What brings smoke from prescribed fires into town?
A meteorological analysis of smoke intrusions into Bend, Oregon

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for the greatest good

Objectives:

- Investigate meteorological conditions that transport smoke into Bend, Oregon
- Increase the pace and scale of treatments while protecting air quality in nearby communities
- Understand smoke dispersion model performance

Prescribed fires

- Improve forest health and create a diversity of plant and wildlife habitat
- Reduce severity of wildfires
- Long-term cost effectiveness compared to repeated thinning and mechanical treatments
- Moderate weather conditions for desired fire behavior

Resource Objective

- Reduce fire hazard
- Enhance palatable forage for mule deer

Prescribed Fire Objective

- Reduce 1 hr fuels by 70-90%
- Reduce 10 hr and 100 hr fuels by 30-60%
- Reduce 1000 hr fuels by 10-30%
- Keep mature tree mortality to less than 10%

Fire Effects

- Fuel consumption
- Tree mortality
- Soil heating
- Smoke production

Fire Behavior

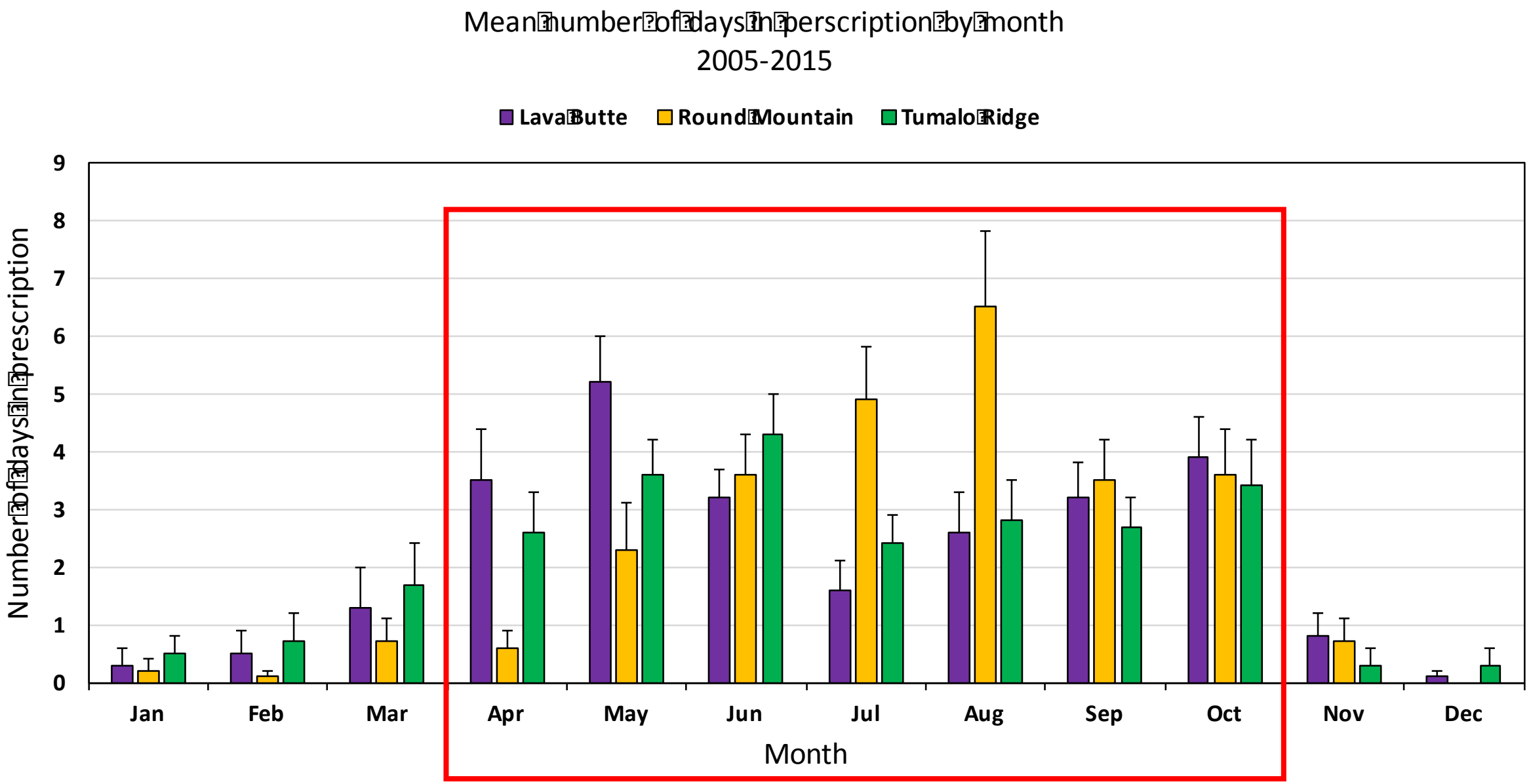
- Flame length
- Rate of spread
- Fire intensity

