Emissions Modeling Perspectives on Fires

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Outline of Topics

- Different fire inventories have different emissions
- Summary of Emissions Modeling Process
- What fires would be within our typical modeling domain?
- What should we do when fires are at a similar scale as our grid cells?
- Temporal Allocation of Fires
- Characterization of multi-day fires
- Speciation of Fires
- Plume rise for Fires
- Representing fires in regulatory modeling / projections

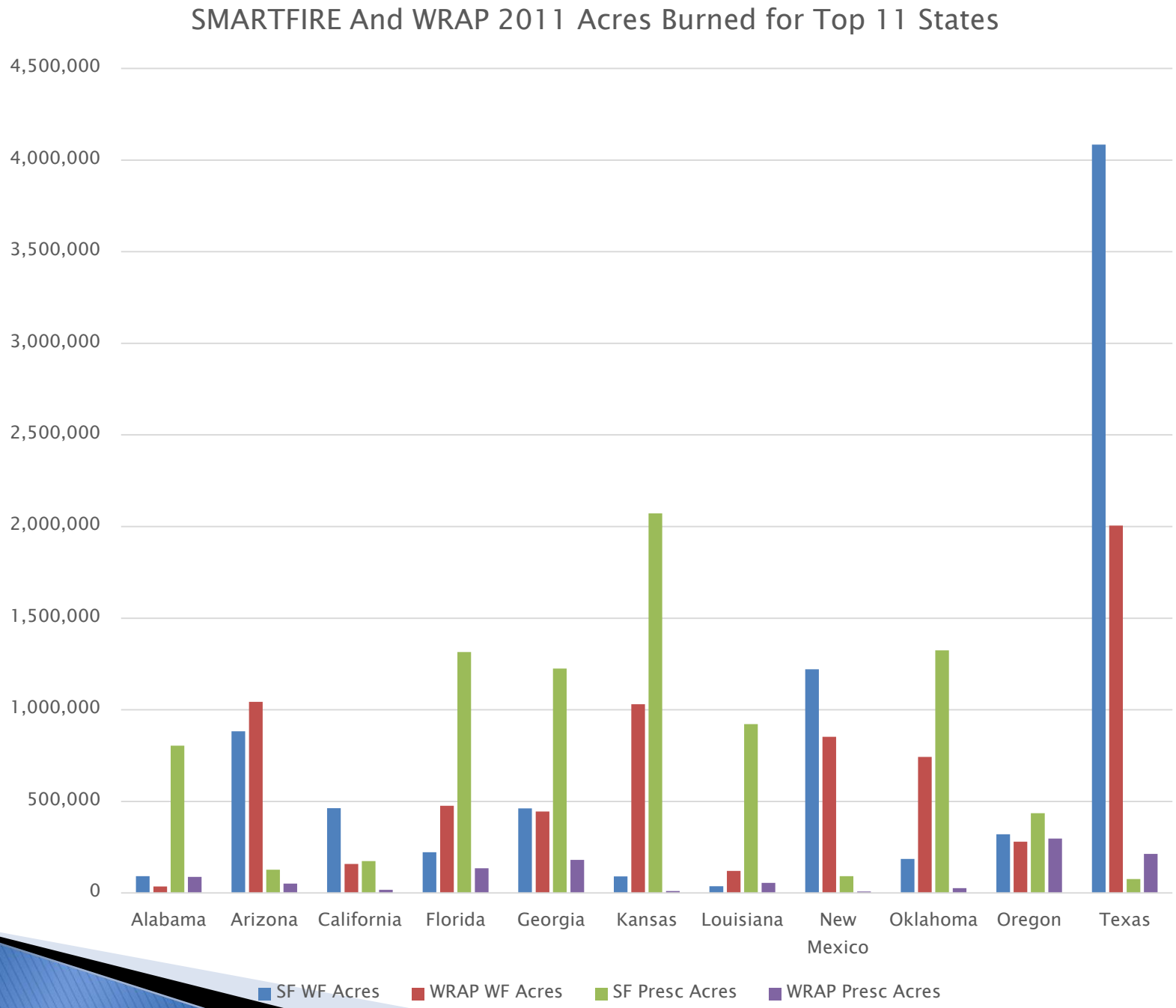
Inventories for Modeling

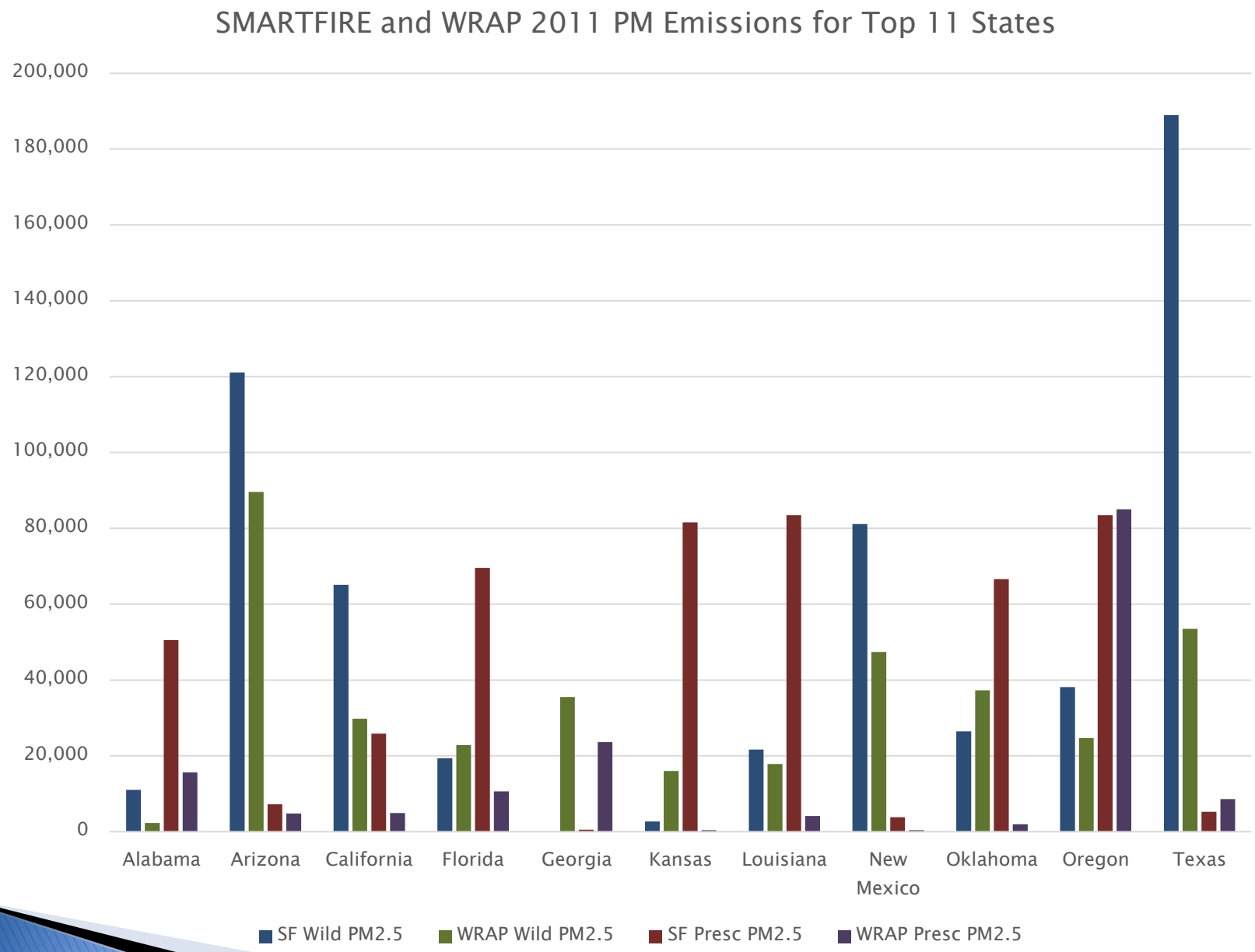
- Inventories exist for same time / location, e.g.:
  - SMARTFIRE 2011 used in NEI
  - WRAP 2011 used in some western modeling

	SF Wild	WRAP Wild	SF Prescribed	WRAP Prescribed	SF TOTAL	WRAP Total
Acres	10,160,439	8,751,863	12,507,865	1,601,822	22,668,304	10,353,684
PM 2.5	1,002,038	825,292	870,770	257,889	1,872,808	1,083,180
PM/ acre	0.099	0.094	0.070	0.161	0.083	0.105

