

Wildfire PM2.5

By Blake Bullwinkel & Jonas LaPier



1. Motivation



A wall of smoke builds off the western coast of the United States (NASA, September 9, 2020)

The New York Times

Aug. 21, 2020

CALIFORNIA TODAY

Can Wildfire Smoke Worsen Covid-19 Symptoms?

Nov. 26, 2020

Wildfire Smoke Is Poisoning California's Kids. Some Pay a Higher Price.



THE SPOKESMAN-REVIEW

Spokane, Washington Est. May 19, 1883

Wildfire smoke in US exposes millions to hazardous pollution

Thu., Oct. 15, 2020

Sunday's bad air set record in Spokane; unhealthy readings expected to stick around until weekend

Mon., Sept. 14, 2020

Project Goals

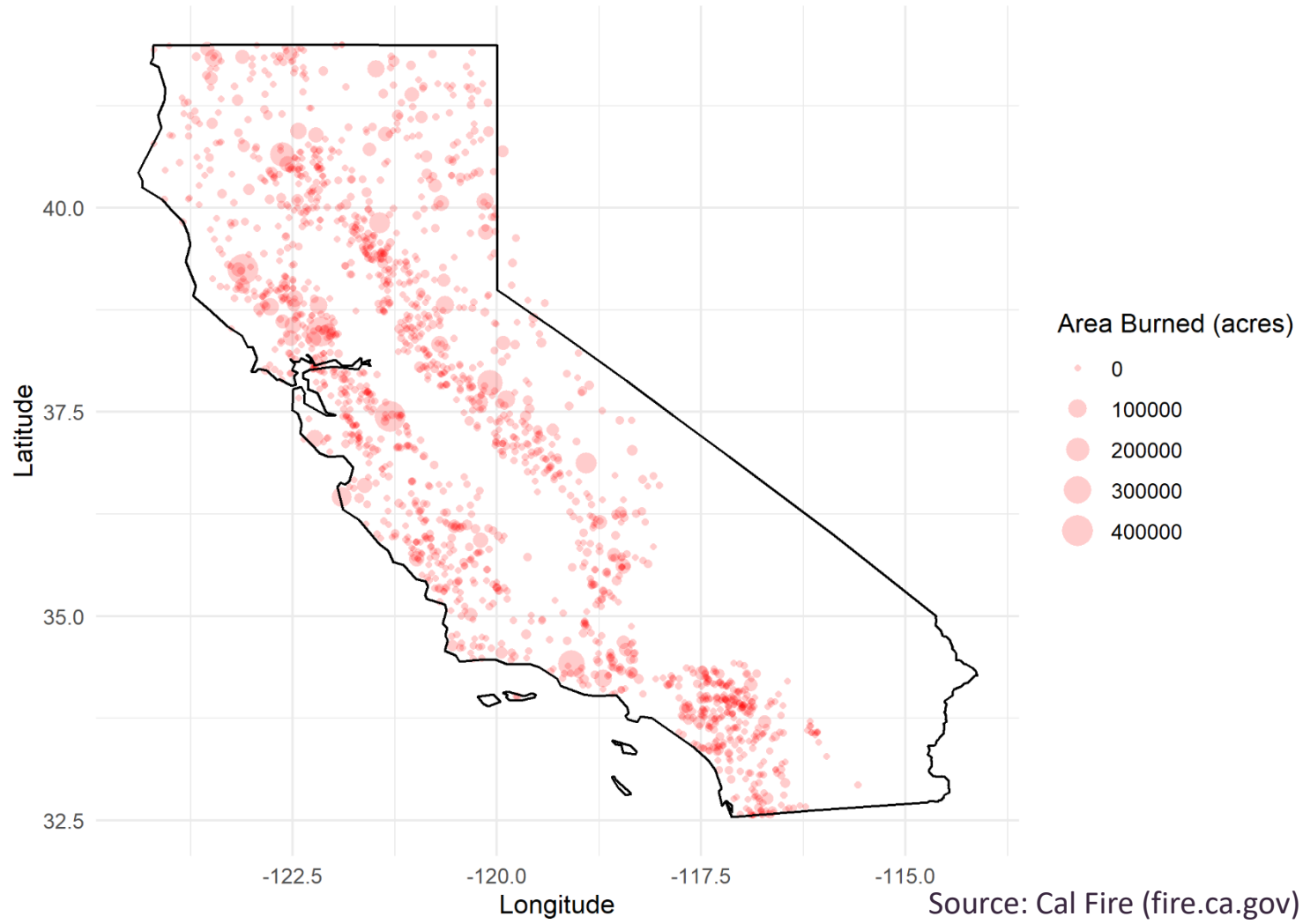
1. Characterize the extent of the 2020 wildfires and compare to historical record
2. Identify smoke events and trace their origins to specific wildfires
3. Explore the correlations between PM exposure and respiratory & cardiovascular health
4. Analyze relationship between PM and COVID-19 cases



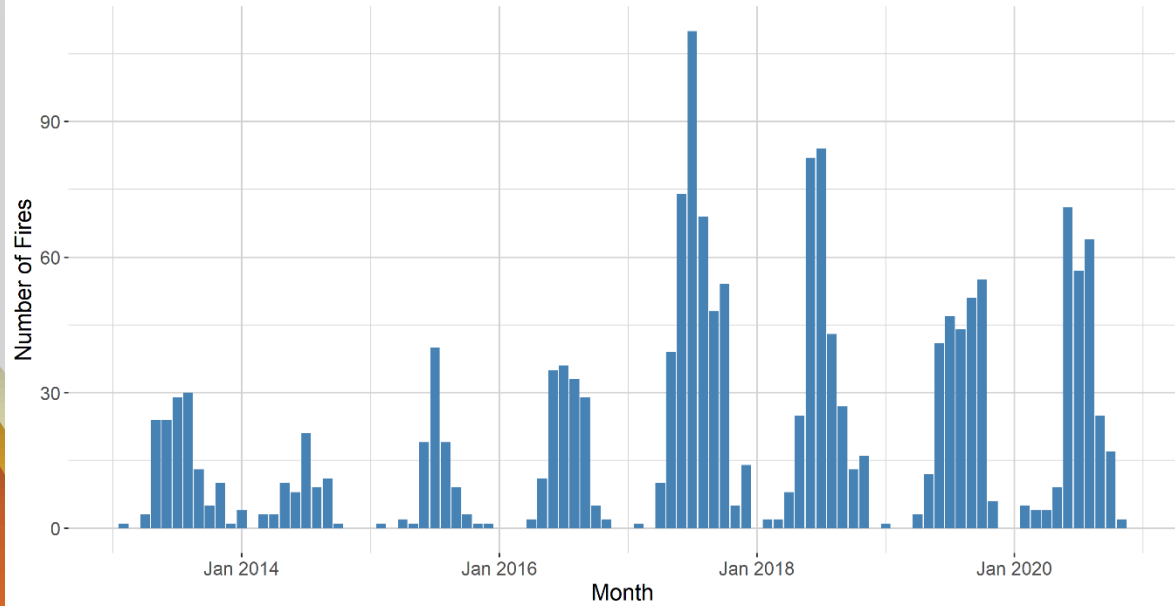
2. Wildfire Exploratory Analysis



Map of California Wildfires 2013-2020

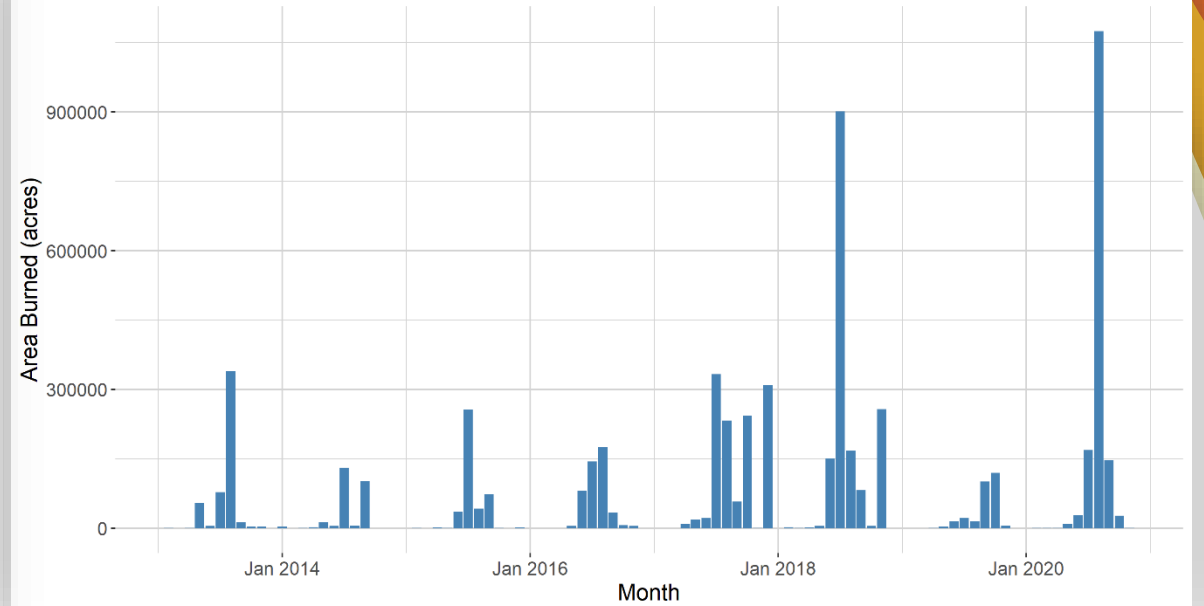


Number of CA Wildfires per Month
2013-2020



Source: Cal Fire (fire.ca.gov)