Prescription Parameters

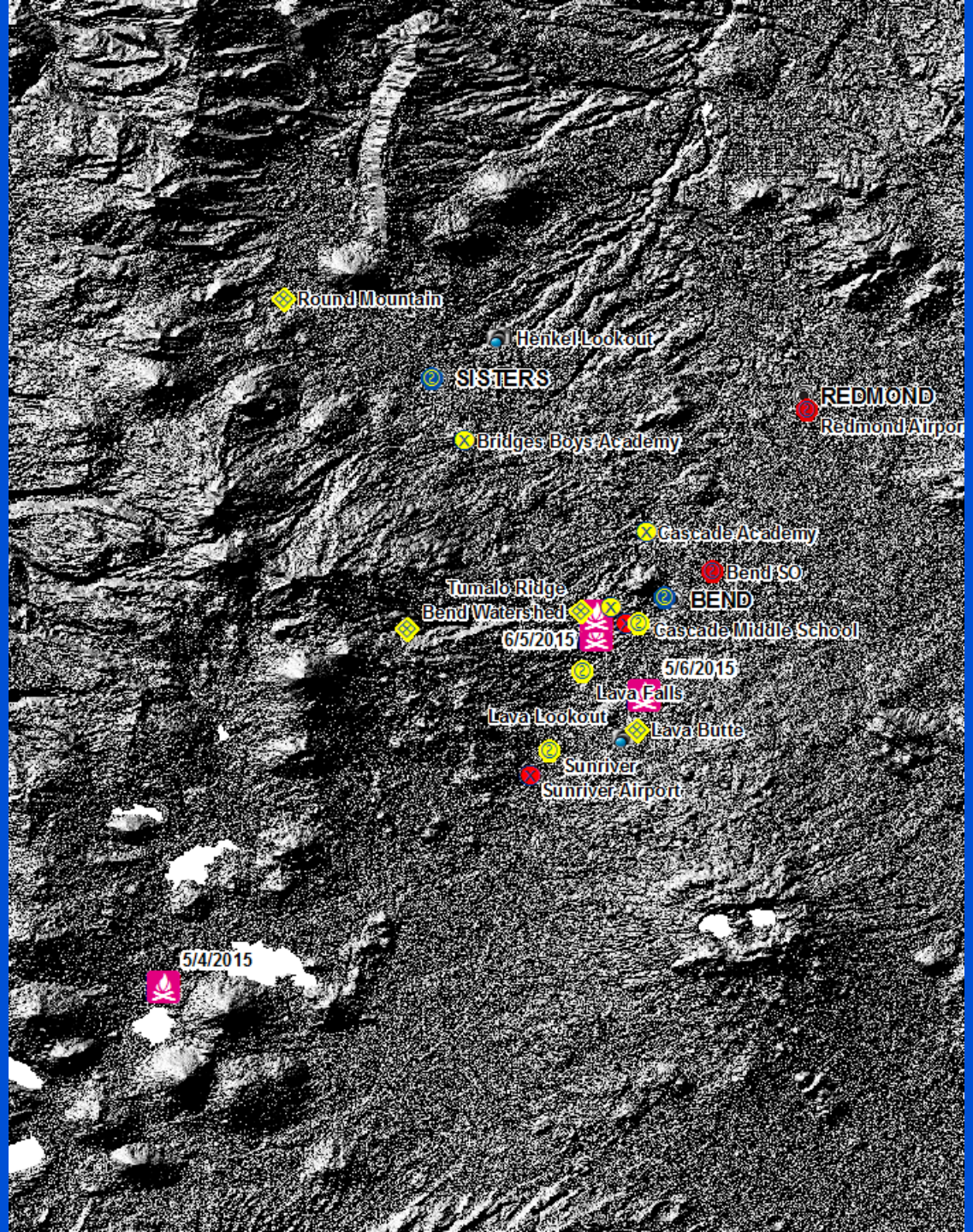
- Meteorological parameters
- Fuel moisture parameters

Meteorological and Fuel Moisture Parameters

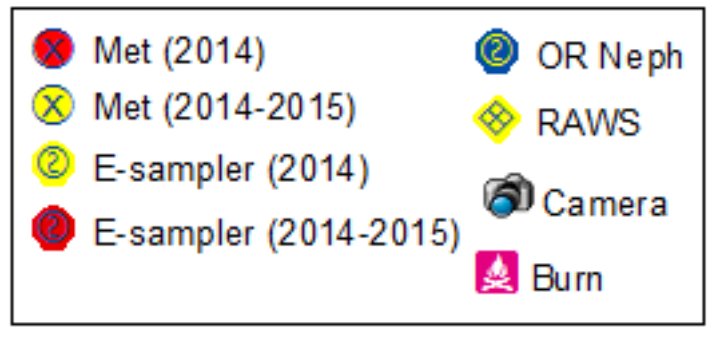
Prescription values	Low	High
Air Temperature (°F)	40	80
Relative Humidity (%)	20	40
Mid-flame Wind Speed (mph)	0	8
1-hr Fuel Moisture (%)	5	10
10-hr Fuel Moisture (%)	6	12
100-hr Fuel Moisture (%)	7	14

