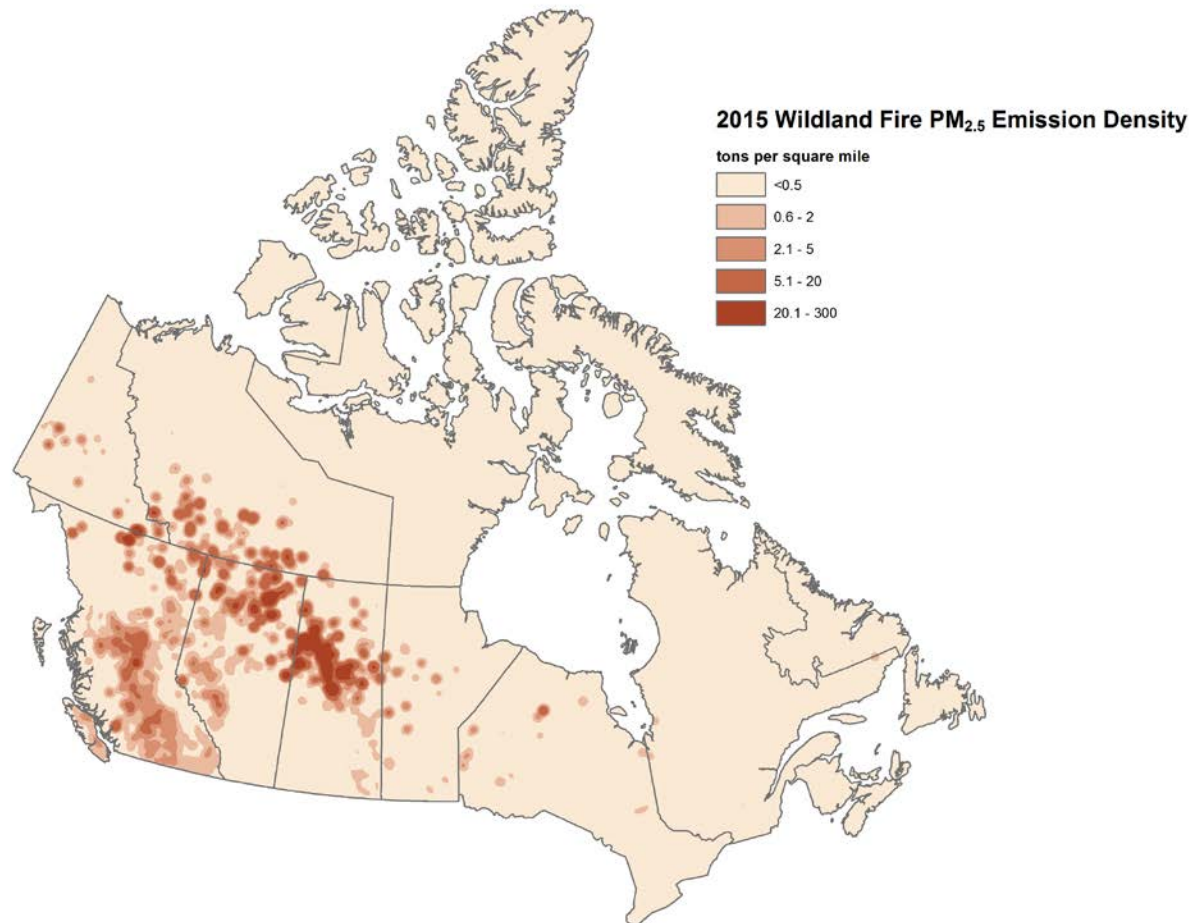
2015 Wildland Fire PM_{2.5} Emission Density in the United States



2015 State Totals of Area Burned and PM_{2.5} Emitted by Fire Type



2015 Wildland Fire and Agricultural Fire PM_{2.5} Emission Density in Canada



2015 Wildland Fire and Agricultural Fire PM_{2.5} Emission Density in Mexico