Area Burned by CA Wildfires per Month
2013-2020

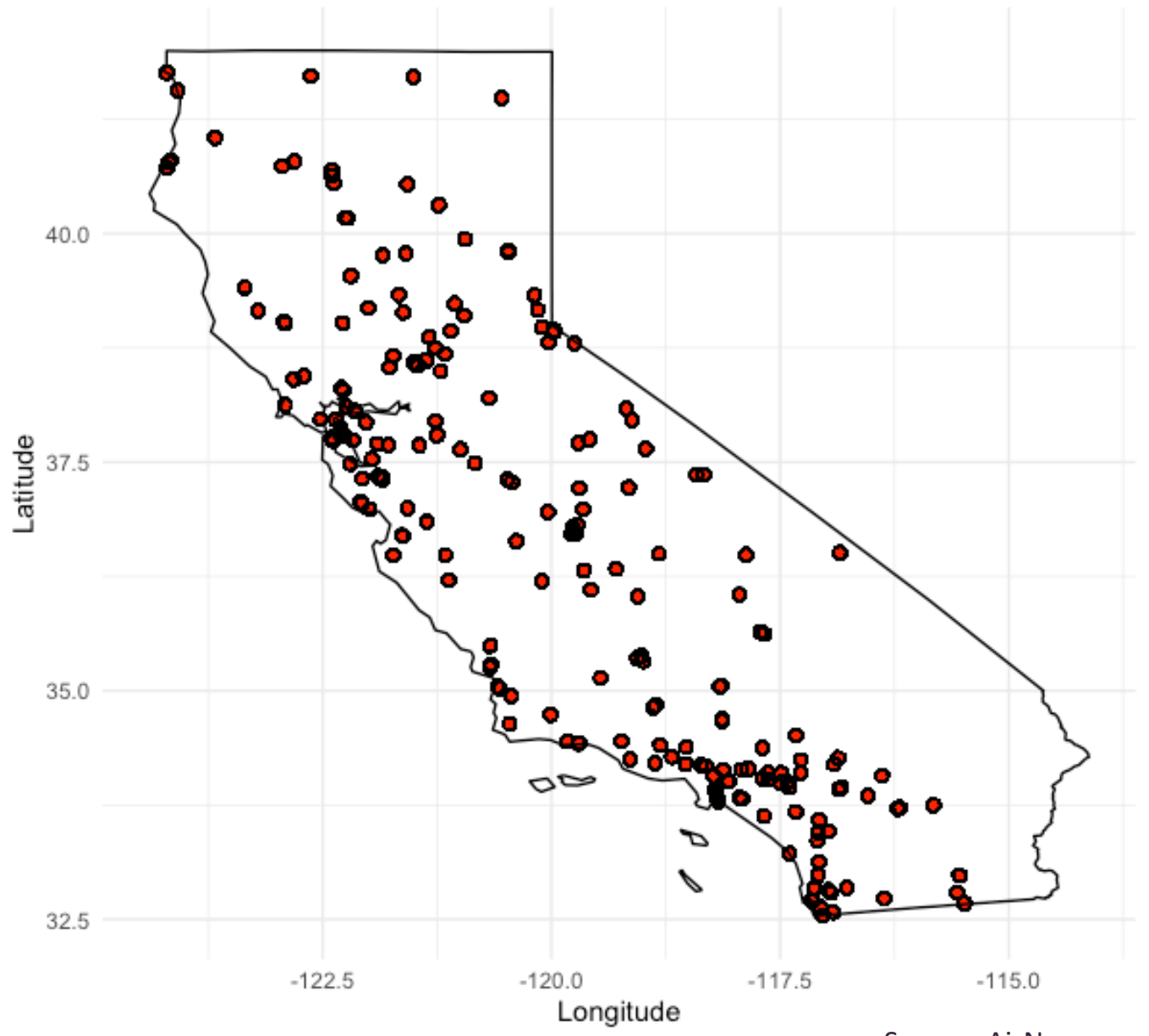


Source: Cal Fire (fire.ca.gov)