Inventories for Modeling

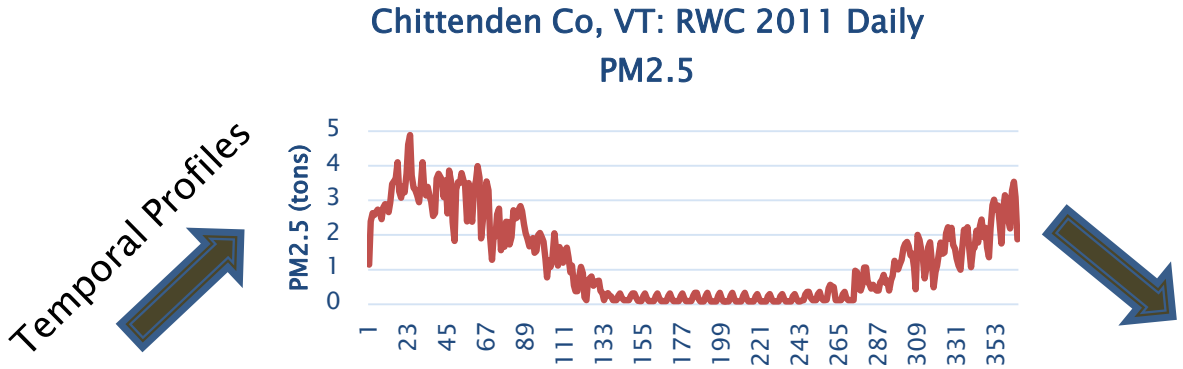
- The inventories have different emissions – why?
  - Activity data differs
    - Q: Is National Interagency Fire Center (NIFC) data suitable for our modeling inputs?
    - NIFC 2011: 8,711,367 acres wild, 2,112,811 acres prescribed (includes AK,HI, PR)
  - Methods used to split fires into wild, prescribed, ag.
  - Land cover data / fuel loading factors
  - Emission factors for each type of fire
  - Fire size assumptions from satellite detects
  - Representation of multi-day fires
  - Flaming vs smoldering treatment
- How do we decide which estimates are best?
- How do we build the NEI / work with states?


SMARTFIRE And WRAP 2011 Acres Burned for Top 11 States
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Alabama
Arizona
California
Florida
Georgia
Kansas
Louisiana
New Mexico
Oklahoma
Oregon
Texas
SF WF Acres
WRAP WF Acres
SF Presc Acres
WRAP Presc Acres


SMARTFIRE and WRAP 2011 PM Emissions for Top 11 States
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Alabama
Arizona
California
Florida
Georgia
Kansas
Louisiana
New Mexico
Oklahoma
Oregon
Texas
SF Wild PM2.5
WRAP Wild PM2.5
SF Presc PM2.5
WRAP Presc PM2.5

Emissions Modeling Process

- Steps needed to convert emissions inventories into the resolution and formats needed by air quality models.

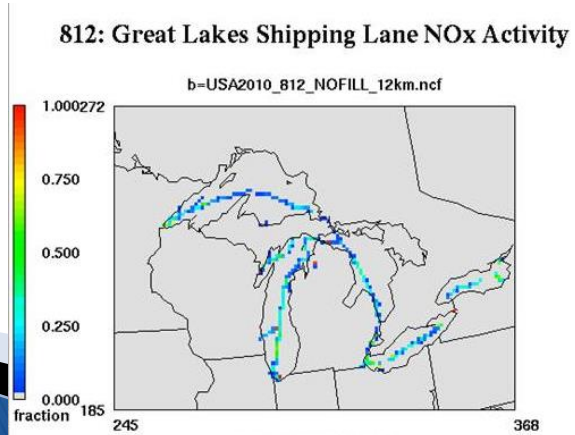


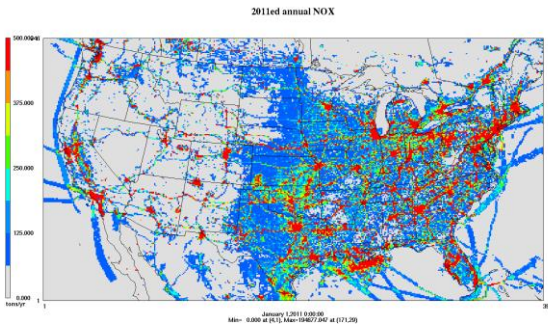
Temporal Profiles

Inventories (annual/ monthly/daily)