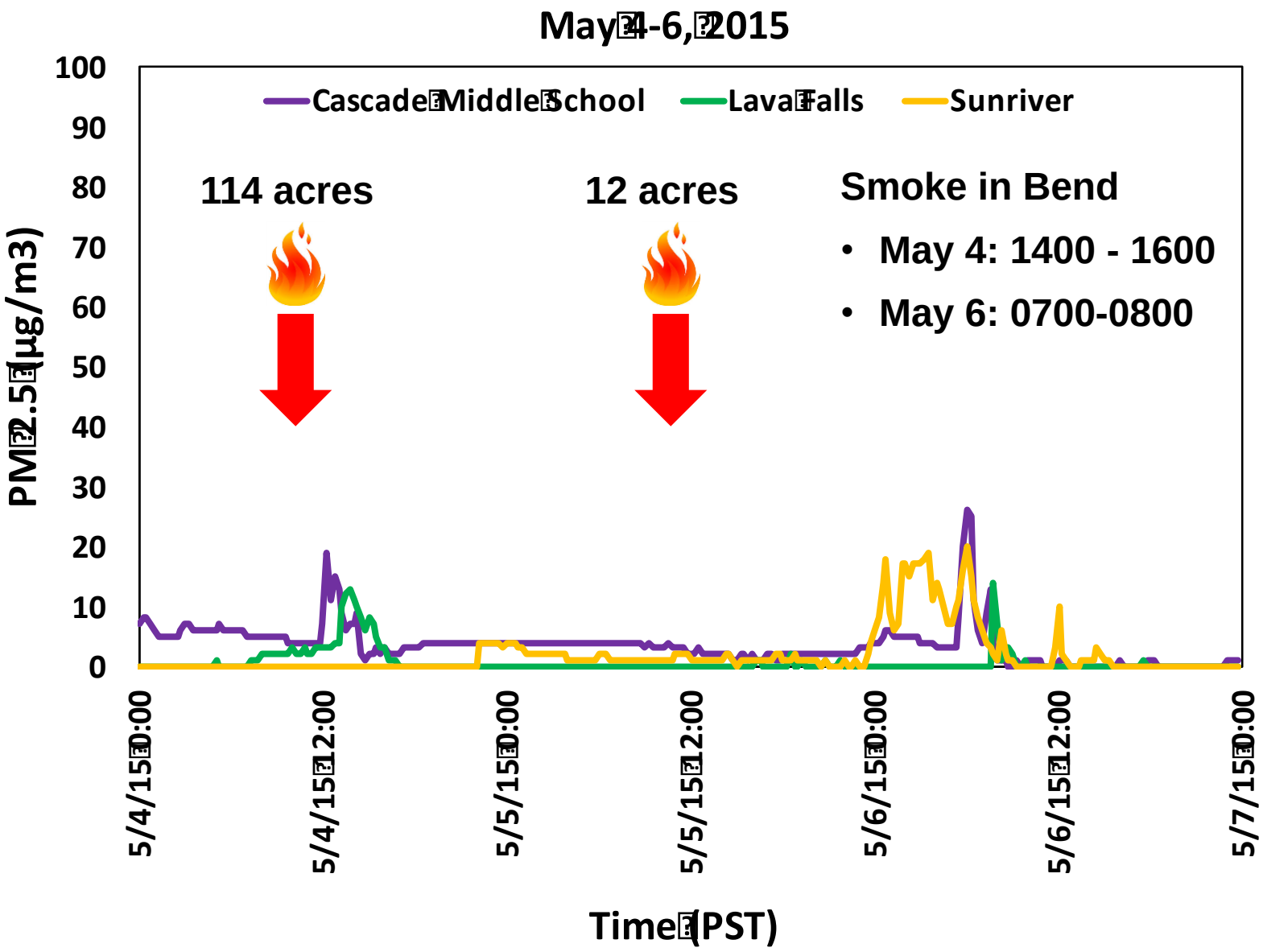


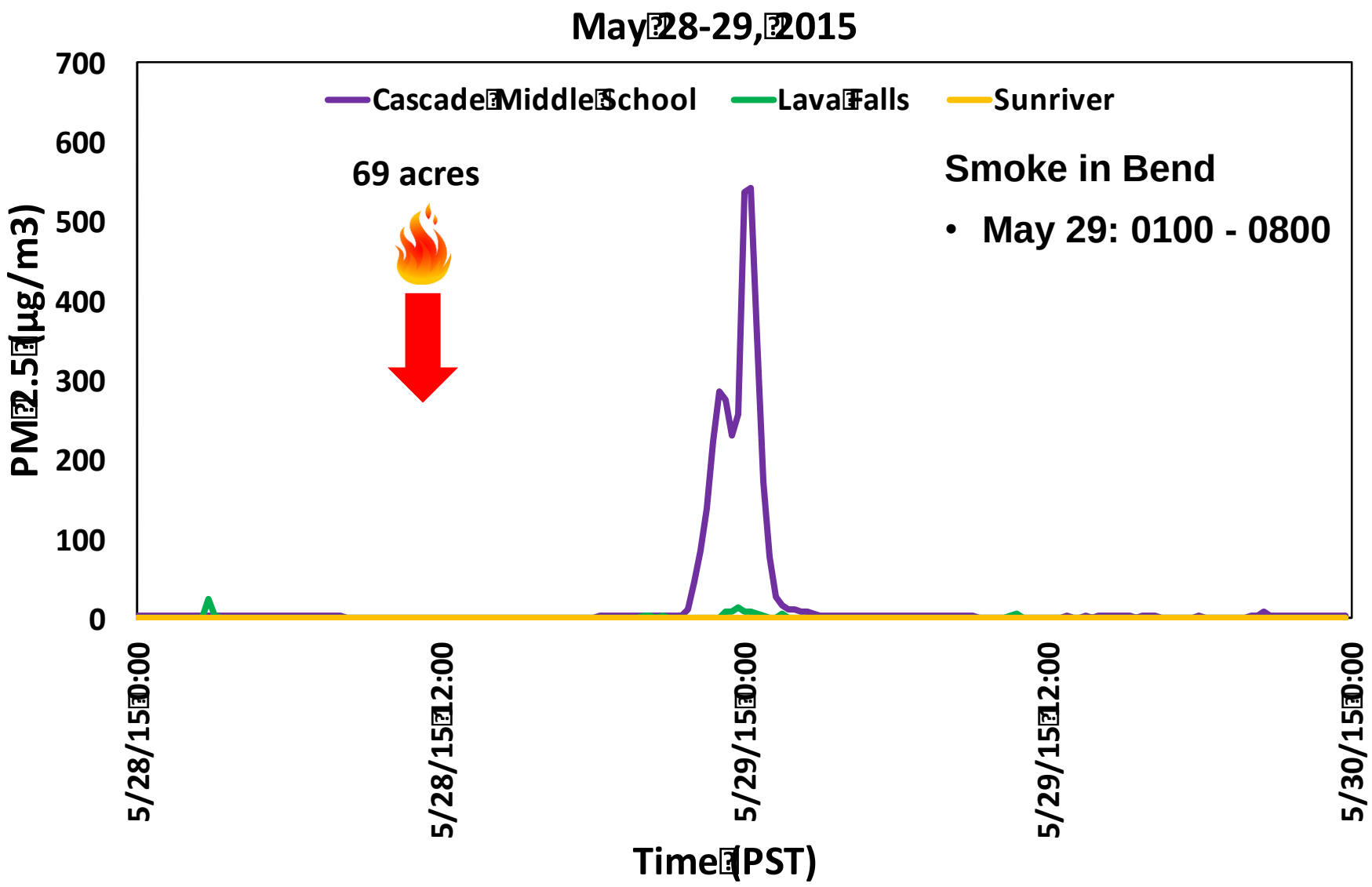
*** Before smoke management considerations**