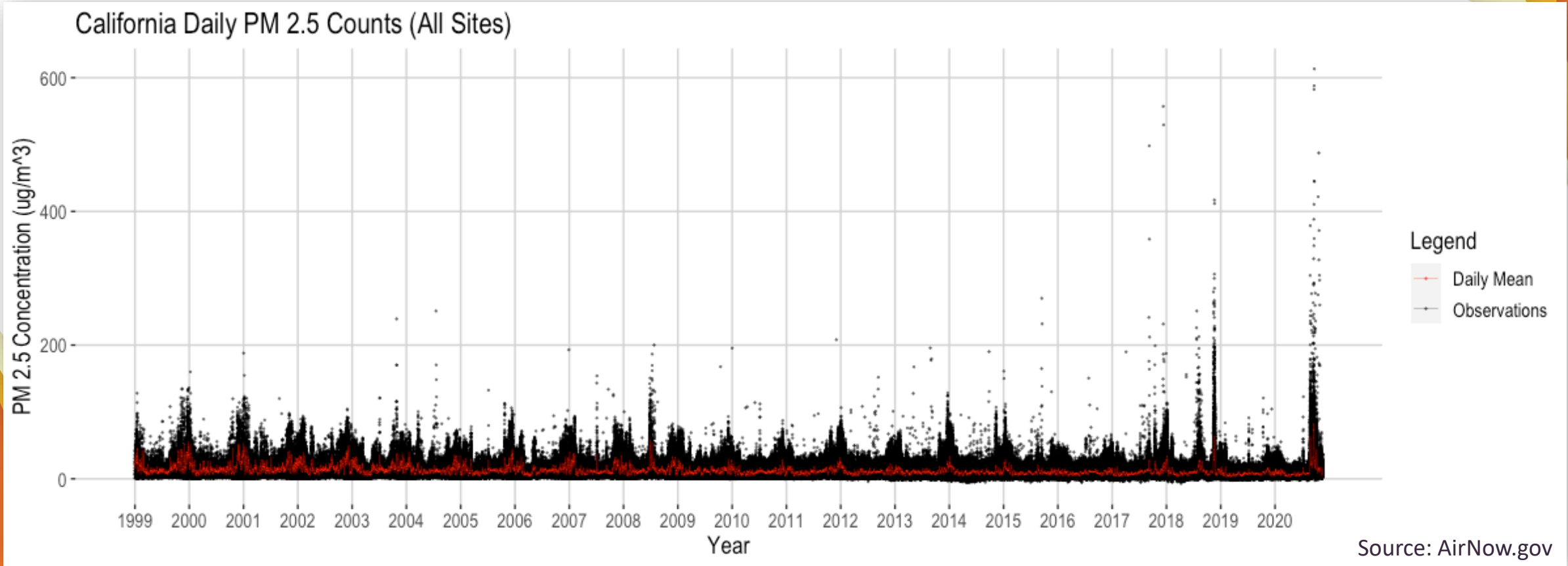
3. PM 2.5 Exploratory Analysis



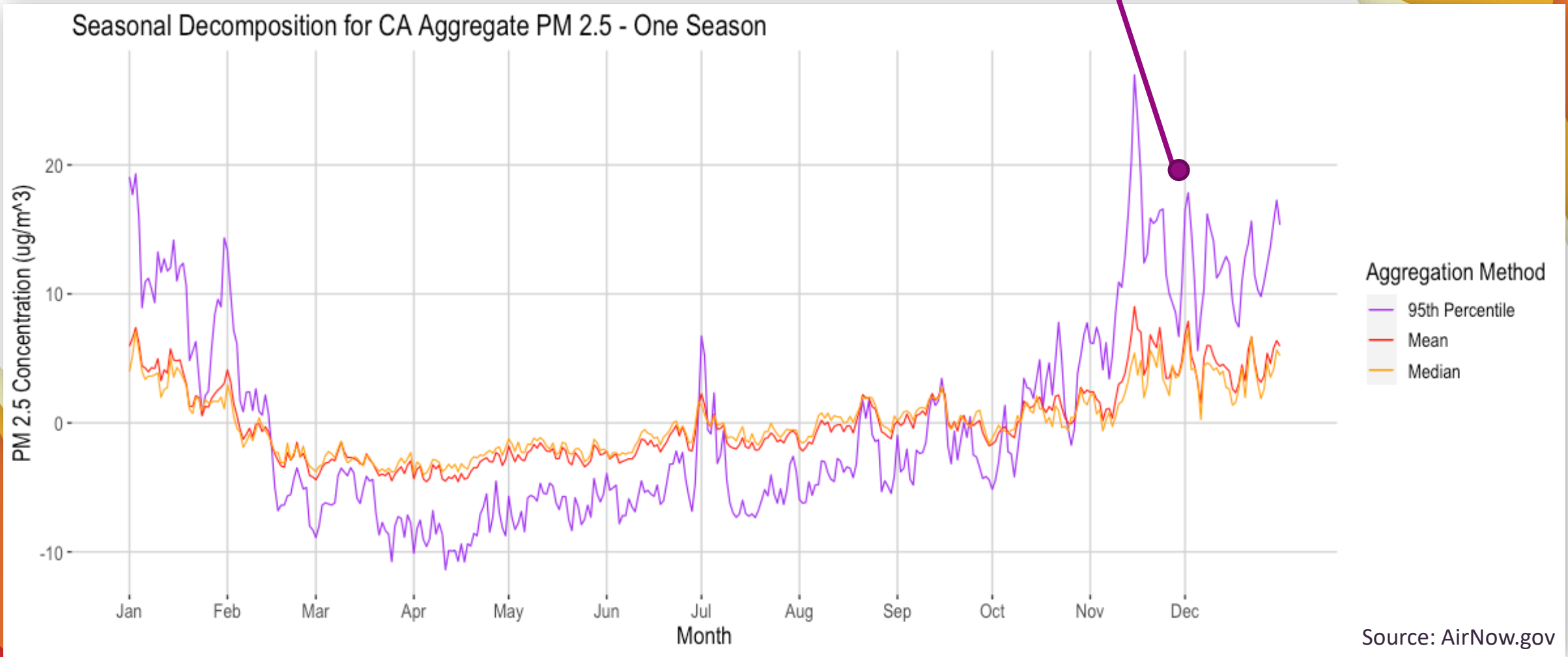
PM 2.5 Sampling Locations in California



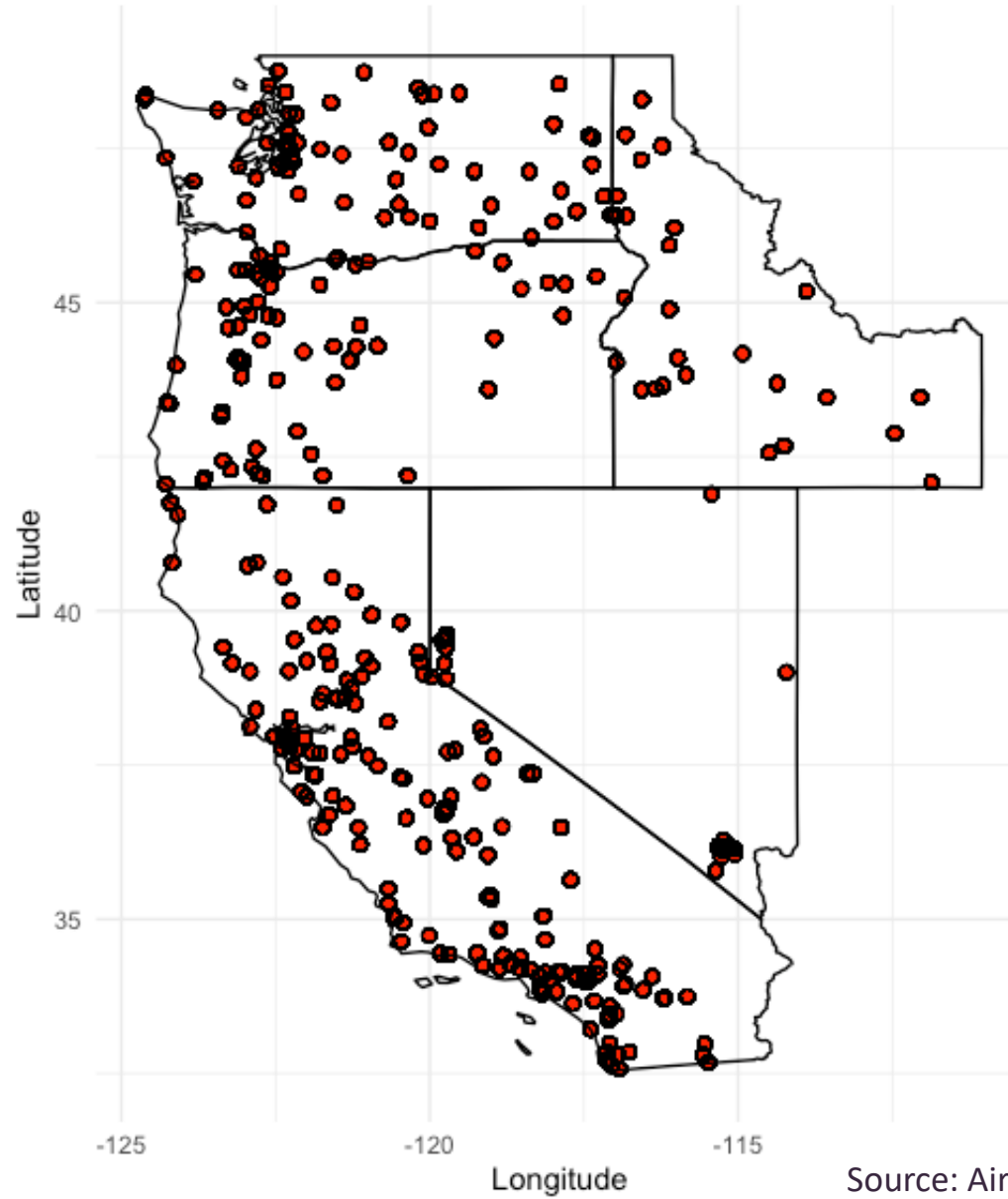
Source: AirNow.gov



PM 2.5 is seasonally greatest in the winter.