Speciation Profiles

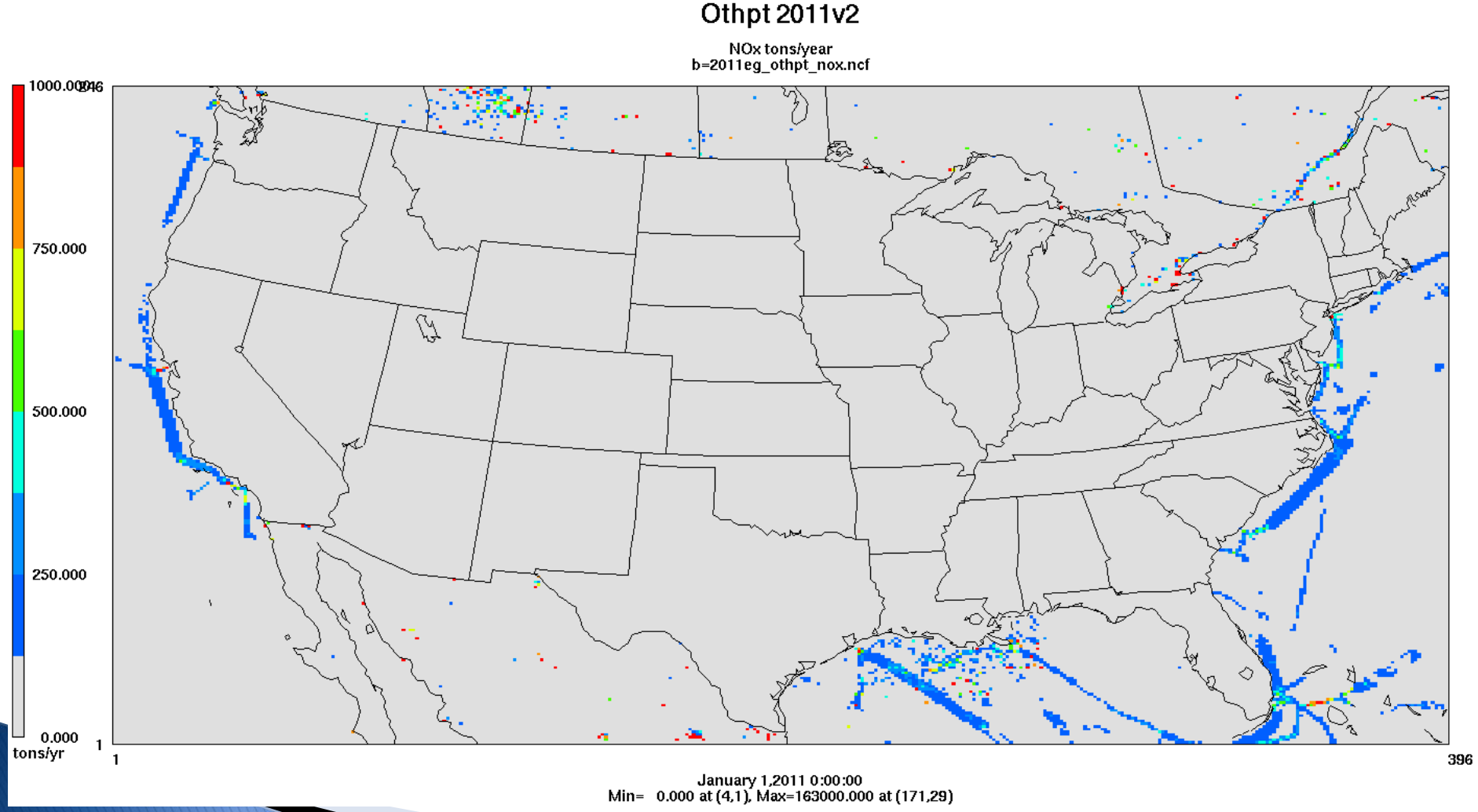
Spatial Surrogates





Gridded, hourly, speciated emissions for air quality modeling

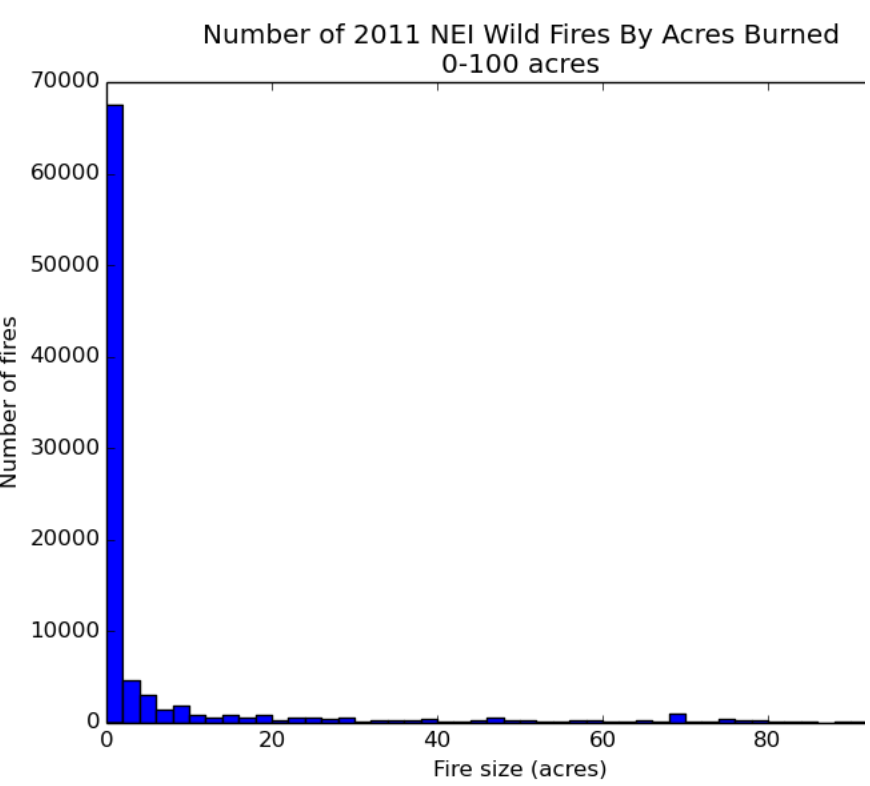
2011v2 Platform Non-Continental U.S. Point Source NOx

