Development of the 2014 Wildland Fire National Emissions Inventory Version 1

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Acknowledgments

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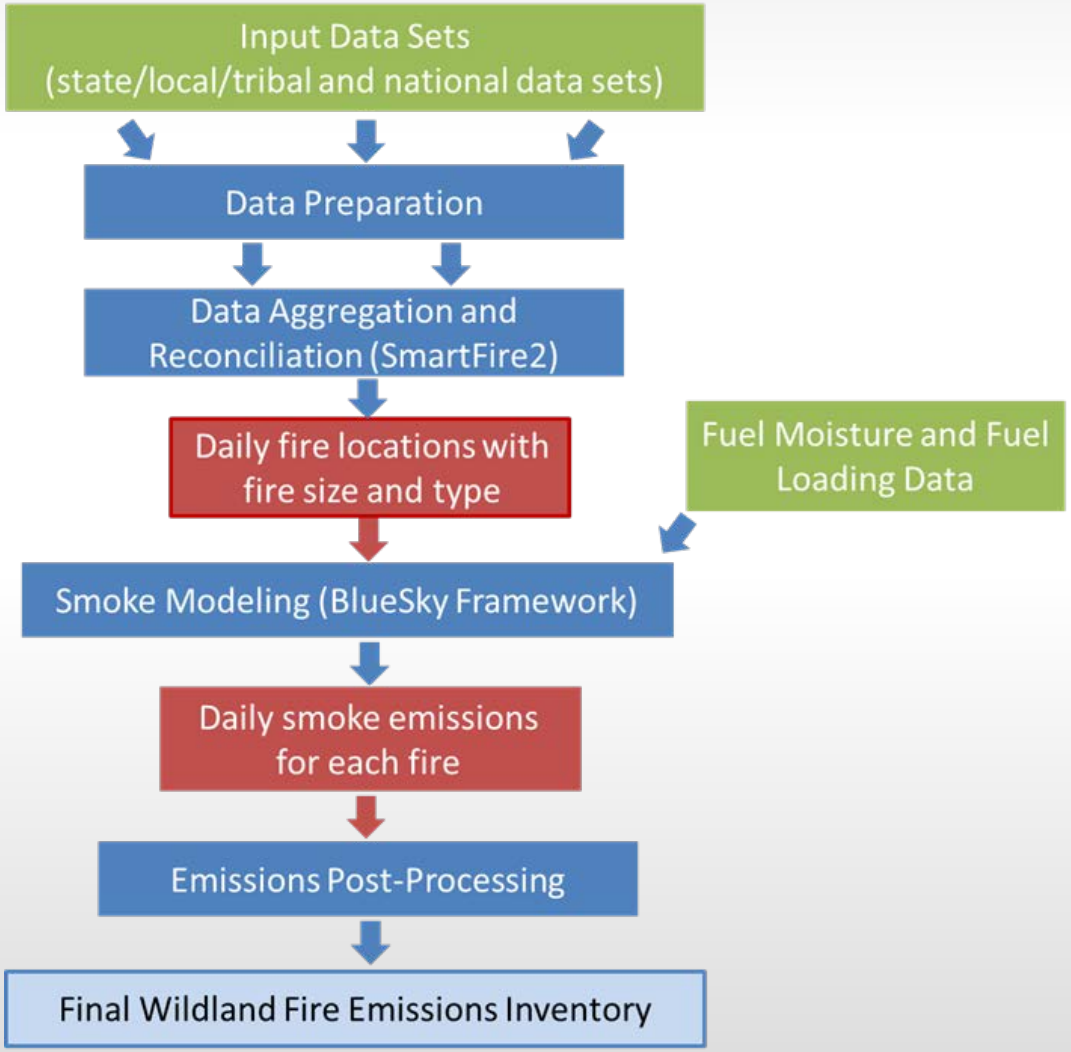
Background (1)

- U.S. EPA's Emissions Inventory and Analysis Group compiles the National Emissions Inventory (NEI) every three years, with 2014 NEI being the latest year available.
- NEI data are used to
  - Assess various National Ambient Air Quality Standards (NAAQS) setting and implementation processes
  - Aid in international emission reporting requirements
  - Inform the public
  - Drive air quality models (regulatory and research)
  - Assess risks from emissions of air toxics
- The final NEI is a combination of data submitted by state, local, and tribal agencies (SLTs) and data developed by the EPA.