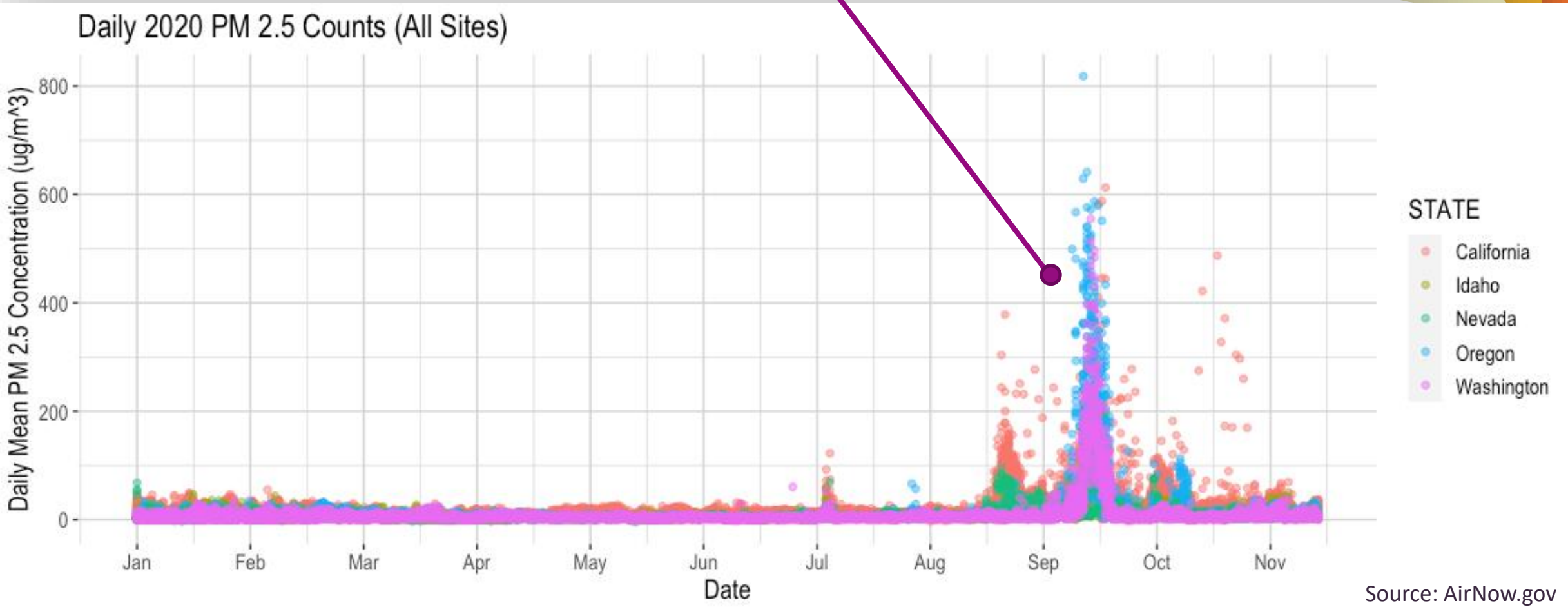


PM 2.5 Sampling Locations in the Western States



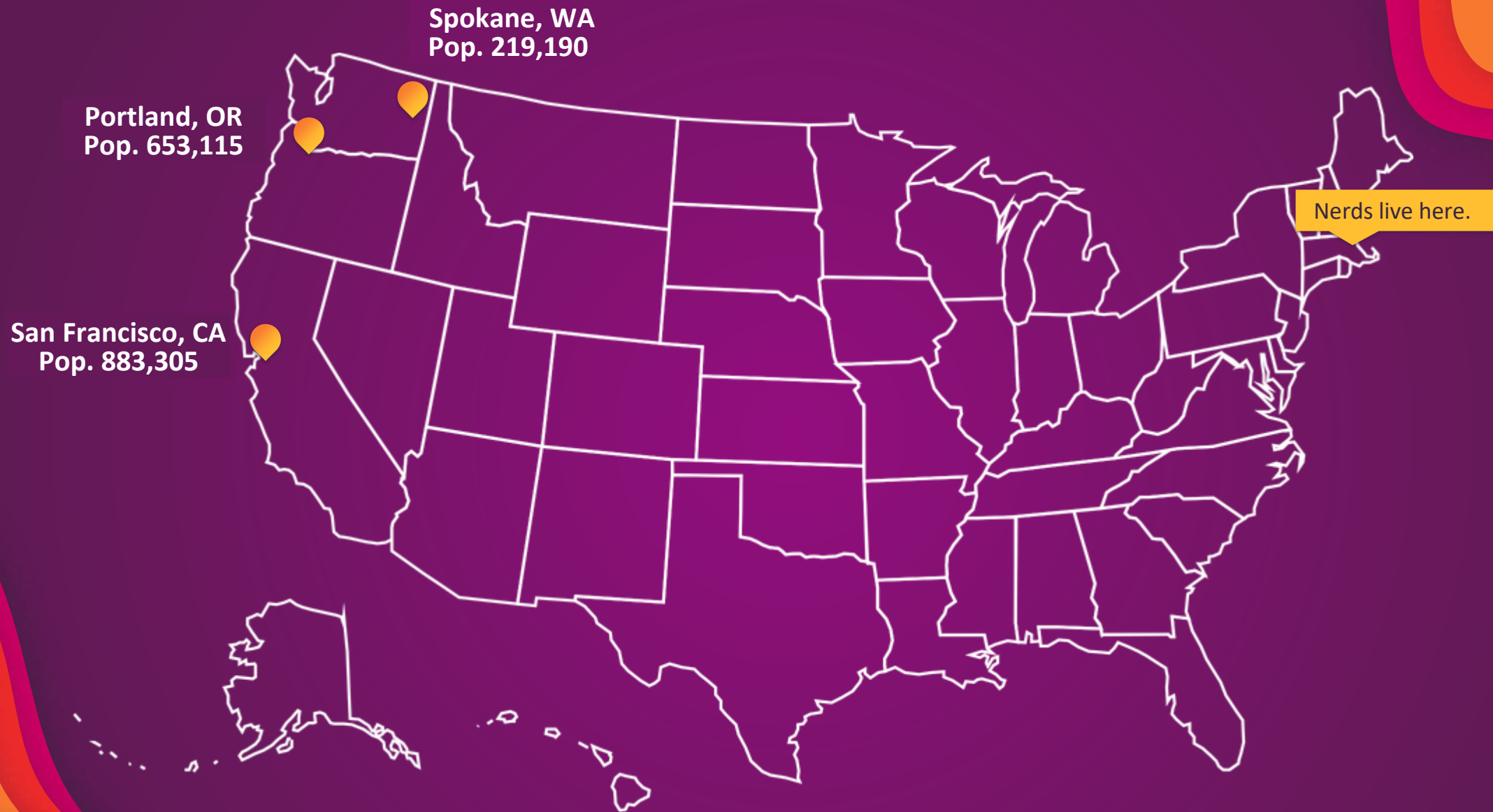
Source: AirNow.gov

The largest events occurred in WA, OR, & CA



4. Smoke Event Analysis





Portland, OR
Pop. 653,115

Spokane, WA
Pop. 219,190

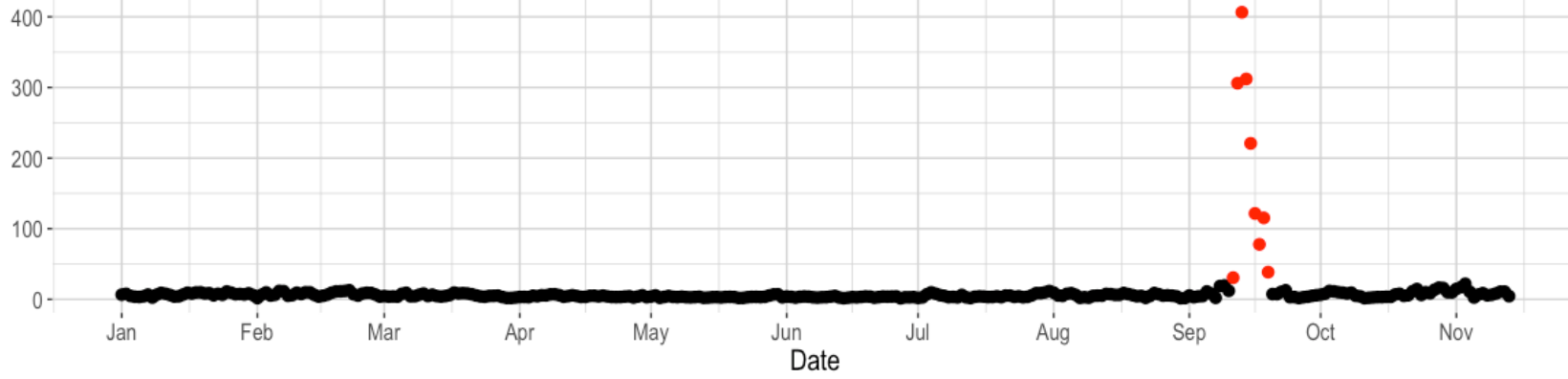
San Francisco, CA
Pop. 883,305

Nerds live here.