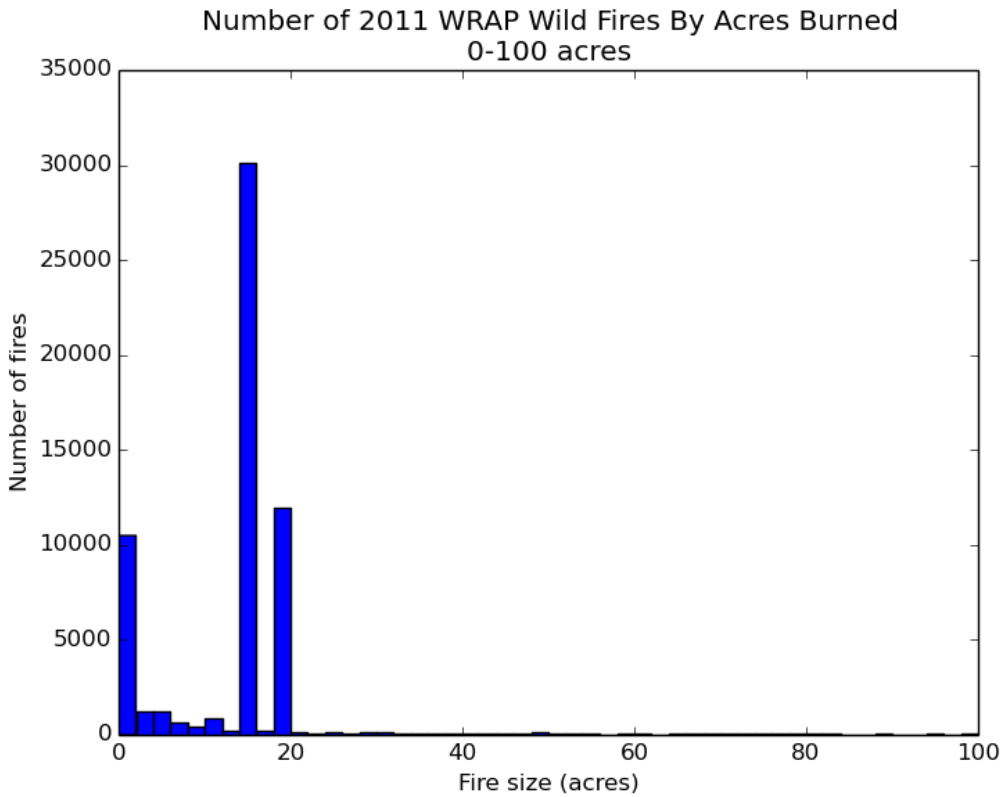


Fire Sizes in Comparison to Grid Cell Sizes

- EPA inventory assumes fires are point sources
  - Works OK for small fires and most are small
- Different inventories have different fire sizes
  - WRAP fires tend to be bigger on average even though total acres burned is less
- What should we do when the size of a fire approaches the size of a grid cell?
  - One half of one 12 km grid cell is about 17,800 acres
  - 2011 NEI has 25 fires larger than this, with the largest being about the size of four grid cells
  - WRAP inventory has 64 fires larger than this
  - Should we overlay a box/circle on the fire to allocate to multiple grid cells? [consider 12km vs 4km modeling]

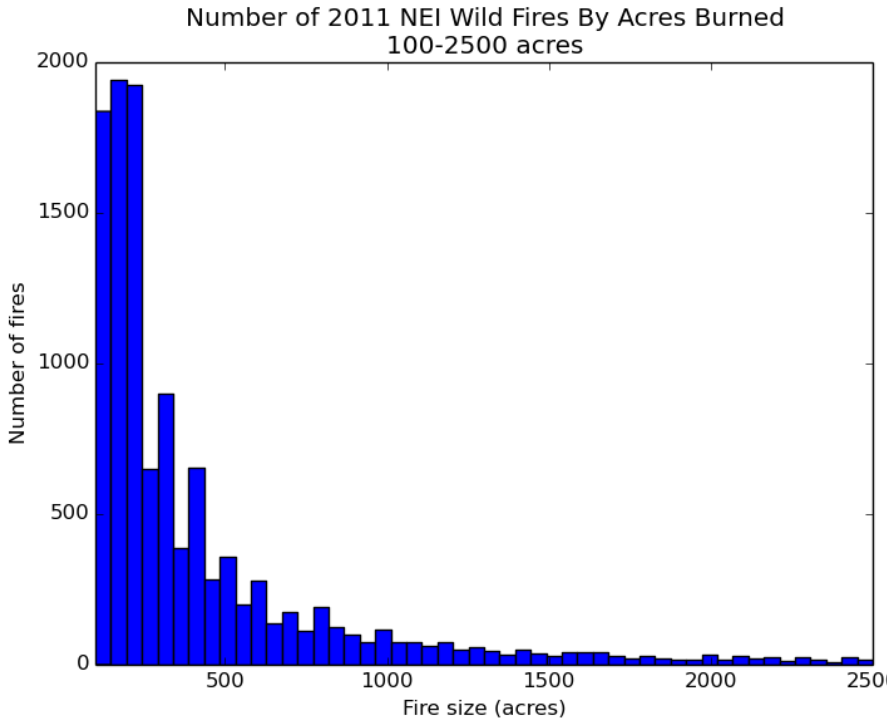
Small Fires (< 100 acres)