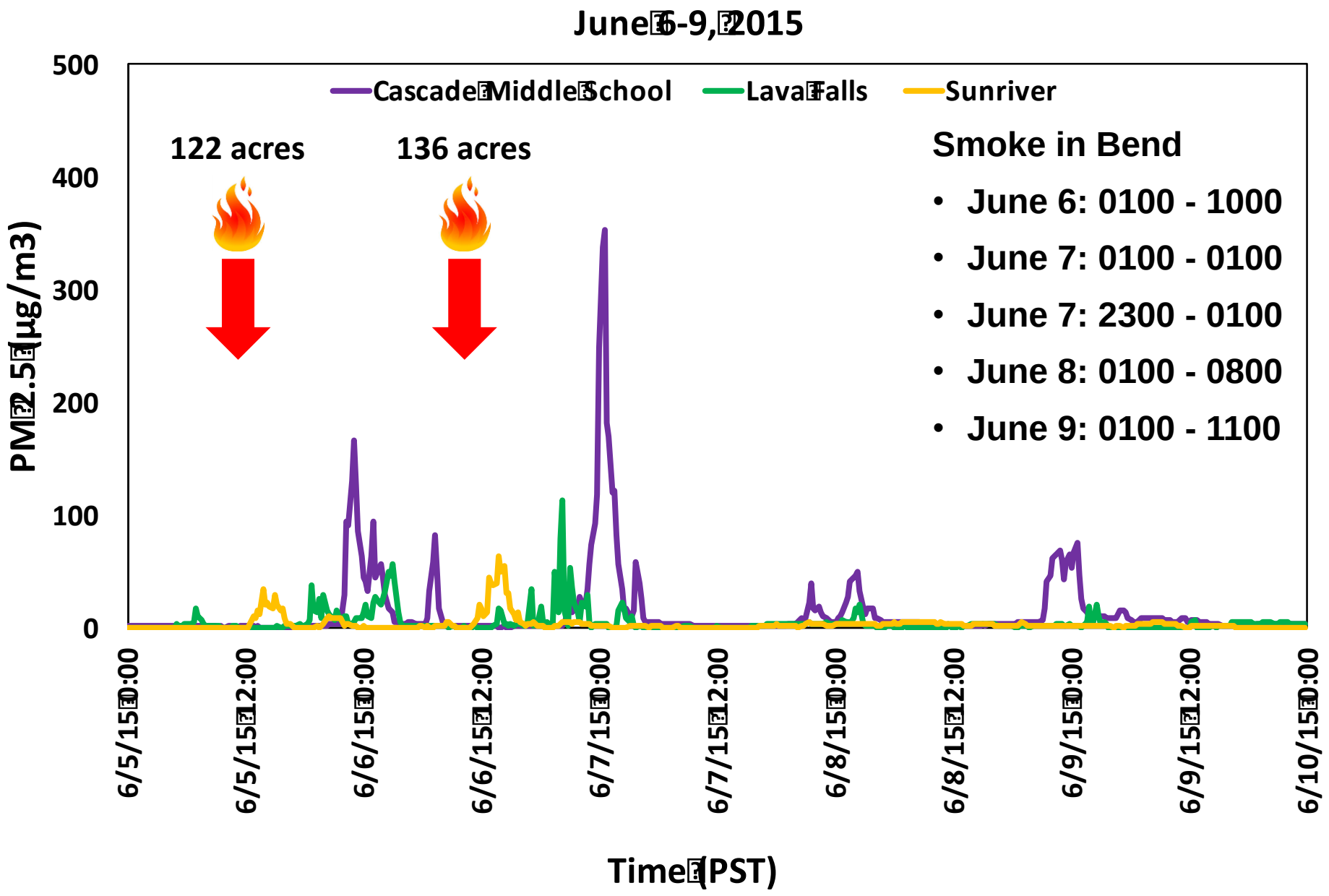


- **Field Work**
  - **Fall 2014**
  - **Spring 2015**
- **Monitors**
  - **Meteorological Stations**
  - **E-Samplers (PM2.5)**
- **Modeling**
  - **1km**
  - **4km**