Background (2)

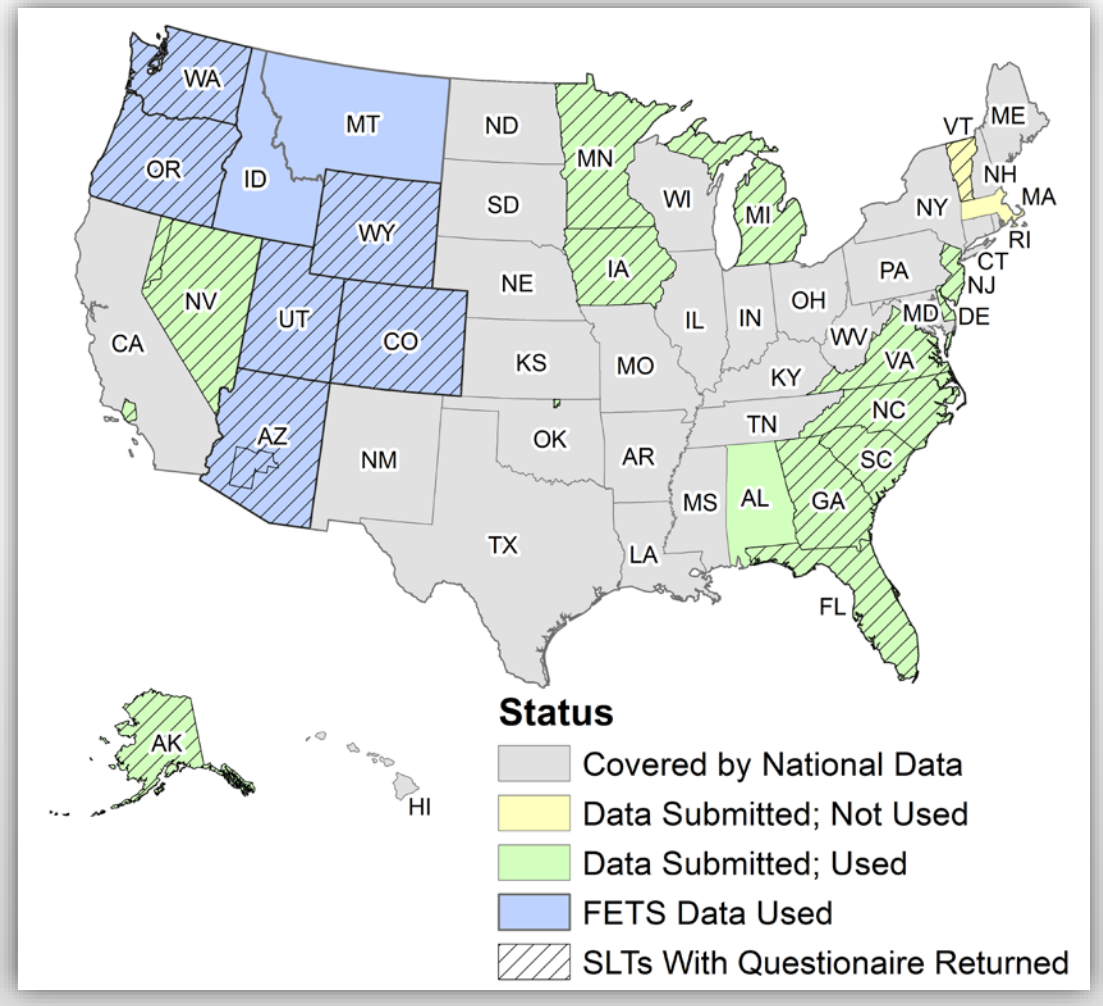
- The 2014 Wildland Fire (WLF) NEI represents wild (WF) and prescribed (Rx) fire sectors of the 2014 NEI.
- Pile and agricultural burns are NOT included in the WLF NEI.
- The WLF NEI consists of geocoded, day-specific emission estimates.
- A draft version of the 2014 WLF NEI was published in March 2016 for SLT review. Fire activity data from three states were included in the draft. Numerous comments were received on the draft.
- Comments on the draft 2014 WLF NEI were incorporated in version 1 of the 2014 WLF NEI presented here.
- For the 2014 WLF NEI v1, emission estimates for all states but Georgia and Washington were based on EPA methods.

