2020 California Wildfires and Air Quality

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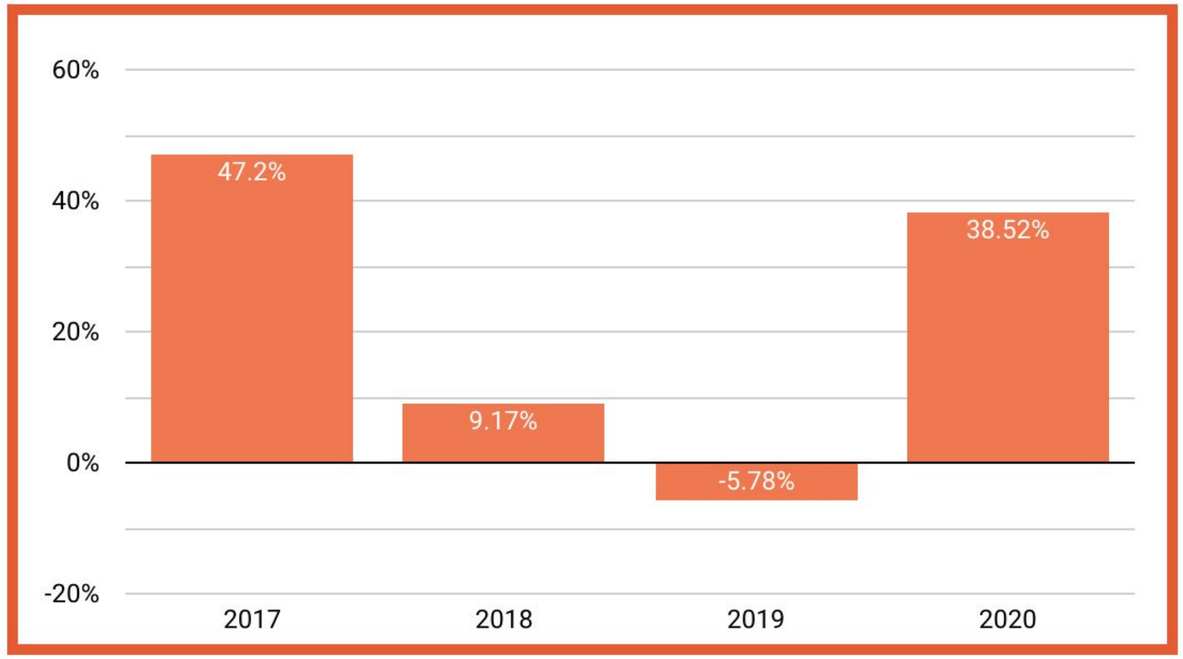
The year 2020 was the largest wildfire year recorded in California’s history.

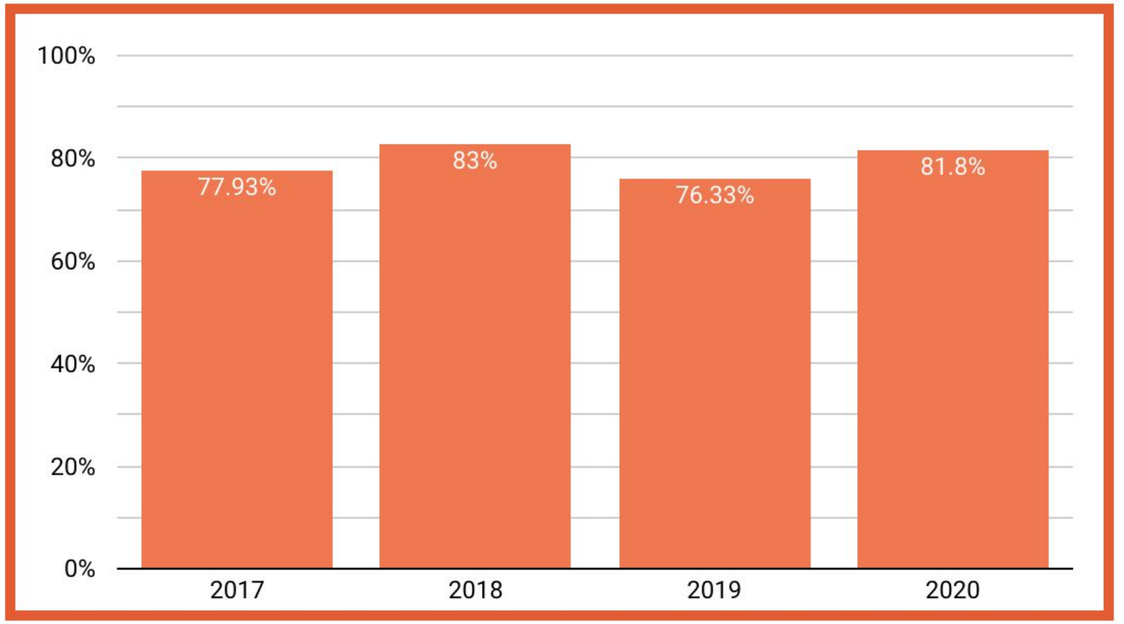
By the end of the year, 9,917 fires had burned 4,397,809 acres which accounts for more than 4% of the state's roughly 100 million acres of land.