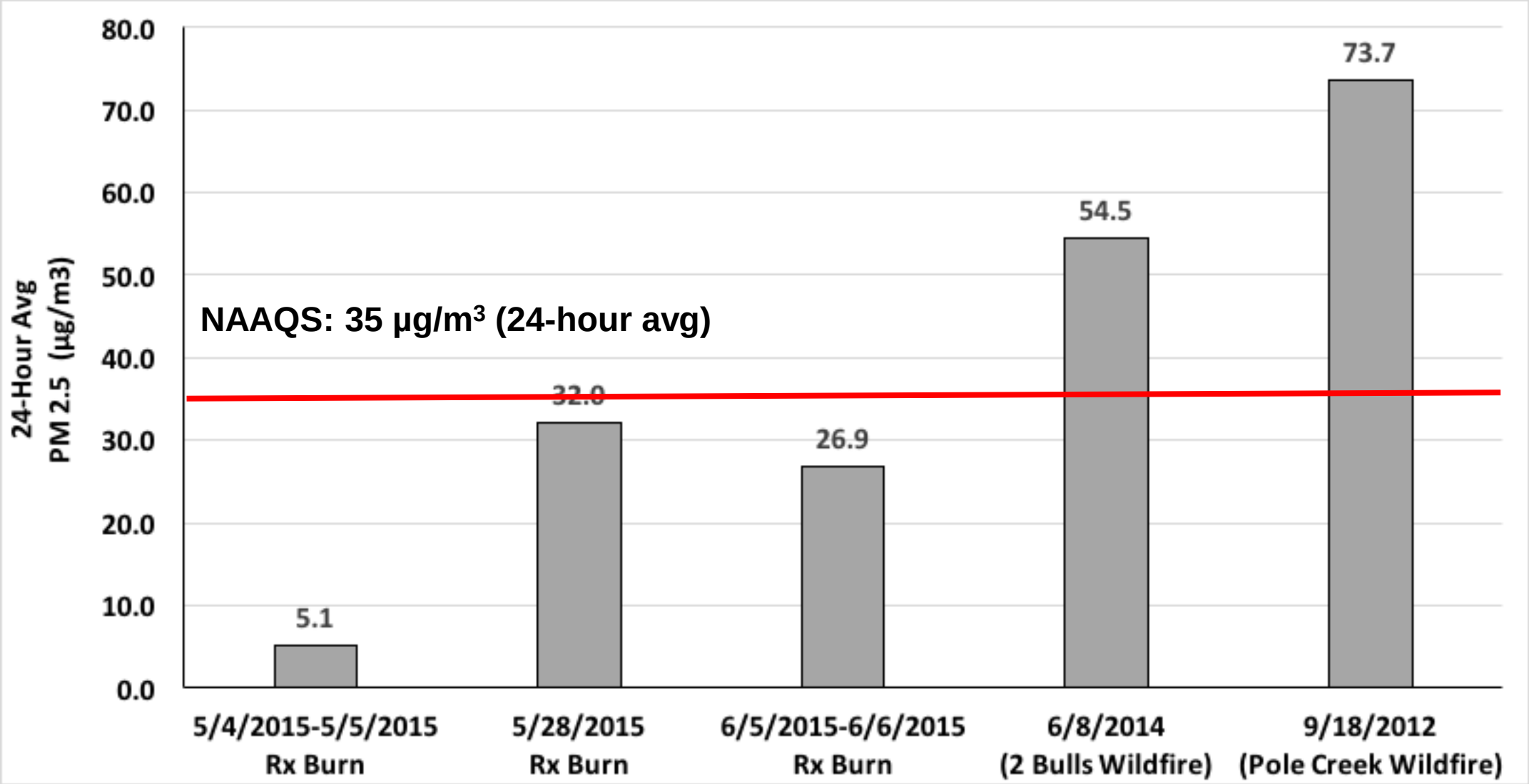



May 4-6, 2015
Cascade Middle School
Lava Falls
Sunriver
114 acres
12 acres
Smoke in Bend
• May 4: 1400 - 1600
• May 6: 0700-0800
PM 2.5 (µg/m3)
100
90
80
70
60
50
40
30
20
10
0
5/4/15 0:00
5/4/15 12:00
5/5/15 0:00
5/5/15 12:00
5/6/15 0:00
5/6/15 12:00
5/7/15 0:00
Time (PST)