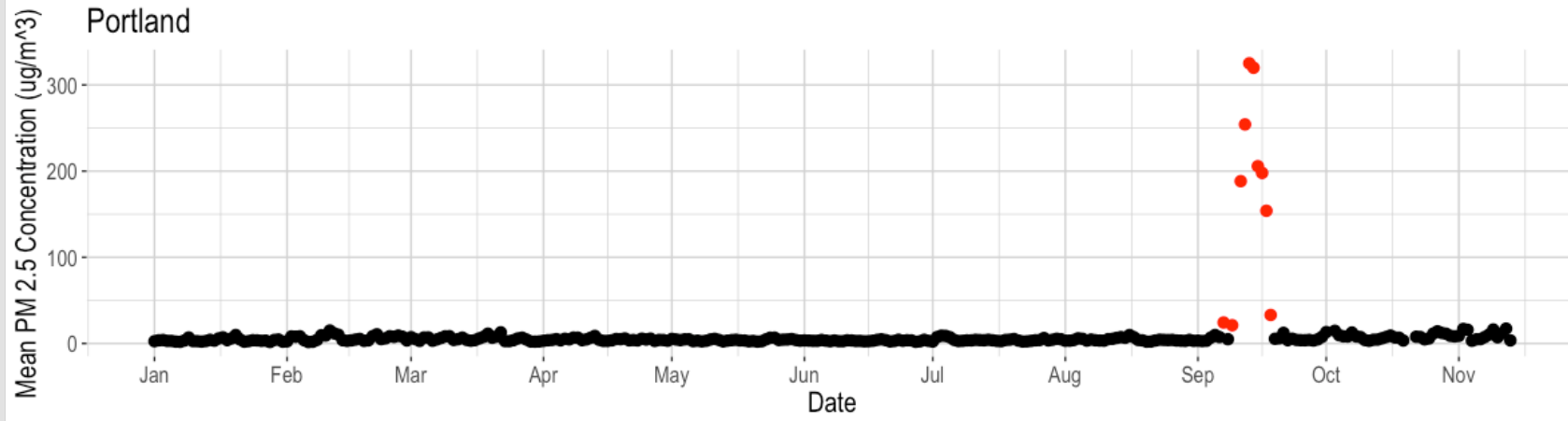
Cities of Interest

Spokane

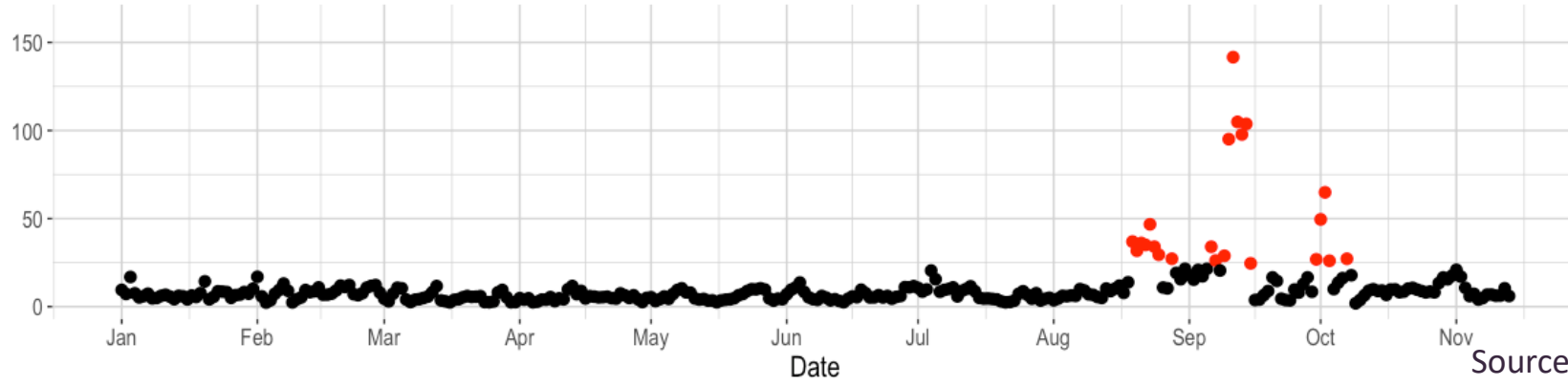
2020 Daily PM 2.5 Counts



Portland



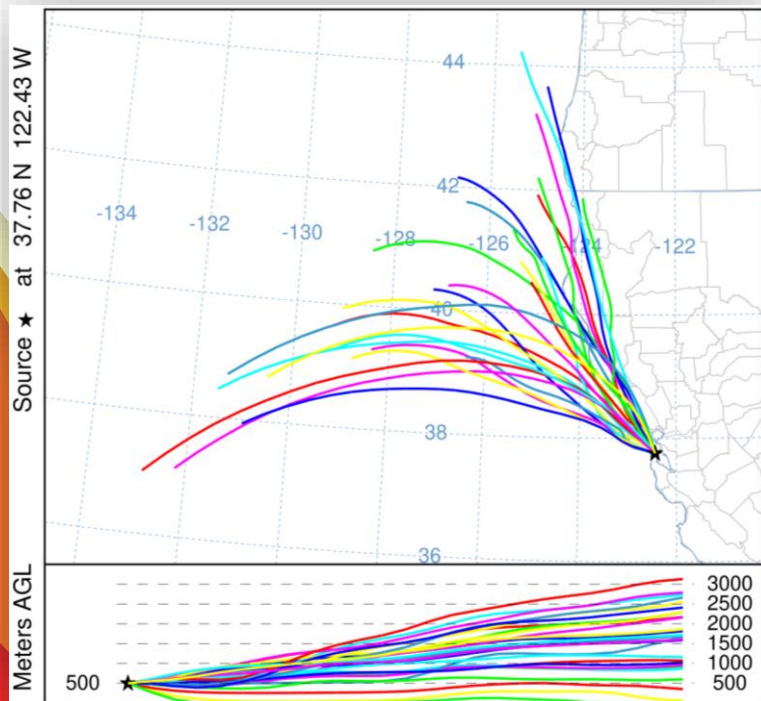
San Francisco



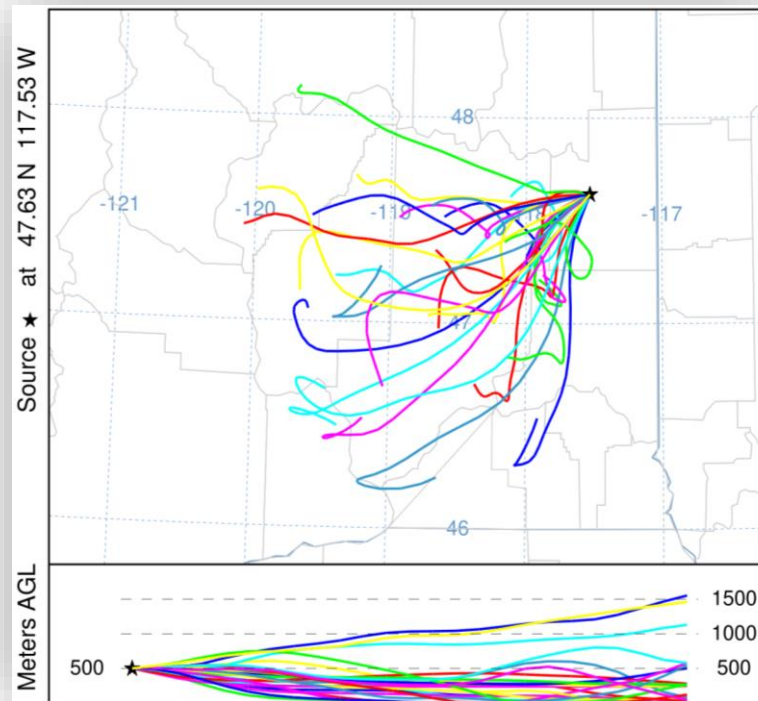
Source: AirNow.gov

HYSPLIT 24hr Back Trajectories

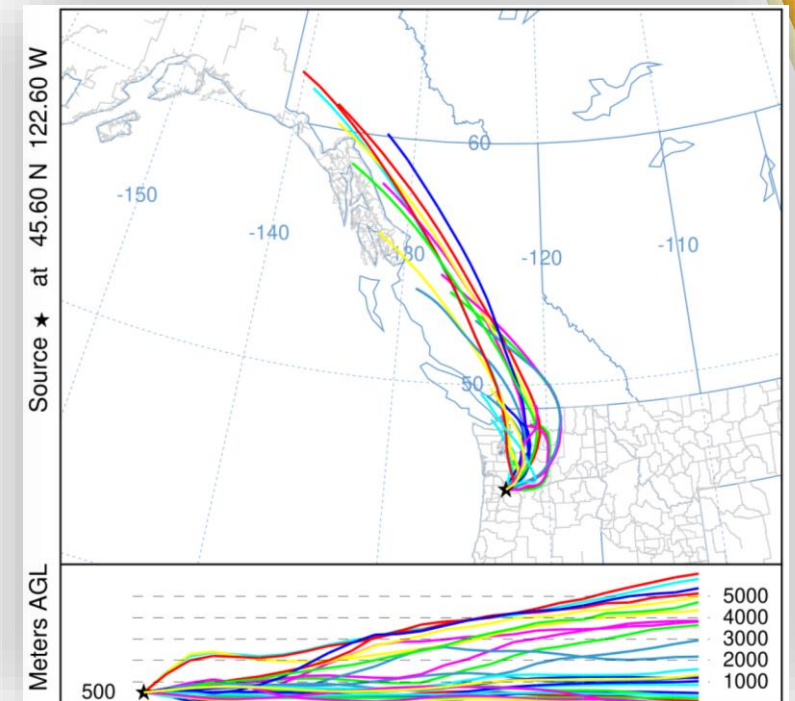
San Francisco, CA
8/19/2020



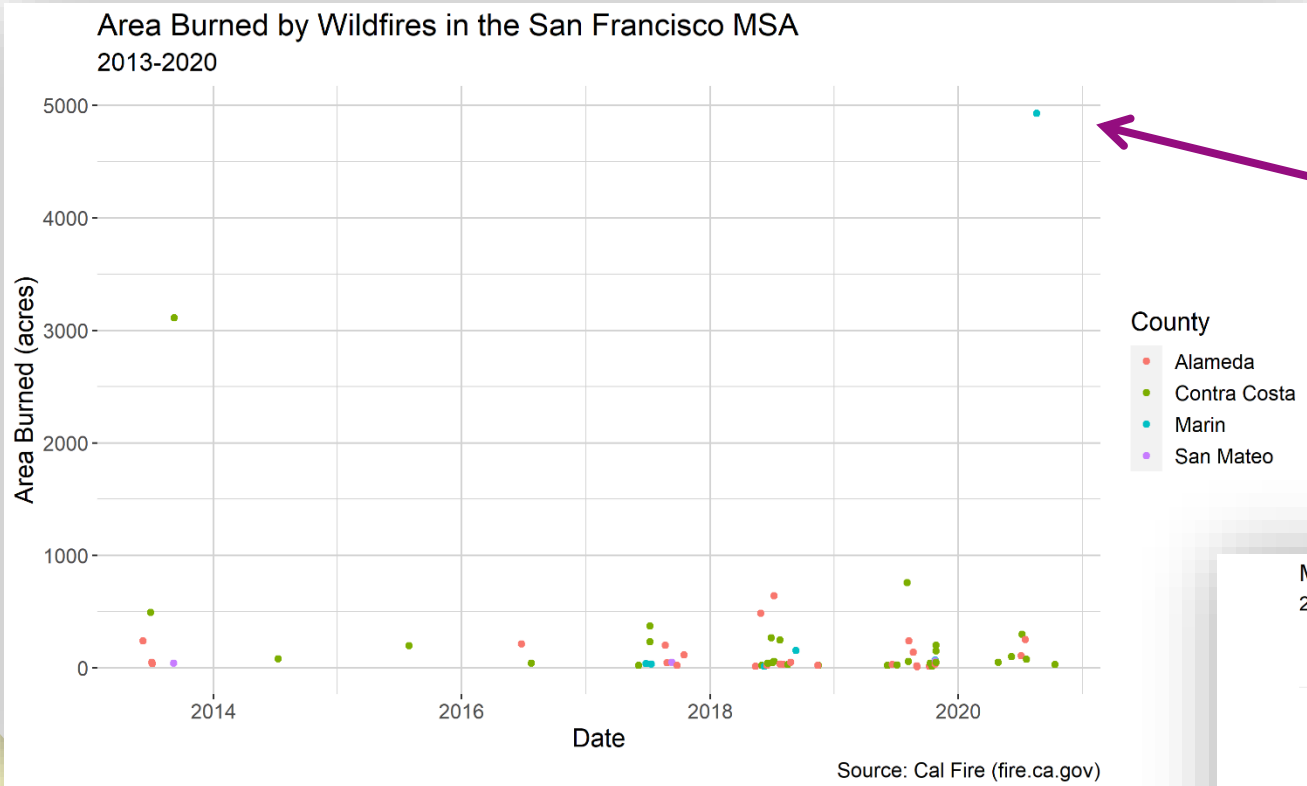
Spokane, WA
9/11/2020



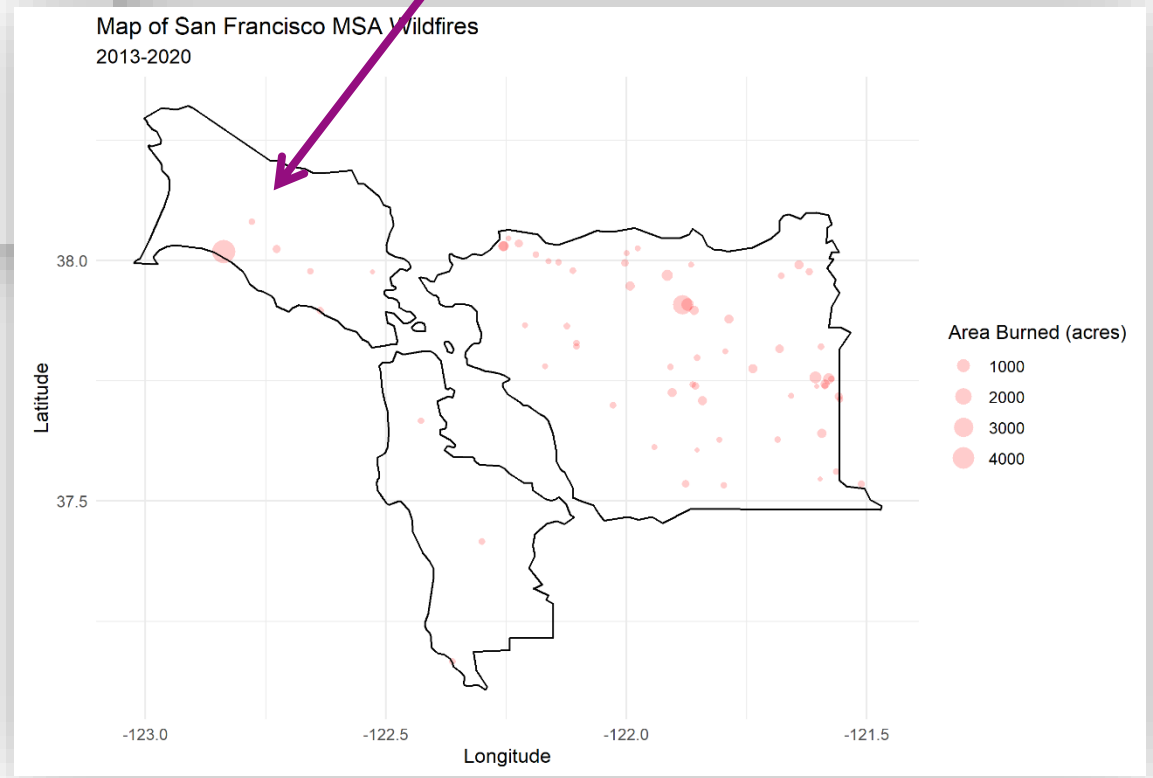
Portland, OR
9/07/2020



Source: ready.noaa.gov/HYSPLIT.php



Woodward Fire, 8/18/2020