Methods – Overview



Methods – Data Sources (1)

- SLTs invited to submit fire occurrence data
  - 54 data sets received
- Data exclusions
  - 22 data sets excluded due to missing information or duplication
- NEI Wildland Fire Inventory Database Questionnaire requested
  - 20 states and the Indian Nation responded
- Final data sources include data from 22 states and one Indian Nation



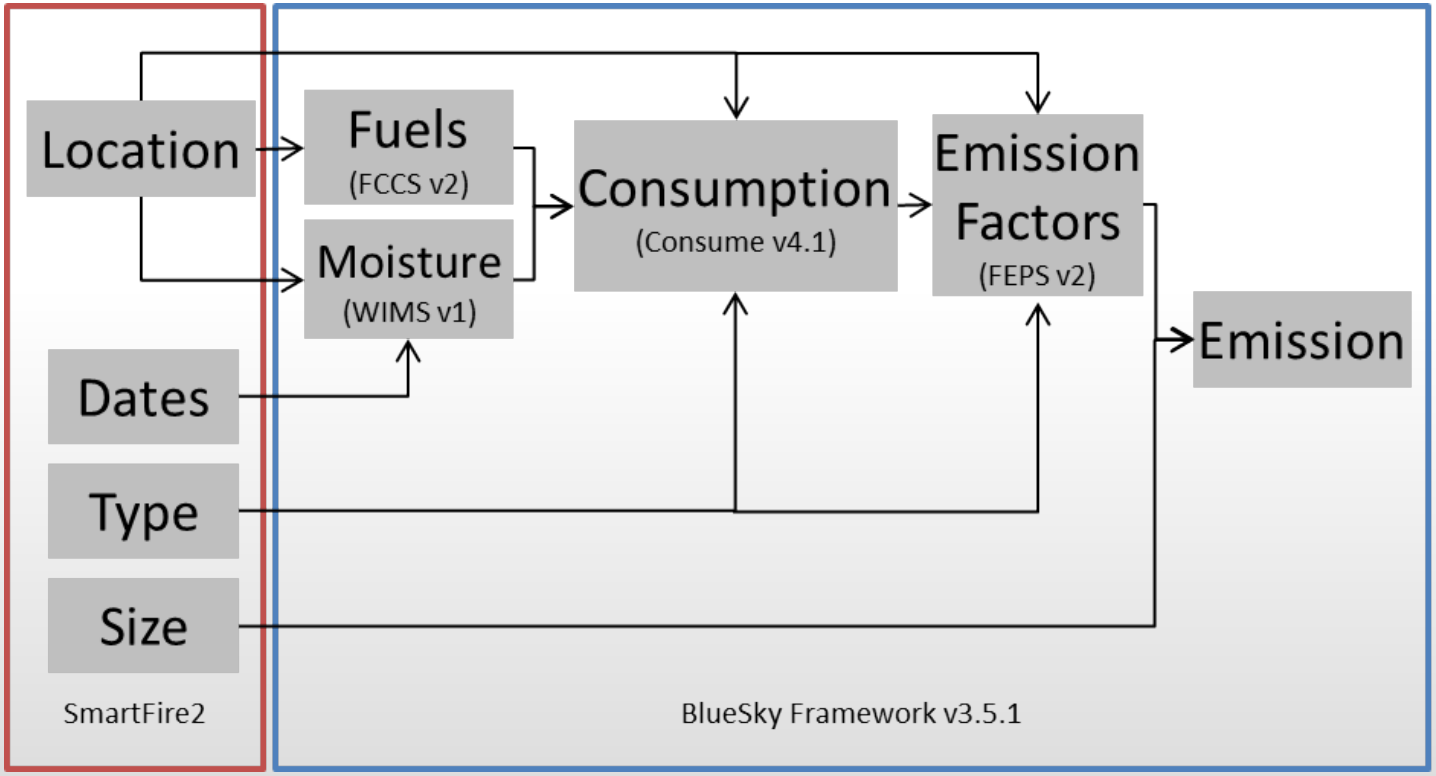
FETS = Fire Emissions Tracking System from Western Regional Air partnership that includes many western states

Methods – Data Sources (2)

- SLT data sets were supplemented with national data
  - National Association of State Foresters (NASF) WF data
  - NOAA's Hazard Mapping System (HMS) data
  - Incident Status Summary (ICS-209) data
  - Geospatial Multi-Agency Coordination (GeoMAC) fire perimeter data
  - USDA Forest Service Activity Tracking System (FACTS) Rx fire perimeter data
  - U.S. Fish and Wildlife Service (USFWS) data
  - U.S. Department of Interior (DOI) Rx data
- Ancillary data sources
  - Fuel moisture data from the USFS Weather Information Management System
  - Fuel Characteristic Classification System (FCCS) fuel loading data

Methods – Data System and Models (1)

For fires in the contiguous United States and Alaska, the following modeling pathway was used to estimate smoke emissions.