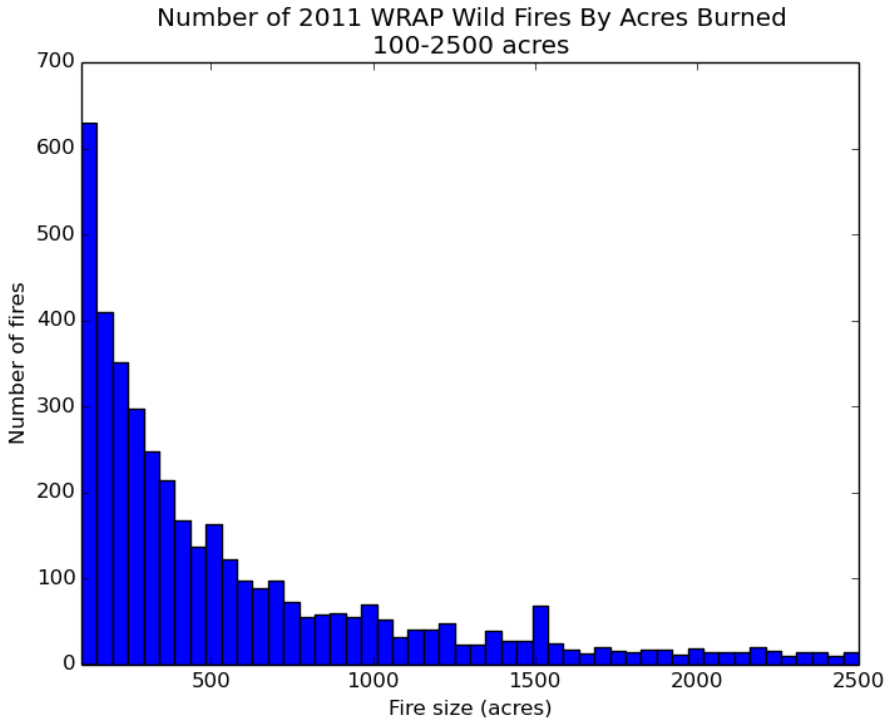




Note: most fires are small – NEI scale is 70,000, WRAP is 35,000

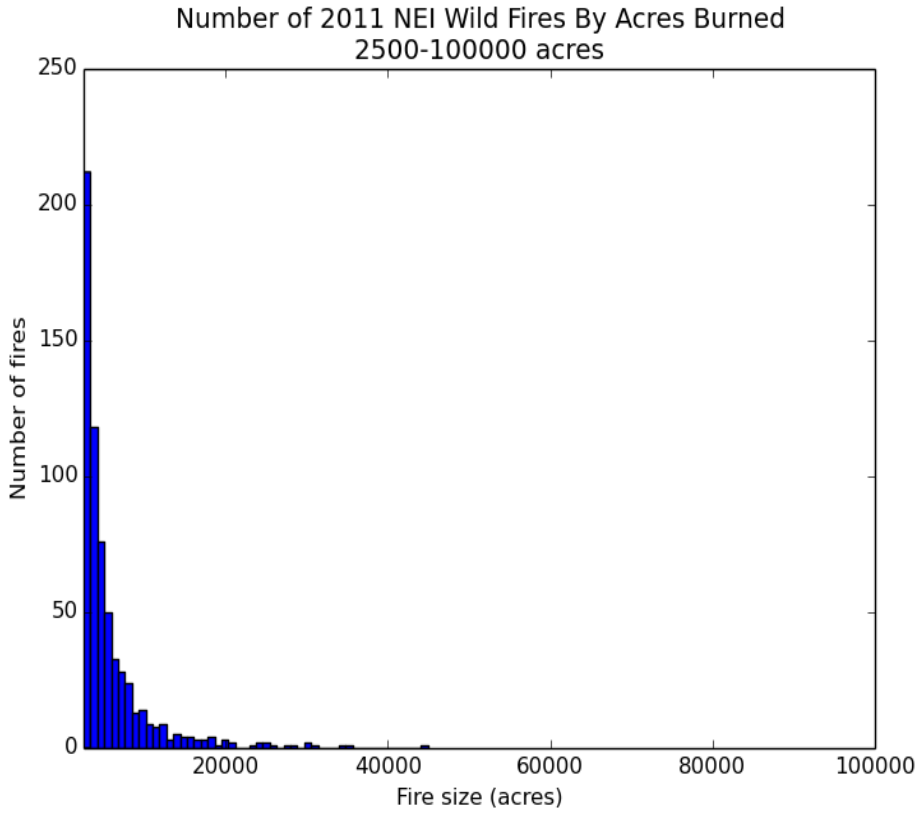
Medium Size Fires (100-2500 acres)