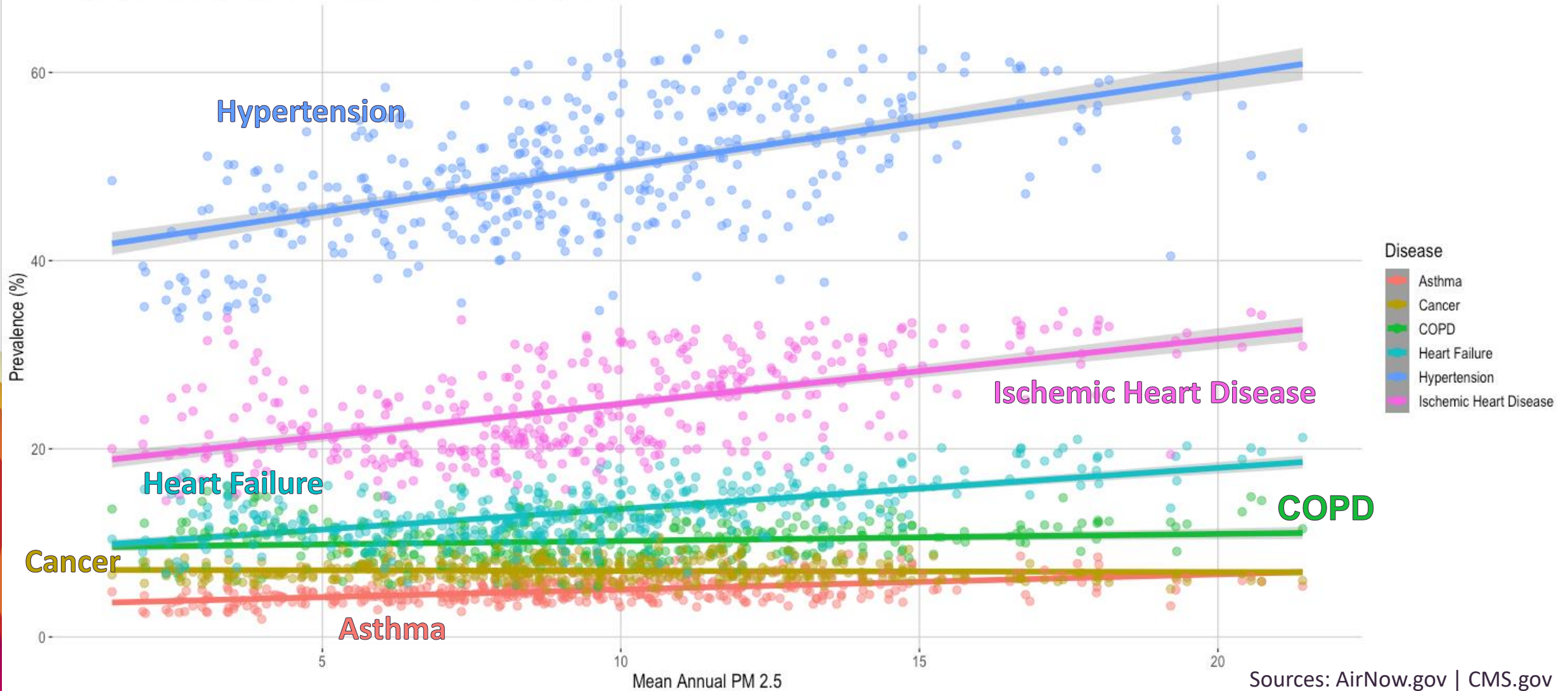


WA: Whitney Fire, WA (127,430 acres), 9/7/2020
 WA: Manning Fires, WA (18,254 acres), 9/7/2020
 OR: Pearl Hill Fire, WA (223,730 acres), 9/7/2020
 OR: Apple Acres Fire, WA (5,500 acres), 9/7/2020

5. Health Impact Analysis

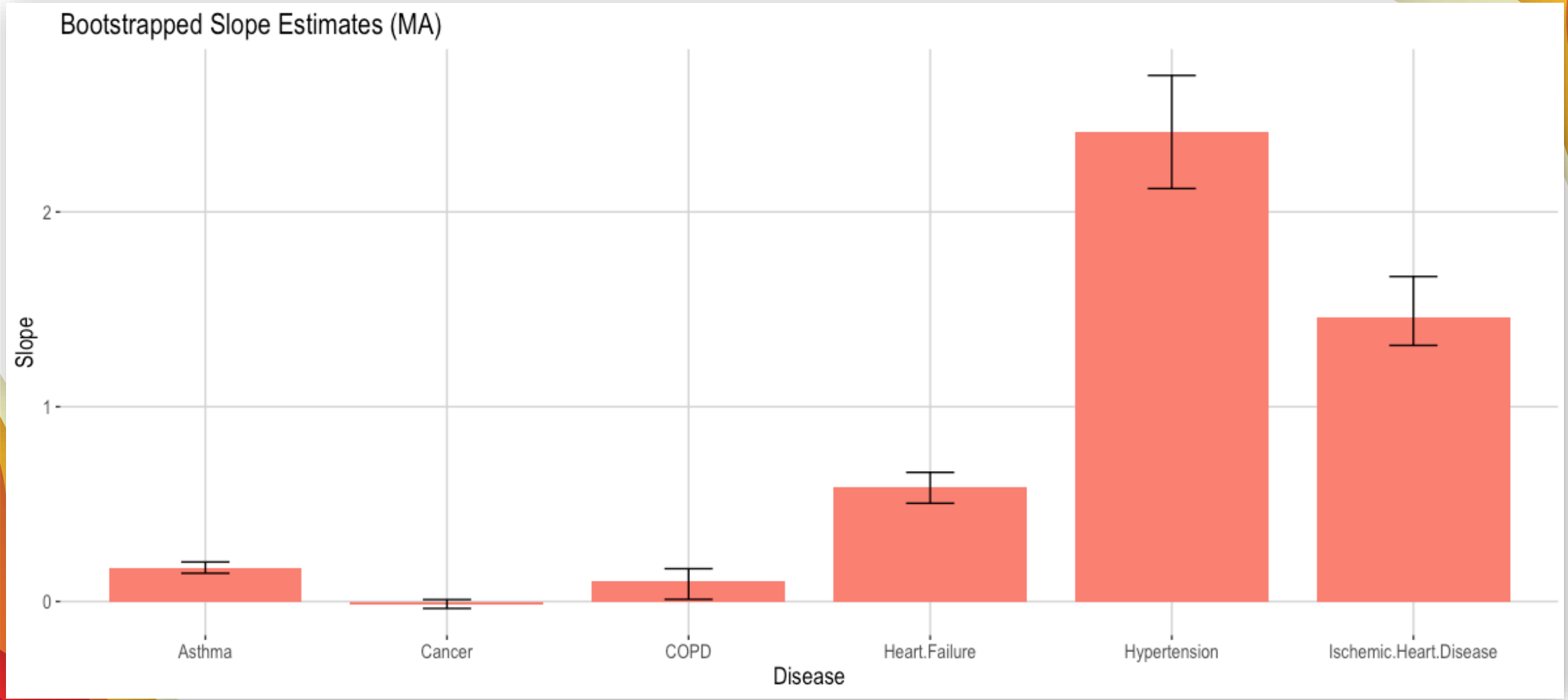


WA, OR, CA County Medicare Disease Prevalence Trends (Mean)

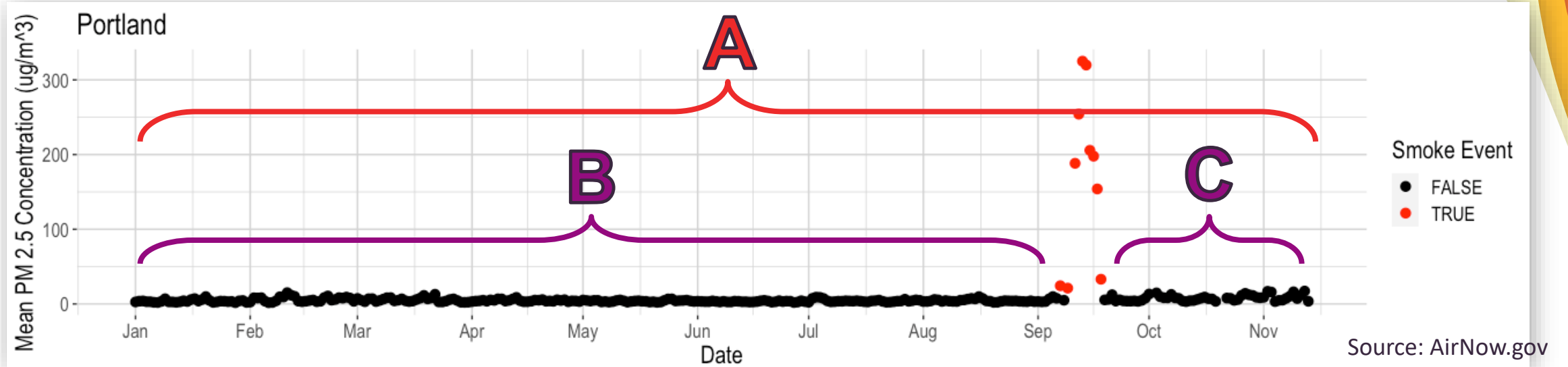


Sources: AirNow.gov | CMS.gov

Major axis regression was applied to 100 bootstrapped samples of each scatterplot. 95% confidence intervals are displayed.