Methods – Data System and Models (2)

For fires in Hawaii and Puerto Rico, Fire Inventory from the National Center for Atmospheric Research (FINN)* was used to estimate smoke emissions.

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	

*Wiedinmyer C., Akagi S.K., Yokelson R.J., Emmons L.K., Al-Saadi J.A., Orlando J.J., and Soja A.J. (2011) The Fire INventory from NCAR (FINN): a high resolution global model to estimate the emissions from open burning. Geosci. Model Dev., 4, 625-641, doi: 10.5194/gmd-4-625-2011.

Methods – Emissions Data Processing

- Emissions were estimated for $PM_{2.5}$, PM_{10}, CO, CO_2, CH_4, NO_x, NH_3, SO_2, VOC, and 34 hazardous air pollutants (HAPs). $PM_{2.5}$ emissions were further broken down into EC, OC, SO_4, NO_3, and PM fine.
- HAPs emission factors and fractions of $PM_{2.5}$ components were provided by EPA.
- FINN does not calculate VOC and HAP emissions. National average ratios of these pollutants to CO_2 for fires in grassland/herbaceous land cover were calculated to estimate VOC and HAP emissions in Hawaii and Puerto Rico.

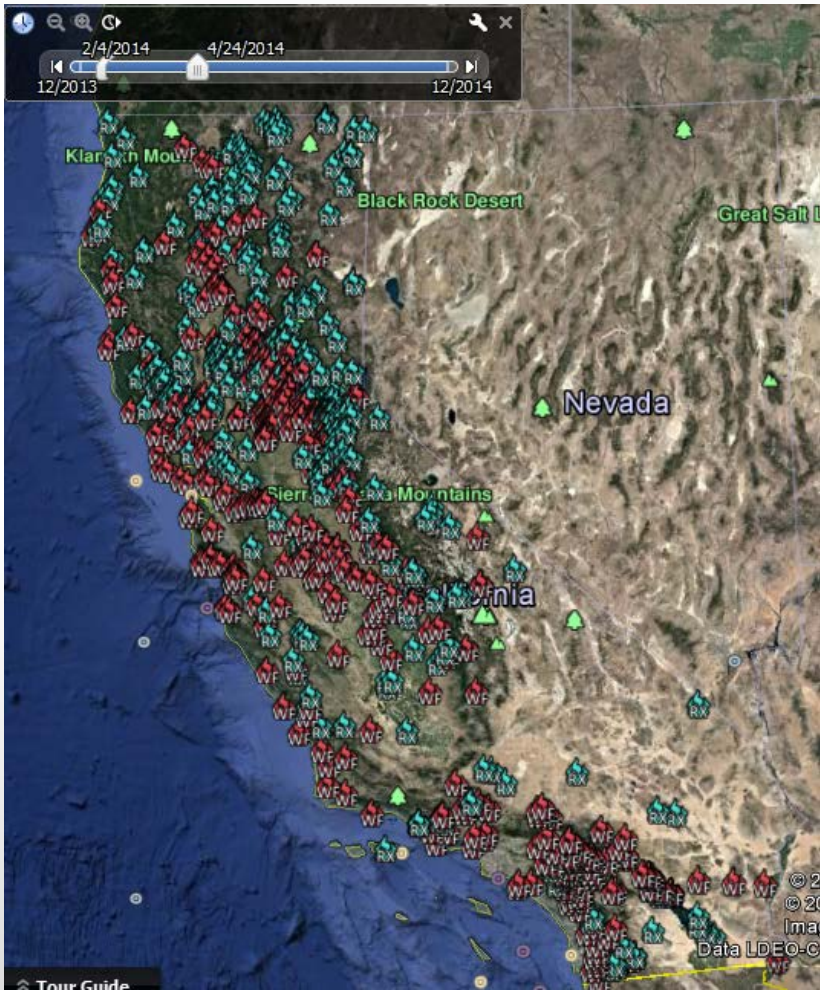
Methods – Improvements from 2011 NEI (1)

- Fire activity data
  - SLT input on data completeness (questionnaire responses) and comments on draft 2014 WLF NEI were used to guide data supplement policies for version 1
- Emission factors (EFs)
  - Updated EFs for HAPs based on Urbanski (2014)* implemented. These EFs were region- and fire type-specific.