Wildfires increase air pollution in surrounding areas, negatively affecting air quality. From eye and respiratory irritation to much more serious disorders such as lung disease, **the associated harm can linger long after the air even clears.**



California- Relative growth in Wildfires compared to 5 yr average

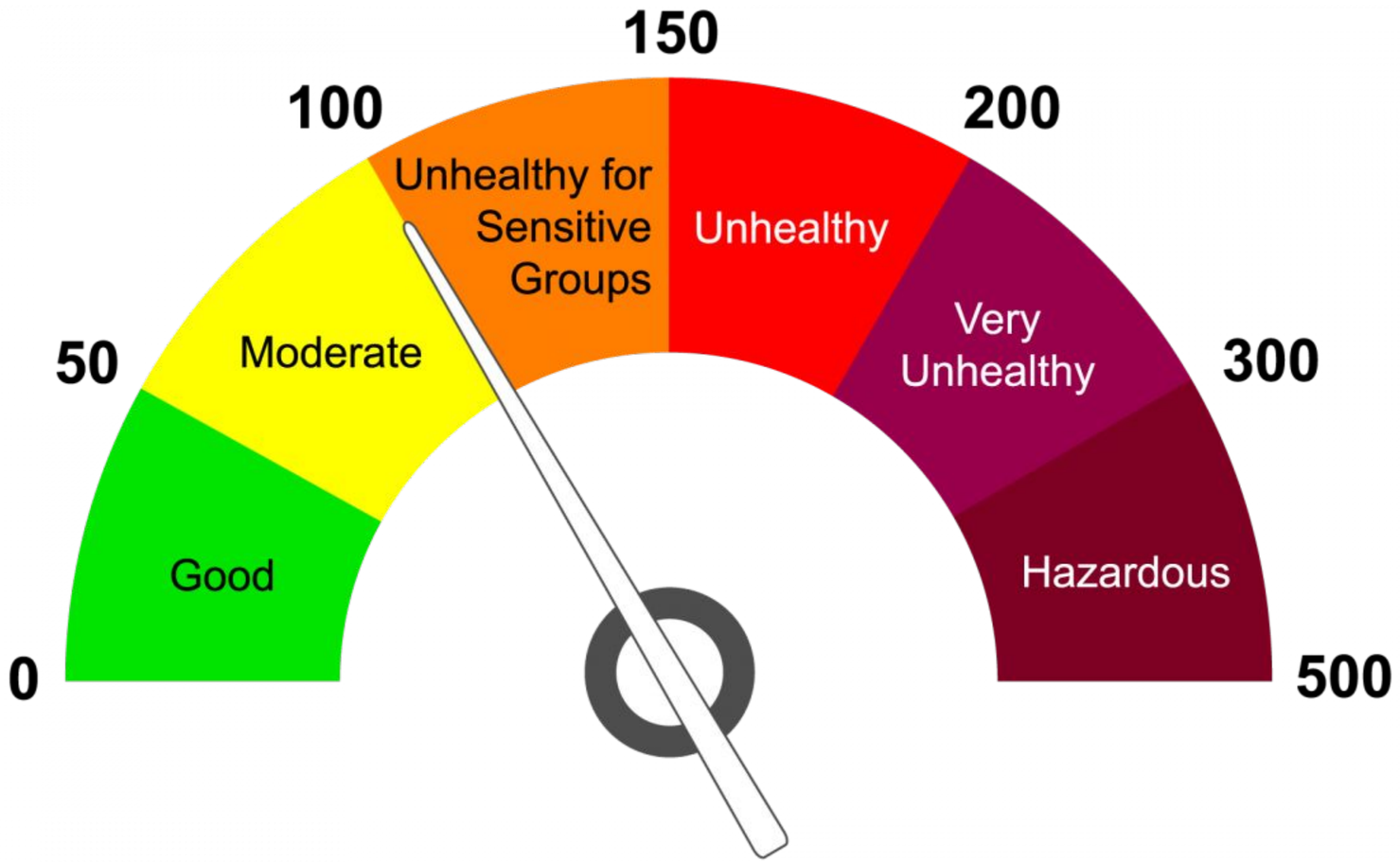