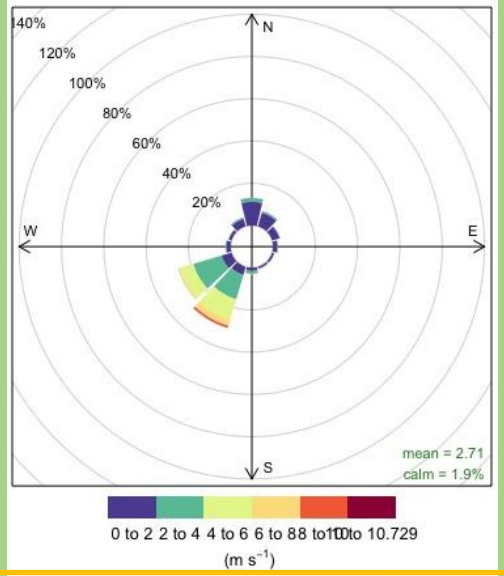
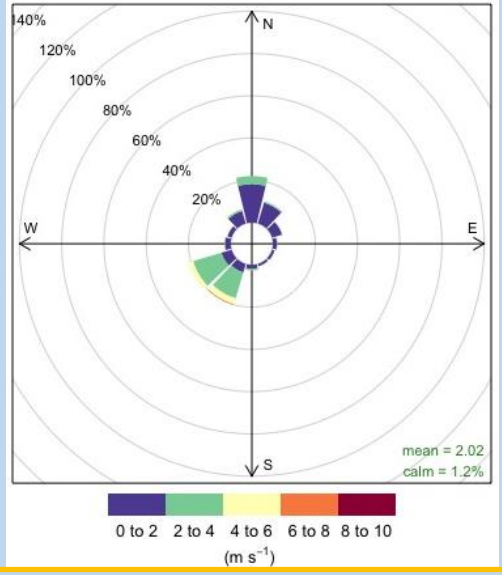
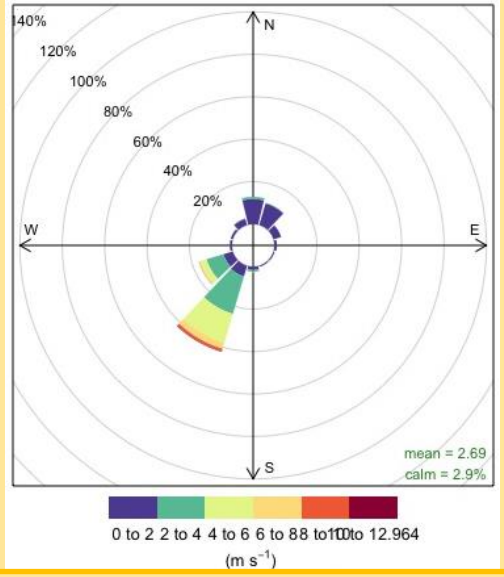
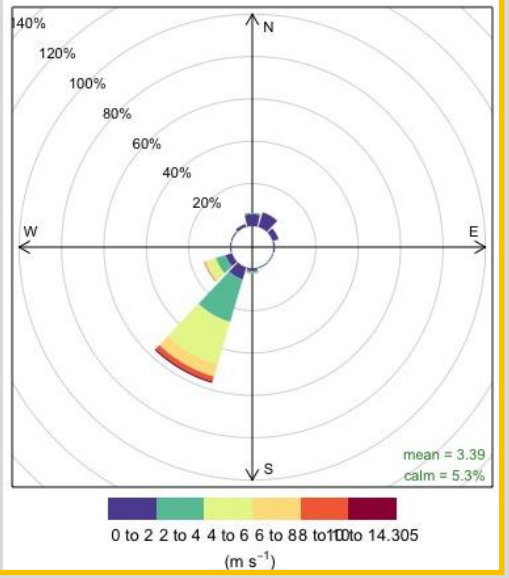
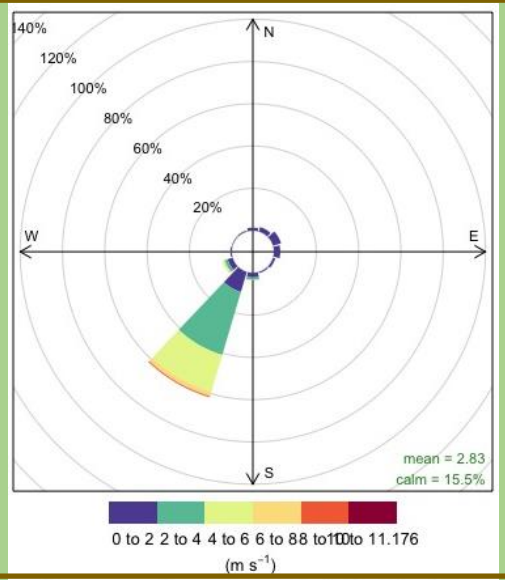
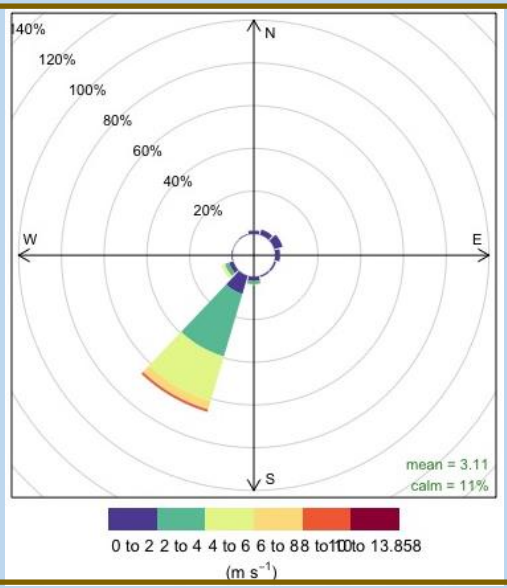
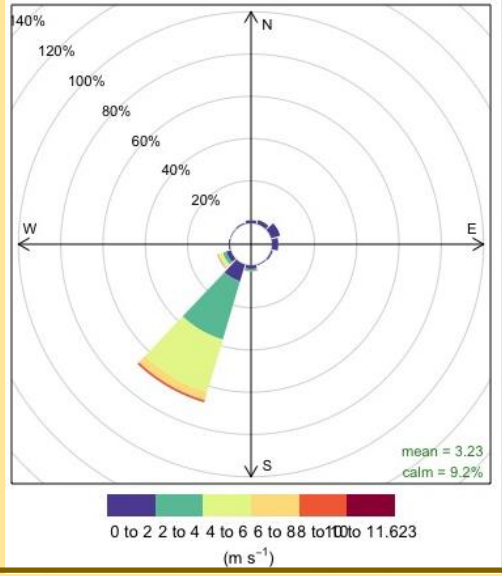
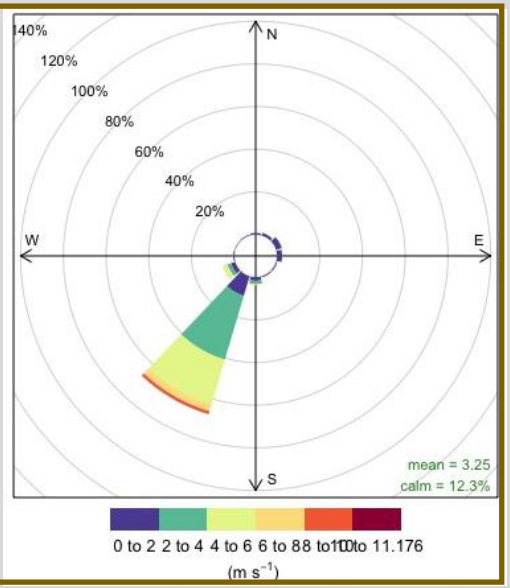