*Urbanski S.P. (2014) Wildland fire emissions, carbon, and climate: emissions factors. *Forest Ecology and Management*, 317, 51-60, doi: 10.1016/j.foreco.2013.05.045.

Methods – Improvements from 2011 NEI (2)

- Emissions inventory data
  - Made flaming and smoldering emissions available
  - Documentation, intermediate fire activity and final emission data published on USFS SmartFire Emissions Inventory (SFEI) website for review: http://sfei.sonomatechdata.com/



Results – 2014 WLF NEI v1 (1)

Overall results

	Area Burned		$PM_{2.5}$ Emitted	
	Acres	% of Total	Tons	% of Total
Rx	10,938,214	72%	782,784	47%
WF	4,239,624	28%	875,230	53%
Total	15,177,838	100%	1,658,014	100%

Top 5 states by area burned

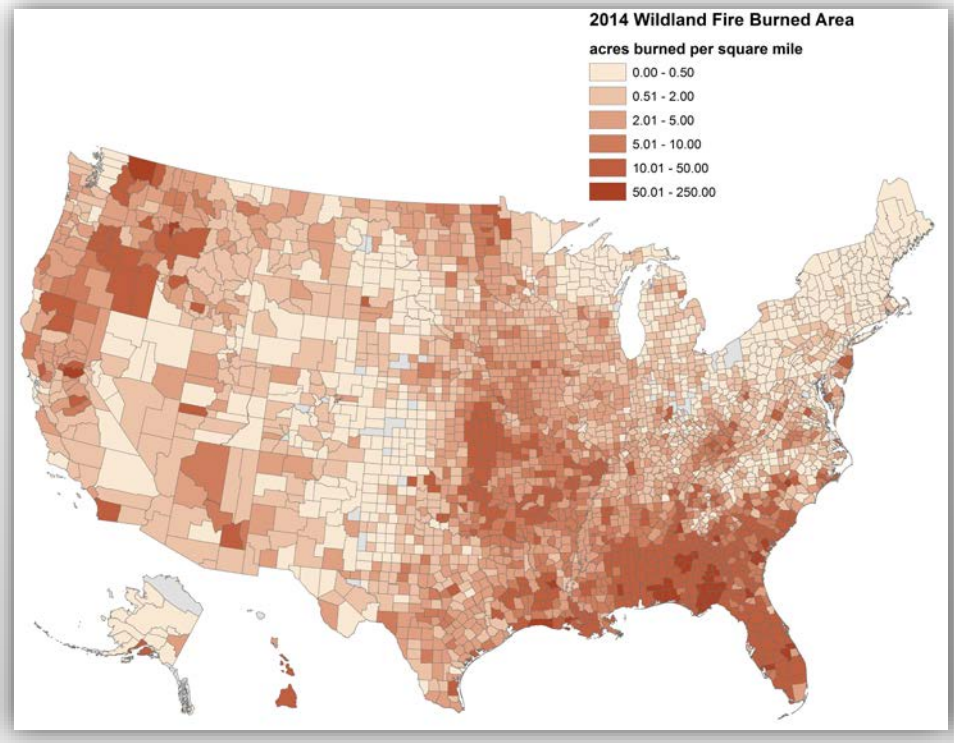
1. Florida
2. Oregon
3. Georgia
4. Alabama
5. Texas