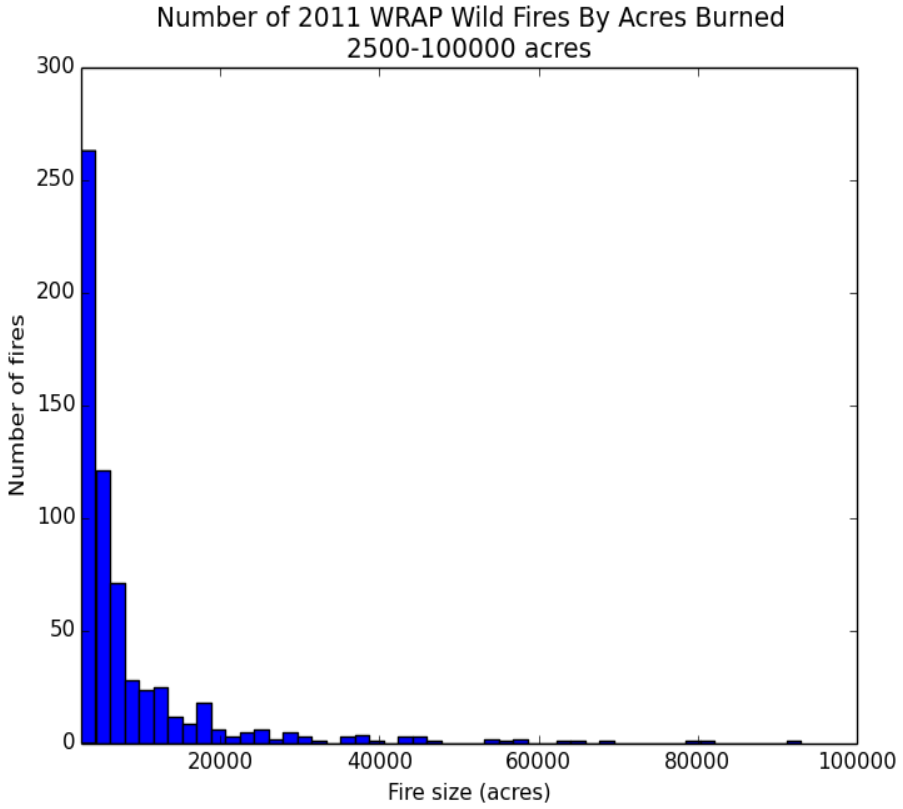




Shape of distribution is similar, but NEI has more fires

Large Fires > 2500 acres





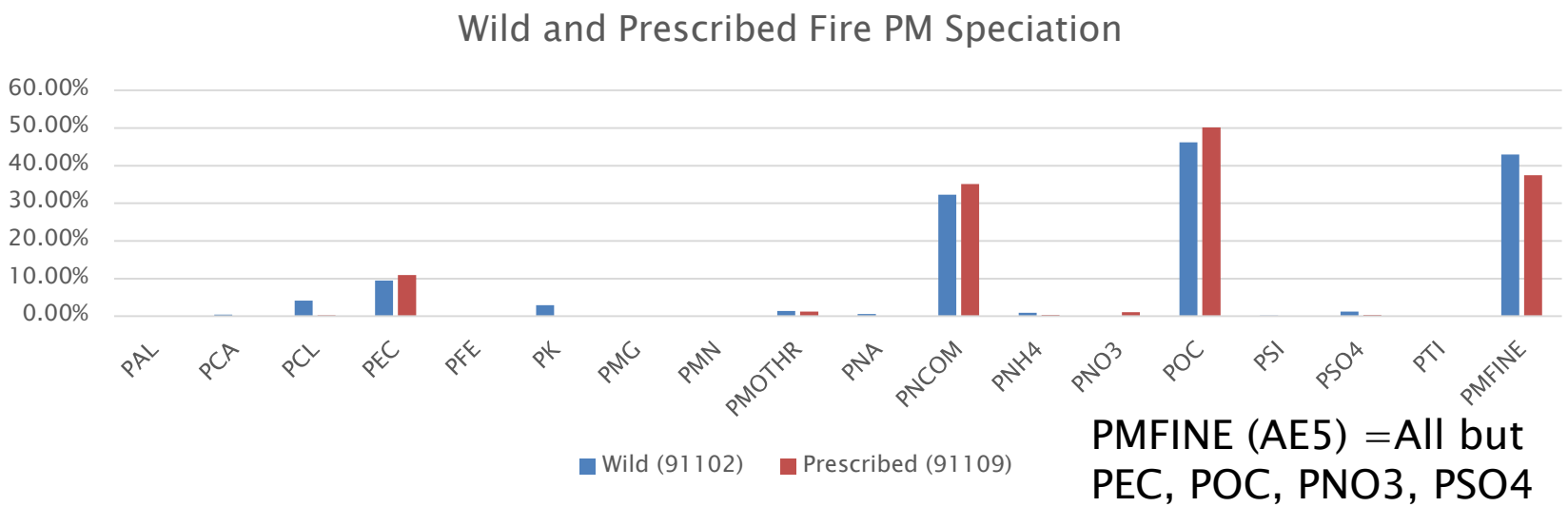
WRAP inventory has more large fires than NEI
* note one very large NEI fire is > 100,000 acres