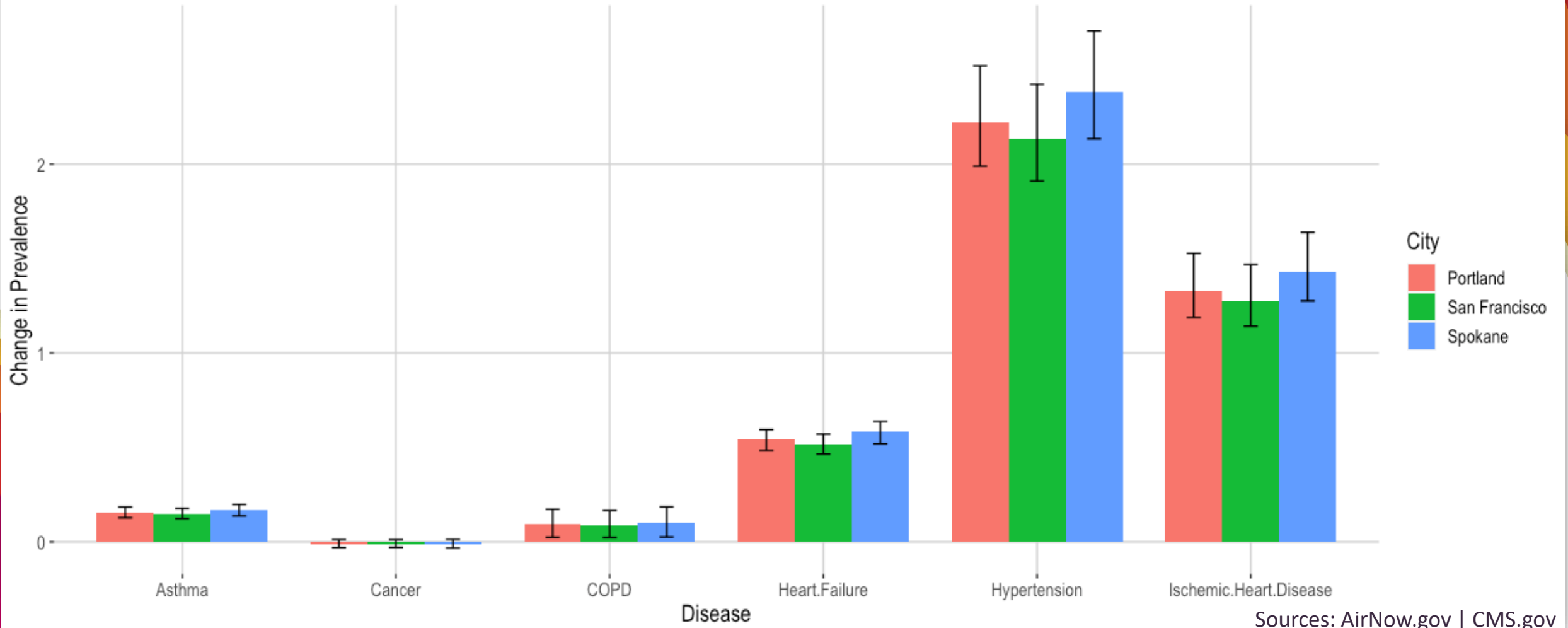
Smoke Impact Calculation Example



Expression for Smoke Impact on Annual Mean

$$\text{mean}(A) - \text{mean}(B + C)$$

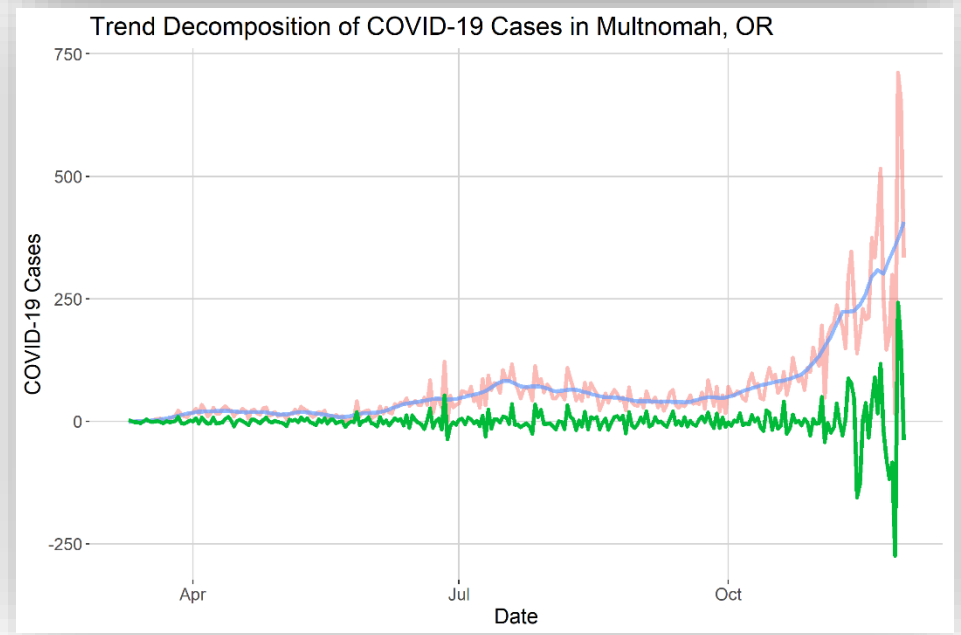
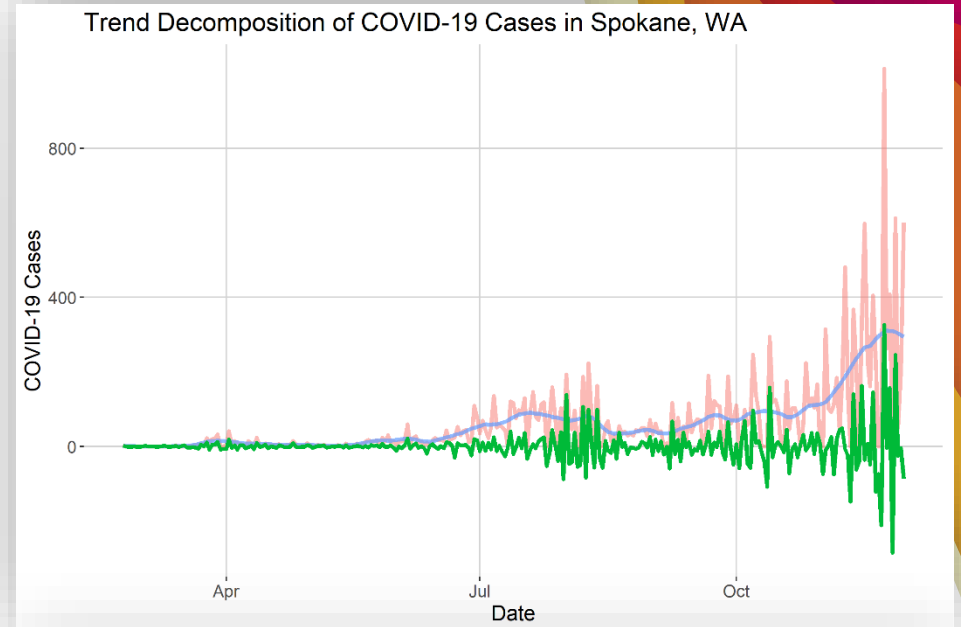
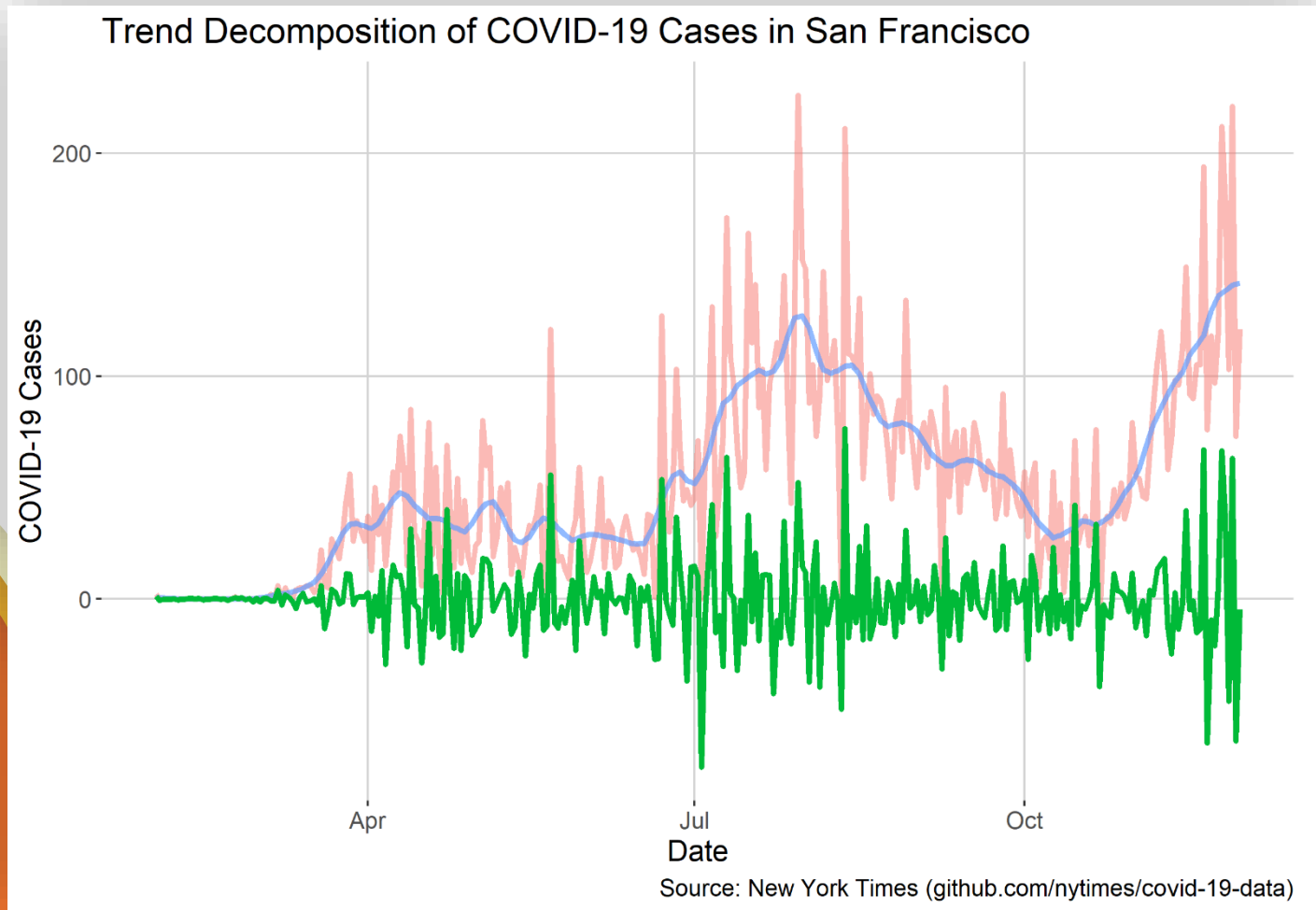
Estimated Impact of 2020 Wildfire Smoke based on MA Regression Slopes