Top 5 states by $PM_{2.5}$ emissions

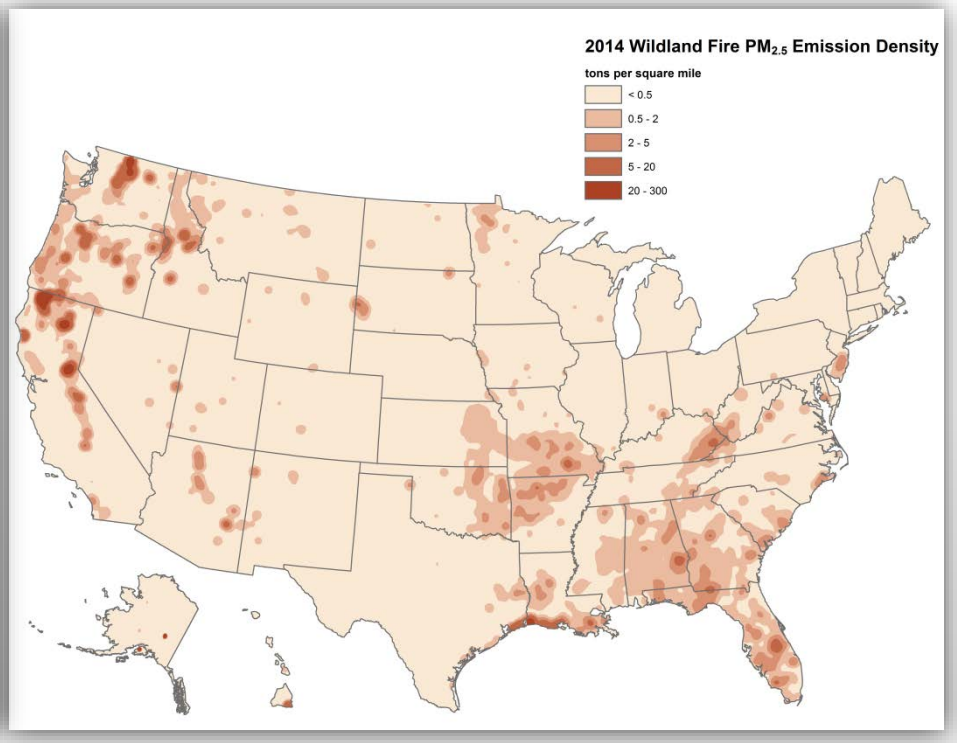
1. California
2. Alaska
3. Oregon
4. Washington
5. Florida

Results – 2014 WLF NEI v1 (2)

Area burned by county

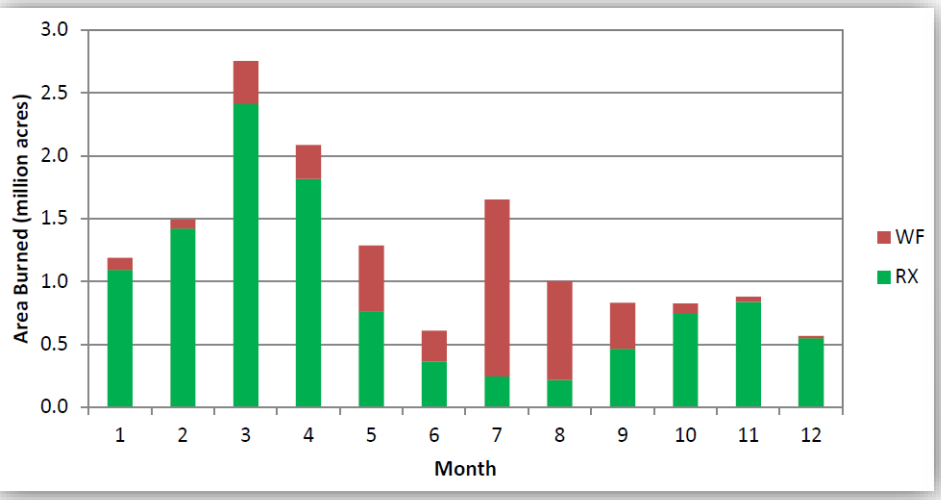


$PM_{2.5}$ emission density

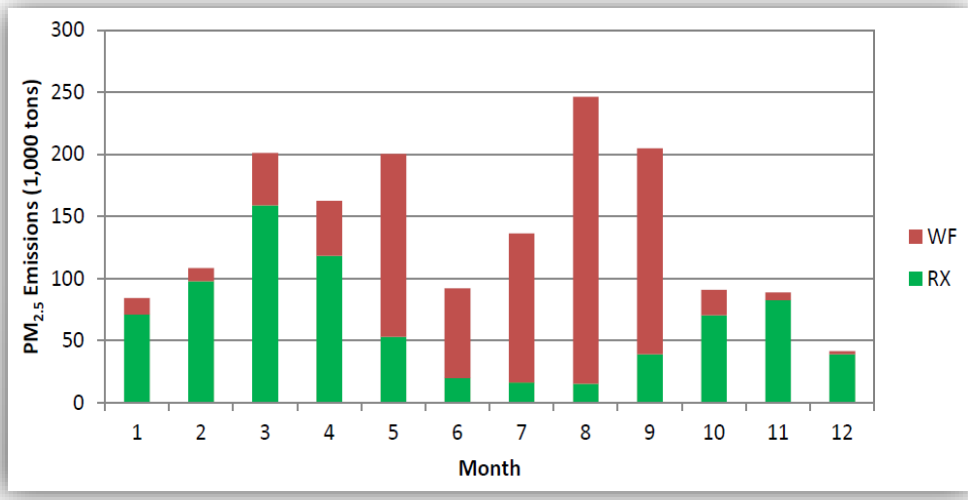


Results – 2014 WLF NEI v1 (3)