Fire Diurnal Temporal Profiles

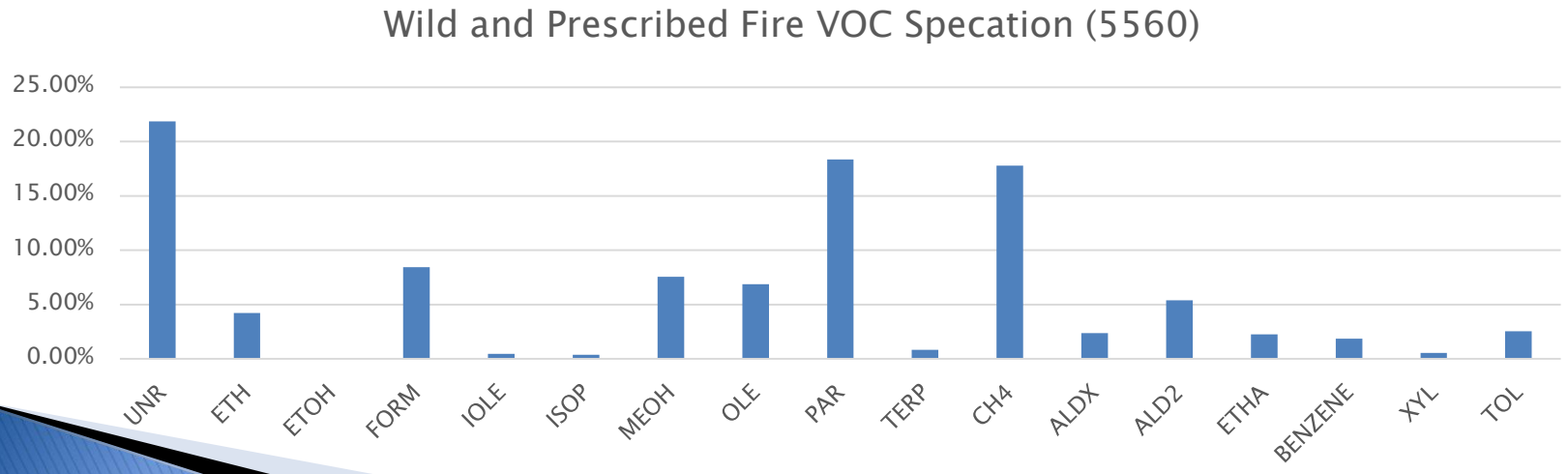
- Both inventories give fire emissions for each day
- Methods for accounting for multi-day fires could differ
- NEI has different temporal profiles (to create hourly emissions) by fire type (i.e., wild, prescribed), and by state

TBD: plots of fire temporal profiles

Speciation Profiles for Fires



PMFINE (AE5) =All but PEC, POC, PNO3, PSO4



Plume Rise for Fires

- WRAP fires have plume centerline, plume bottom and plume top
- CMAQ and SMOKE compute fire plume rise from acres burned and heat flux
  - Uses Briggs algorithm modified for fires
  - Acres burned is submitted to NEI
  - Heat flux not always available in inventories – will be required in 2014
- Should plume rises differ for different fire types? (e.g., wild, prescribed, flaming, smoldering)

Fires in Regulatory Applications

- Before 2011 platform, we used average fires for regulatory assessments and actual year fires for model evaluation cases
  - This is more expensive and sometimes confusing
  - Average fires are “made up” and subject to lots of uncertainties
- 2011 platform uses actual fires for regulatory assessments
  - It was a representation of conditions that actually happened
  - This allows us to consider areas unusually impacted by fires during specific episodes and exclude as needed
- Comments ask for fires to be used in both ways