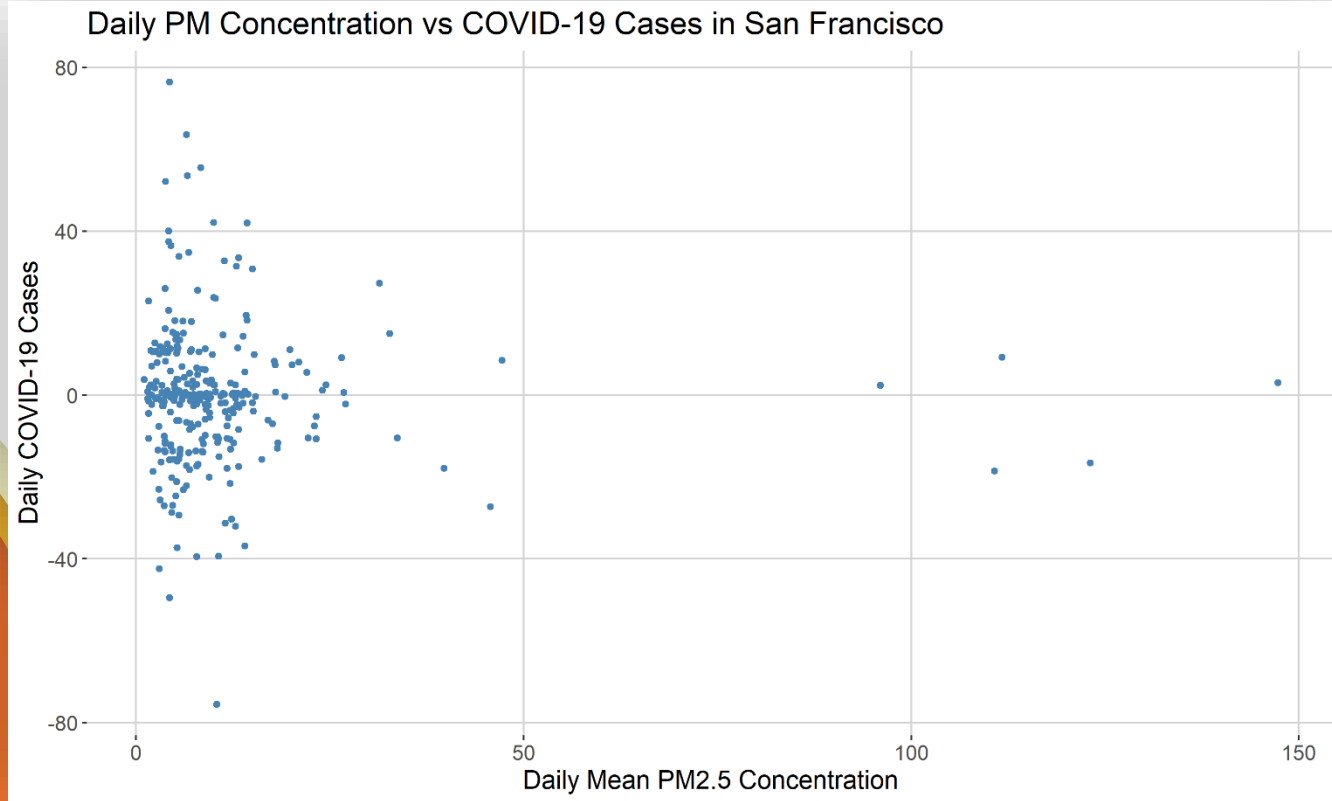


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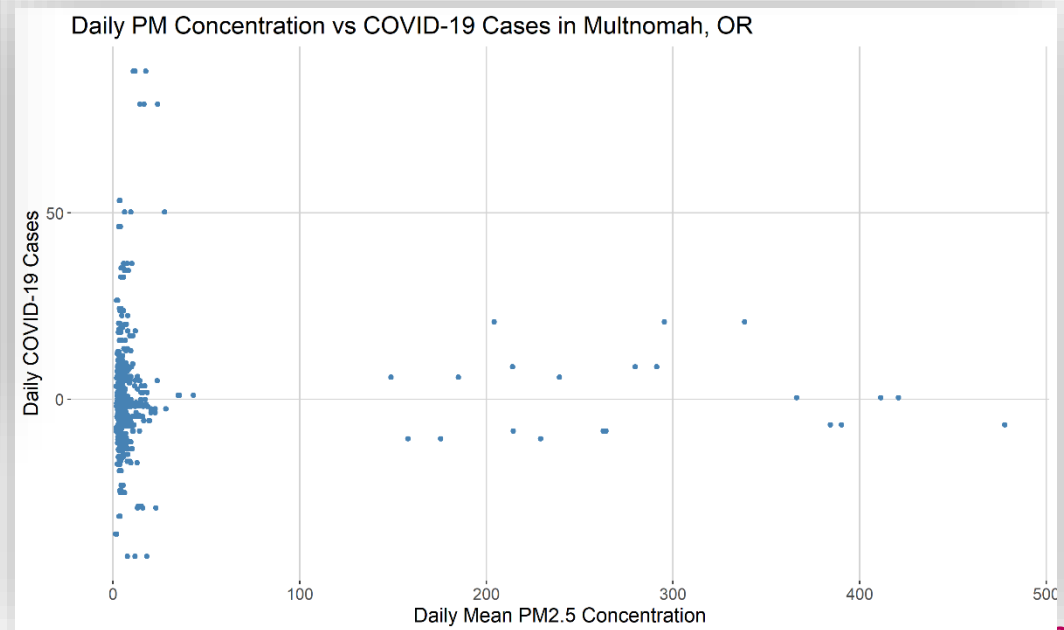
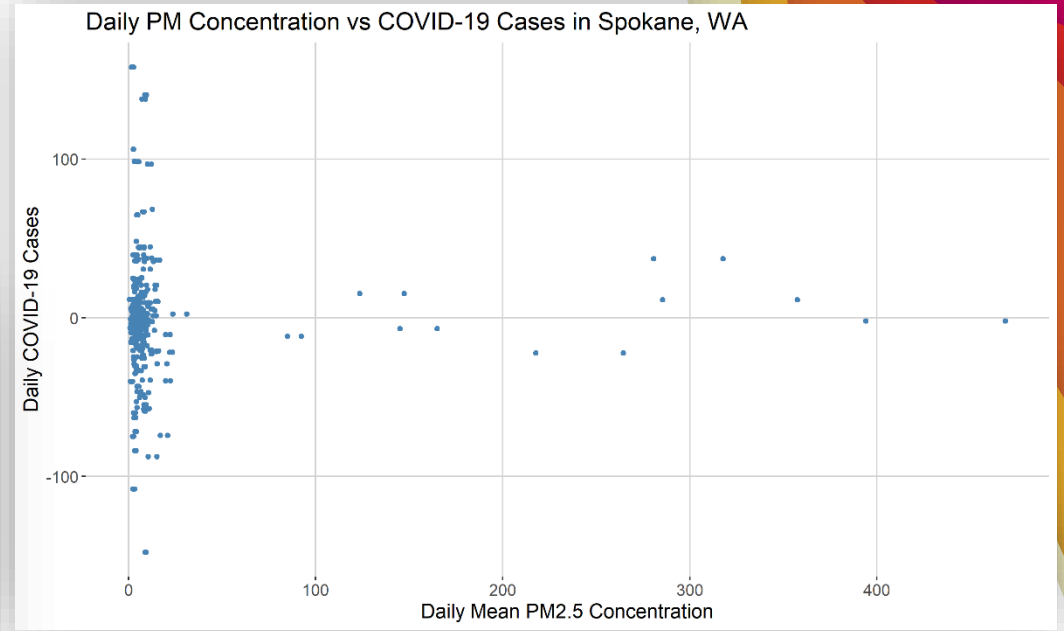
3. COVID-19 Impact Analysis







Sources: AirNow.gov | NYT



References

- Burke, 2020: *The Changing Risk and Burden of Wildfire in the US*
- Liu, 2017: *Wildfire-specific Fine Particulate Matter and Risk of Hospital Admissions in Urban and Rural Counties*
- Liu, 2016: *Who Among the Elderly Is Most Vulnerable to Exposure to and Health Risks of Fine Particulate Matter From Wildfire Smoke?*
- Liu, 2016: *Particulate Air Pollution from Wildfires in the Western US under Climate Change*



Thanks!

Any questions?