Monthly area burned

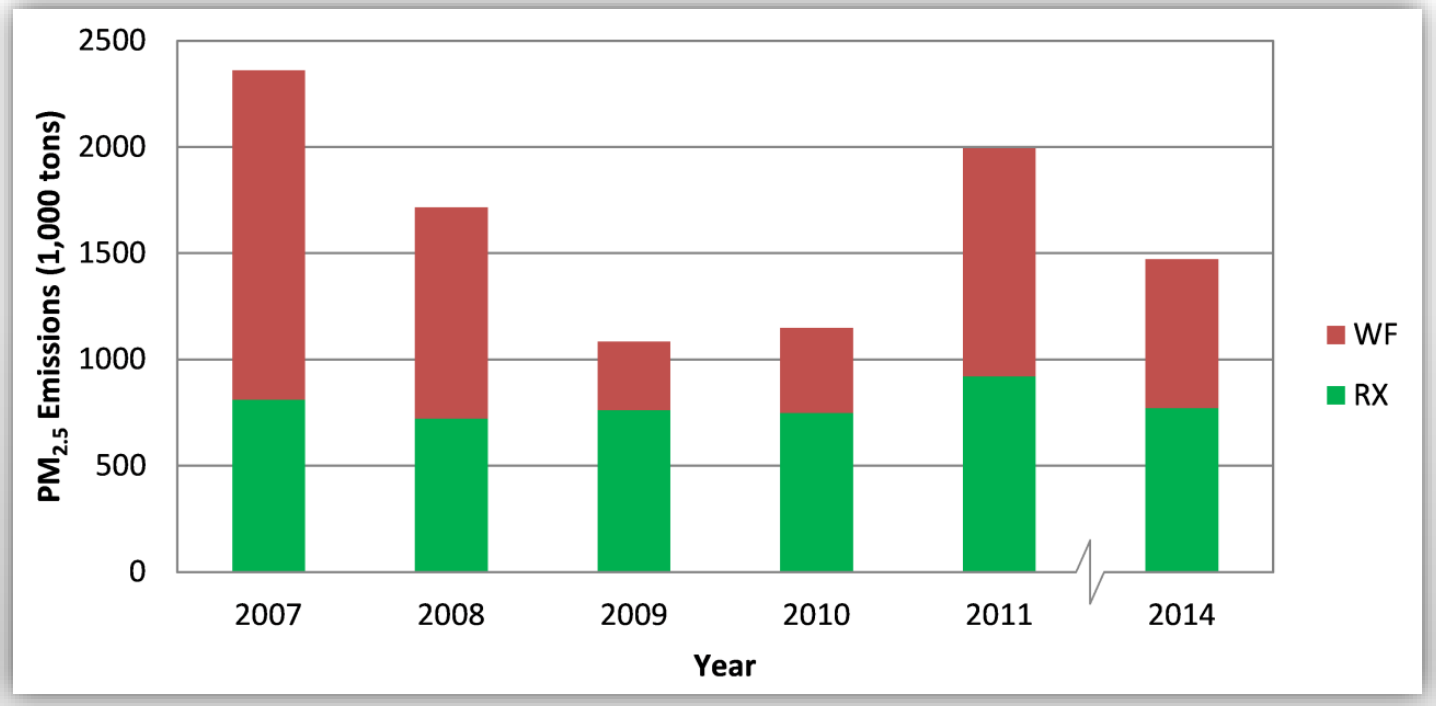


Monthly $PM_{2.5}$ emitted



Results – Comparison (1)

Total $PM_{2.5}$ emissions from wildland fires in the contiguous United States from 2007 to 2011, and 2014, by fire type.



Results – Comparison (2)

Burned area estimates from four fire inventories.

Inventory	Burned Area (Acres)		
	Total	Wildfire	Prescribed Fire
2014 WLF NEI v1	15,177,838	4,239,624	10,938,214
NIFC[1]	–	3,595,613	2,389,798
National Prescribed Fire Use Survey Report[2]	–	–	8,946,900
GFED4.1s[3]	6,483,298	–	–

