Status of EPA’s National Emissions Inventory for Wildland Fire

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The views expressed in this presentation are those of the authors and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.
States, locals, and tribal agencies are invited to submit fire occurrence data.

Final data sources include data from 22 states and one Indian Nation.

This data is supplemented with that from:
- National Association of State Foresters wildfire (WF) data
- NOAA's Hazard Mapping System data
- Incident Status Summary (ICS-209) data
- Geospatial Multi-Agency Coordination (GeoMAC) fire perimeter data
- USDA Forest Service Activity Tracking System (FACTS) Prescribed (Rx) fire perimeter data
- U.S. Fish and Wildlife Service data
- U.S. Department of Interior Rx data

FETS = Fire Emissions Tracking System from Western Regional Air partnership that includes many western states.
For fires in the contiguous United States and Alaska, the BlueSky framework is used to estimate smoke emissions.
Changes in the 2014 Wildland Fire NEI

• Improved fire activity data
  – States, locals, and tribal agencies provided input on data completeness (questionnaire responses) and comments on draft 2014 WLF NEI were used to guide data supplement policies for final WLF NEI

• Improved Emission factors (EFs)
  – Updated EFs for hazardous pollutants HAPs based on Urbanski (2014) implemented. These EFs are region- and fire type-specific.

• Estimating flaming and smoldering emissions separately


For fires in the contiguous United States and Alaska, the BlueSky framework is used to estimate smoke emissions. The source of emission factors is not transparent.

Elements emitted:
- Elemental Carbon (EC)
- Organic Carbon (OC)
- \( \text{SO}_4 \)
- \( \text{NO}_3 \)
For fires in the contiguous United States and Alaska, the BlueSky framework is used to estimate smoke emissions. The source of emission factors is not transparent, and SPECIATE wildfire PM profiles are inappropriate for these purposes. Elements such as Elemental Carbon (EC), Organic Carbon (OC), SO$_4$, and NO$_3$ are considered in the emission modeling process.
NEI Wildland Fire Emissions – Data Systems/Models

For fires in the contiguous United States and Alaska, the BlueSky framework is used to estimate smoke emissions. The source of emission factors is not transparent; SPECIATE wildfire PM profiles are inappropriate. Scant data for flaming/smoldering profiles of questionable quality.
Experimental Methods: Field Measurements

‘Flyer’ sampler package mounted to the roof of an ATV. Maneuver sampler into the plume and target different types of combustion (back burn, heading fire, residual smolder)

Flyer Measurements:

• $\text{CO}_2$, CO sensors
• PM light scatter
• Black carbon
• PM2.5 Teflon & Quartz filters
Experimental Methods: Laboratory Measurements

Open burn test facility (burn hut) = 60 m³ cinder block room, clad with stainless steel

1 m² burn pan on top of an electronic balance

- **Teflon Filters**: Gravimetric, ION Chromatography, XRF, ICP-MS
- **Quartz Filters**: Thermal optical analysis (IMPROVE protocol)
- **Summa Cannisters**: EPA TO-15
- **DNPH Cartridges**: EPA TO-11A
Fuel Source Regions

Sycan Marsh, OR
Grass fire
Lodgepole/Ponderosa pine litter
October 2017

Flint Hills, KS
Tallgrass Prairie fires
November 2017

RTP, NC
Southeastern forest litter
Spring 2016, Fall 2017

Source: A US national fuels database and map for calculating carbon emissions from wildland and prescribed fire, Proceedings of the 4th Fire Behavior and Fuels Conference 2013
Case Study – SE United States: Emission Factors

Southeastern U.S.: Alabama, Georgia, Florida, North Carolina, South Carolina

- NEI 2014 uses FEPS emission factors for flaming and smoldering
- Our lab flaming emission factor is 1.5 x FEPS
- Our lab smoldering emission factor is 2.4 x FEPS
- Previous measurements of Rx fires by Aurell et al. are comparable to our lab emission factors:

<table>
<thead>
<tr>
<th>Fire Location</th>
<th>Emission Factor</th>
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<tbody>
<tr>
<td>FL</td>
<td>13.5 ± 0.7</td>
</tr>
<tr>
<td>NC</td>
<td>22.7 ± 11.2</td>
</tr>
<tr>
<td>SC</td>
<td>46.5 ± 18.0</td>
</tr>
</tbody>
</table>

Case Study – SE United States: PM Composition

• Wildfire profile (WF) included some pile burns and fence posts, which may account for the higher elemental carbon and inorganic fractions.

• Working to add more profiles to cover other regions of the U.S.
Case Study – SE United States: Potential impact on inventory

<table>
<thead>
<tr>
<th>Total SE U.S. PM2.5 Emissions (tons)</th>
<th>Wildfire PM2.5 Emissions (tons)</th>
<th>Prescribed Fire PM2.5 Emissions (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEI 2014 258,765</td>
<td>Case Study 512,685</td>
<td>NEI 2014 21,192</td>
</tr>
<tr>
<td>258,765</td>
<td></td>
<td>Case Study 43,634</td>
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<tr>
<td></td>
<td></td>
<td>NEI 2014 237,574</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case Study 469,051</td>
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</tbody>
</table>

Note: NEI 2014 uses FEPS emission factors and Reff et al. 2009 PM speciation. Potential impact data shown here is only a back of the envelope estimate of the potential impact of modifying the emission factors and speciation profile based on our research effort.
Next Steps

- Complete laboratory analyses of PM samples
- Complete data analysis of PM, VOC, FTIR, aldehyde, and NH$_3$ samples
- Generate PM & VOC Speciation profiles for field and lab data
- Extract filters for toxicological assays
- Work with USFS to get consideration of our emission factors for use in the BlueSky Framework
- Open to collaborations and input from USFS, states, locals, tribes, et al. to create most robust EF and profile dataset to draw upon
- Publish results

Future Experimental Work

- Burn Minnesota forest litter and peat in the lab (June 2018)
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