May 28-29, 2015
Cascade Middle School
Lava Falls
Sunriver
69 acres
Smoke in Bend
• May 29: 0100 - 0800
PM2.5 (µg/m3)
700
600
500
400
300
200
100
0
5/28/15 0:00
5/28/15 12:00
5/29/15 0:00
5/29/15 12:00
5/30/15 0:00
Time (PST)


June 6-9, 2015
Cascade Middle School
Lava Falls
Sunriver
122 acres
136 acres
Smoke in Bend
• June 6: 0100 - 1000
• June 7: 0100 - 0100
• June 7: 2300 - 0100
• June 8: 0100 - 0800
• June 9: 0100 - 1100
PM 2.5 (µg/m3)
500
400
300
200
100
0
6/5/15 0:00
6/5/15 12:00
6/6/15 0:00
6/6/15 12:00
6/7/15 0:00
6/7/15 12:00
6/8/15 0:00
6/8/15 12:00
6/9/15 0:00
6/9/15 12:00
6/10/15 0:00
Time (PST)

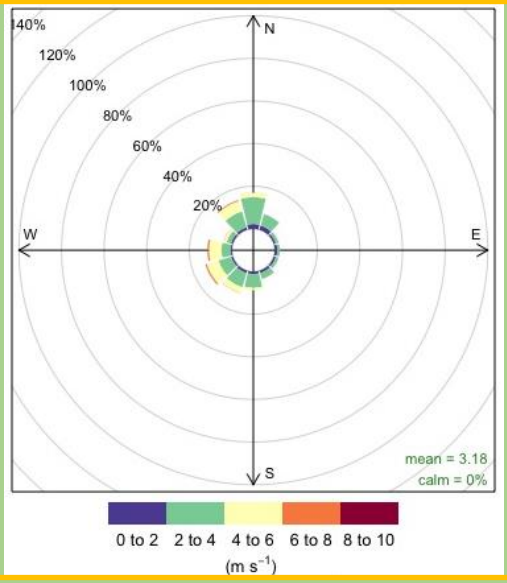
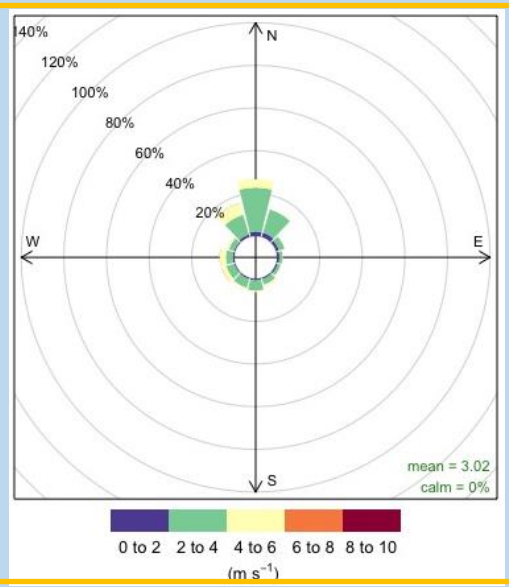
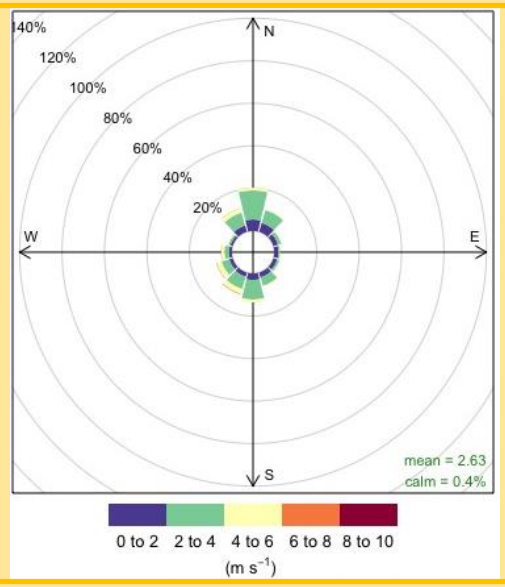
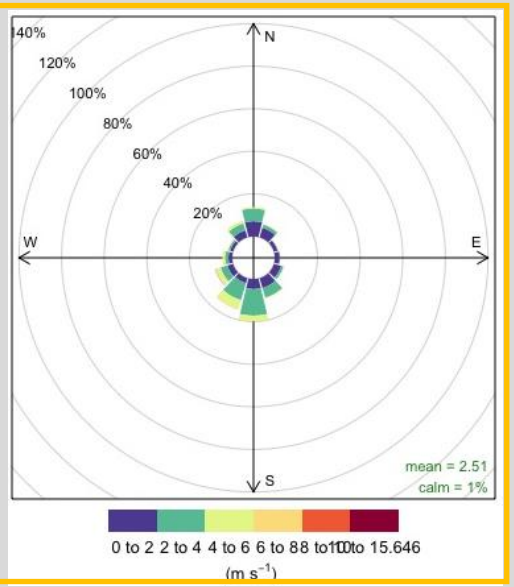
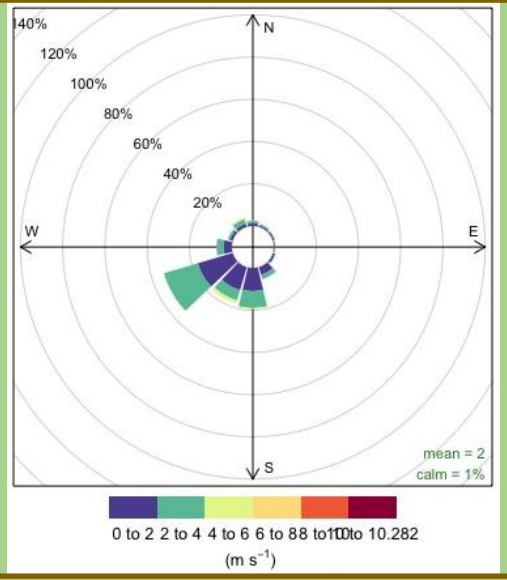
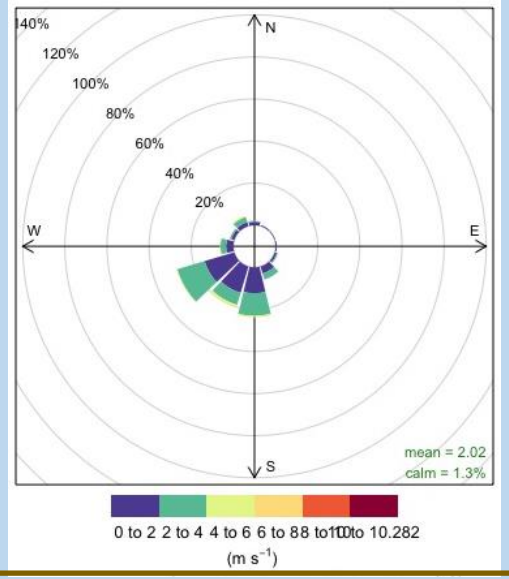
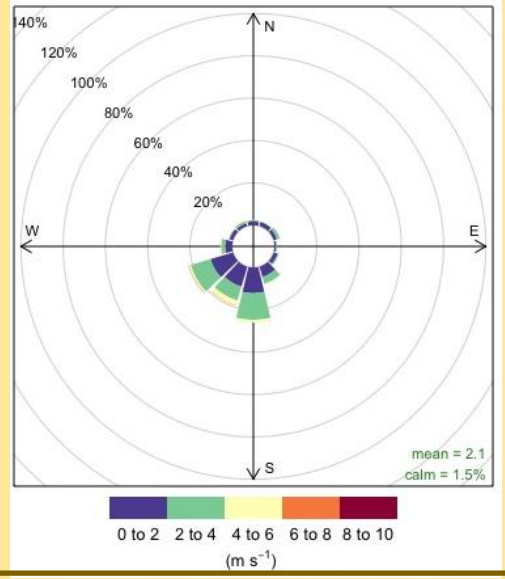
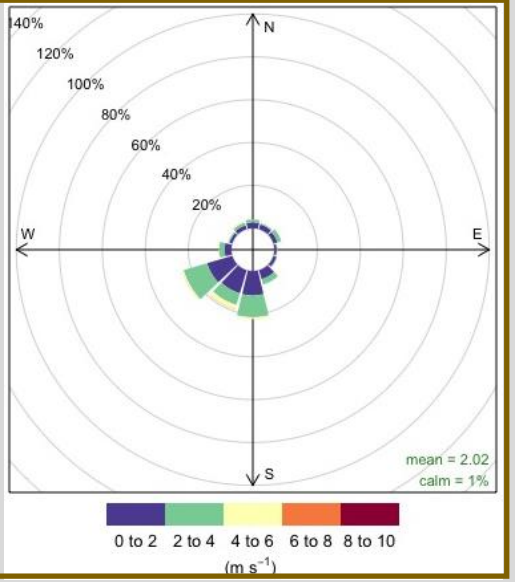
Comparison of Smoke Impacts in Bend with NAAQS