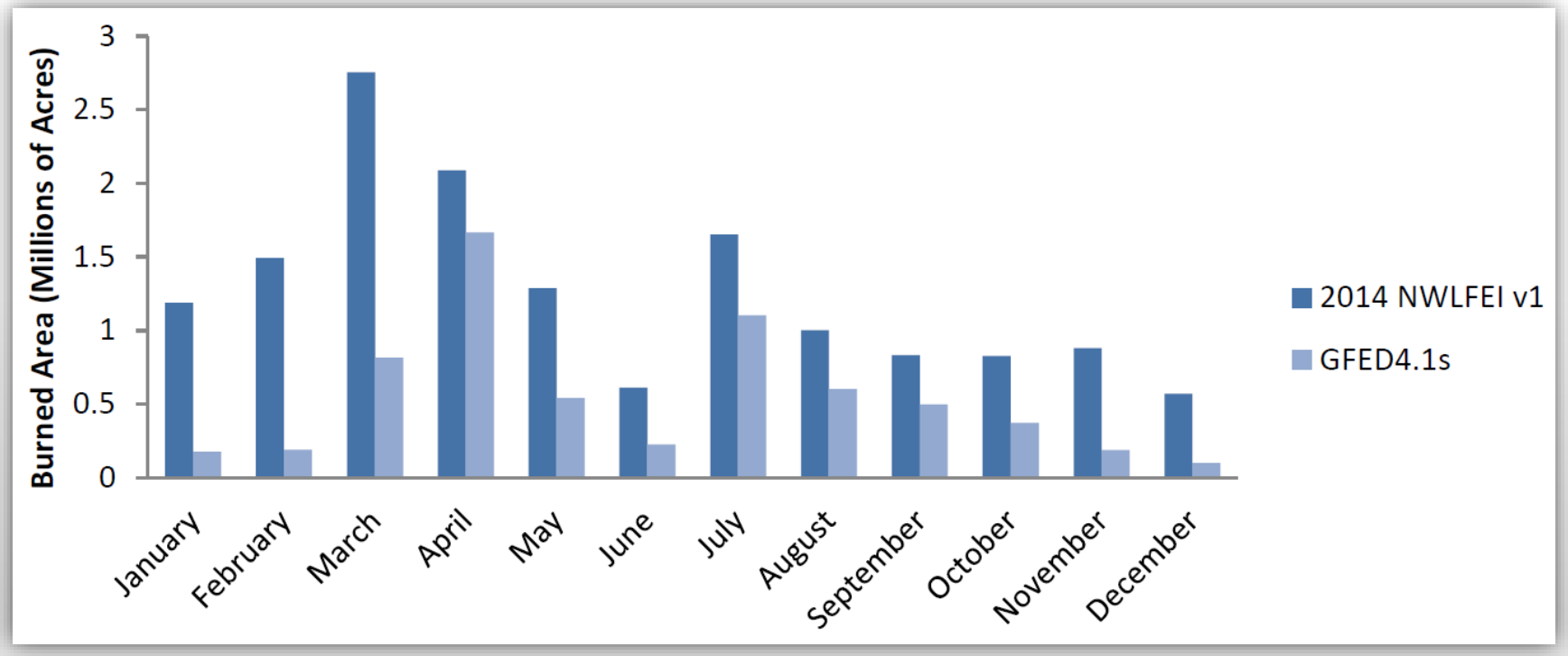
1 http://www.nifc.gov/fireInfo/fireInfo_statistics.html

2 http://www.stateforesters.org/2015-national-prescribed-fire-use-survey-report

3 http://www.globalfiredata.org/

Results – Comparison (3)

Monthly burned area for 2014 from the WLF NEI v1 and the Global Fire Emissions Database v4.1s (GFED4.1s).*



*http://www.globalfiredata.org/

Conclusions

- 2014 WLF NEI v1 is the most comprehensive fire activity database for the U.S.
- Emissions from prescribed fires are much less than those from wildfires per acre burned.
- There are seasonal and geographical differences in area burned and emissions by fire type.
- Our burned area estimates are about 20% higher than estimates in other national statistics.

What's Next

- The 2014 WLF NEI v1 are available on EPA's CHIEF website and the USFS SFEI website for review.
- While not an NEI year, the 2015 WLF emissions inventory was developed for use in modeling and other assessments and is currently under EPA review prior to its release
  - Since 2015 is not an NEI year, the effort did not include collecting SLT fire activity data. Only national data were used.
- A paper for the Journal of the Air & Waste Management Association is currently being written.

Areas of Improvement for the Next NEI Cycle

- Version update for FCCS, CONSUME and FINN – need resources to implement
- Pile burn emissions – need the data and methods
- Emission factor update – new EFs compiled, results under review; need to implement
- New data – assess higher spatially and temporally resolved remote sensing fire detections

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