Lava Butte 2005-2015

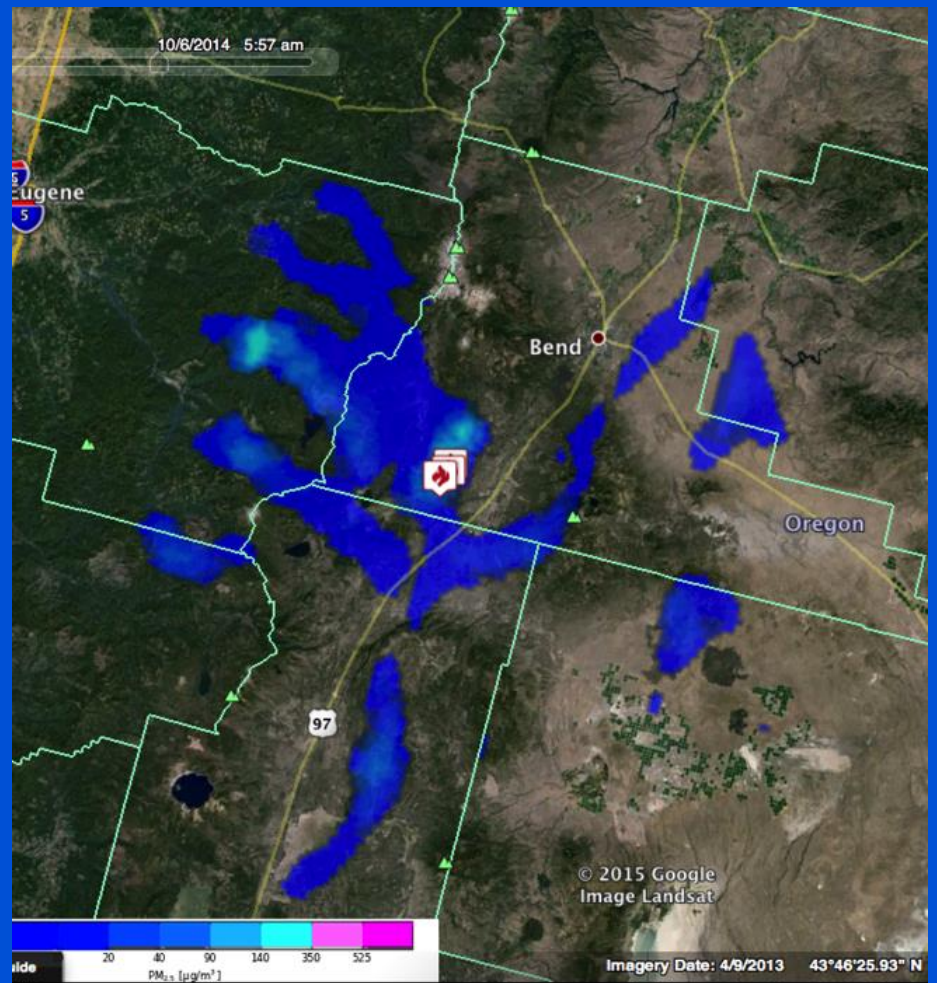
	Spring	Summer	Autumn	Winter
Daytime 11-07 PST				
Nighttime 01-07 PST				

Tumalo Ridge 2005-2015

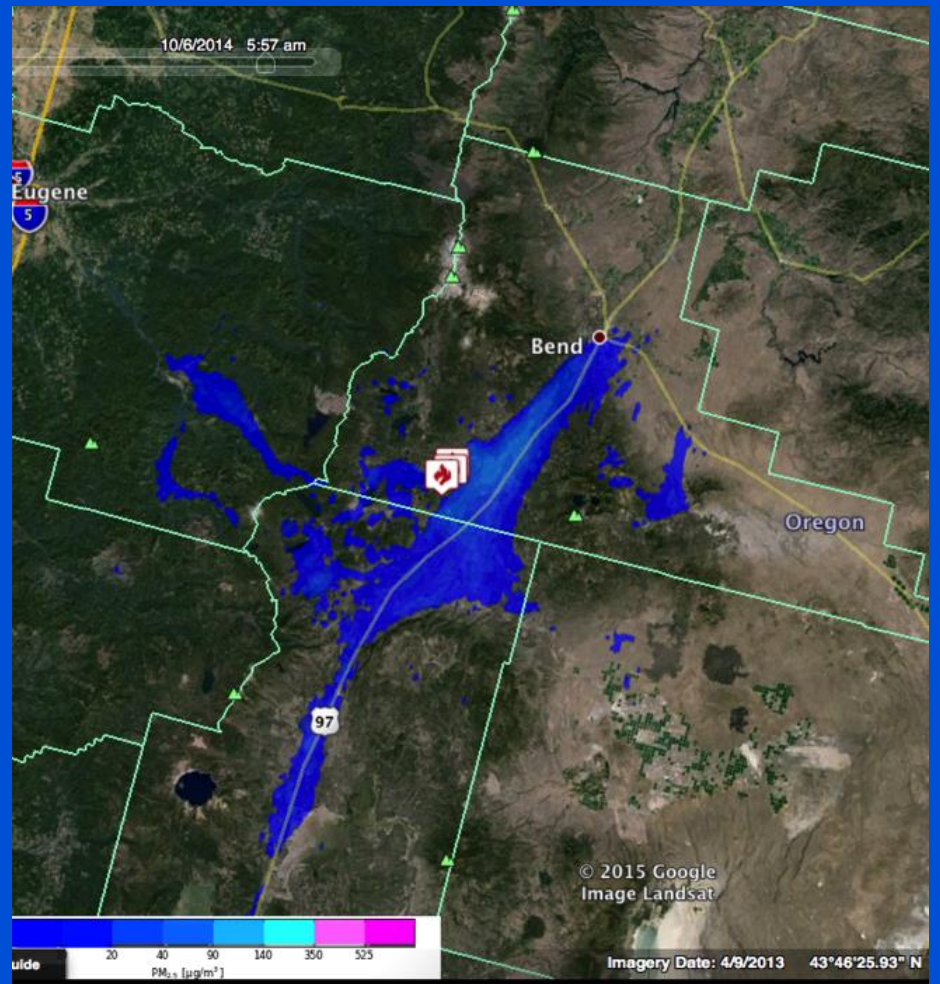
	Spring	Summer	Autumn	Winter
Daytime 11-07 PST				
Nighttime 01-07 PST				

6 Oct 2014, 5AM PDT – Morning intrusion into Bend from previous-day prescribed burn using different spatial resolutions

Daily scheduled BlueSky run – UW 4km met



Custom hi-res BlueSky run – NWS FW 1km met



Smoke Modeling Results

- 1-km domain captured the timing of the smoke transport to Bend
- 1-km results did not simulate concentrations well
- 4-km results did not simulate timing or concentrations well

Thank you!

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Photo Seattle Times, 9/2012