California- Share of wildfires in USA

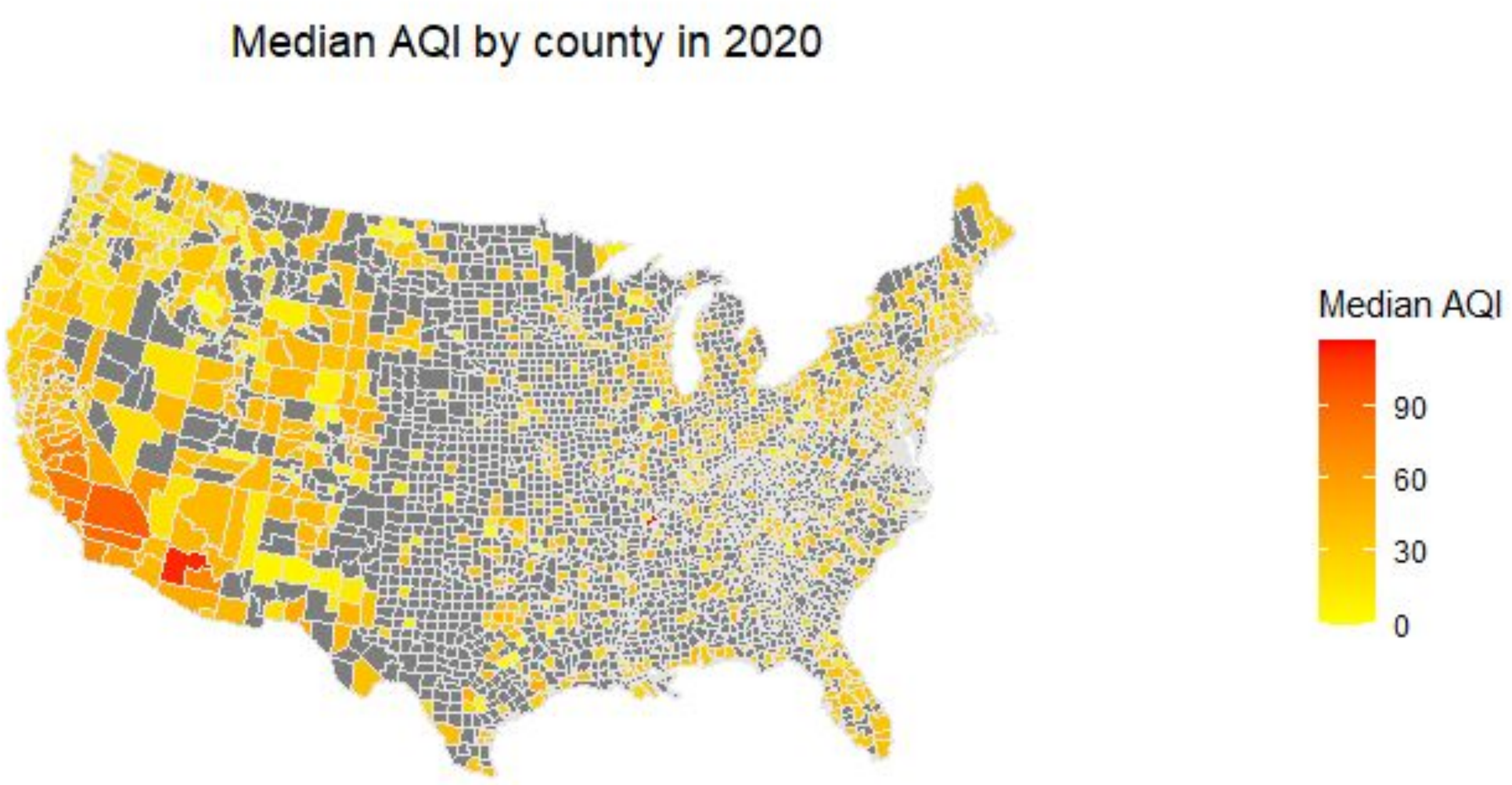


We will be looking at two research problems:

- How big of an impact has the California Wildfire 2020 season inflicted on the state’s air quality?
- How long does it take for air quality to return to normal after the start of a wildfire?

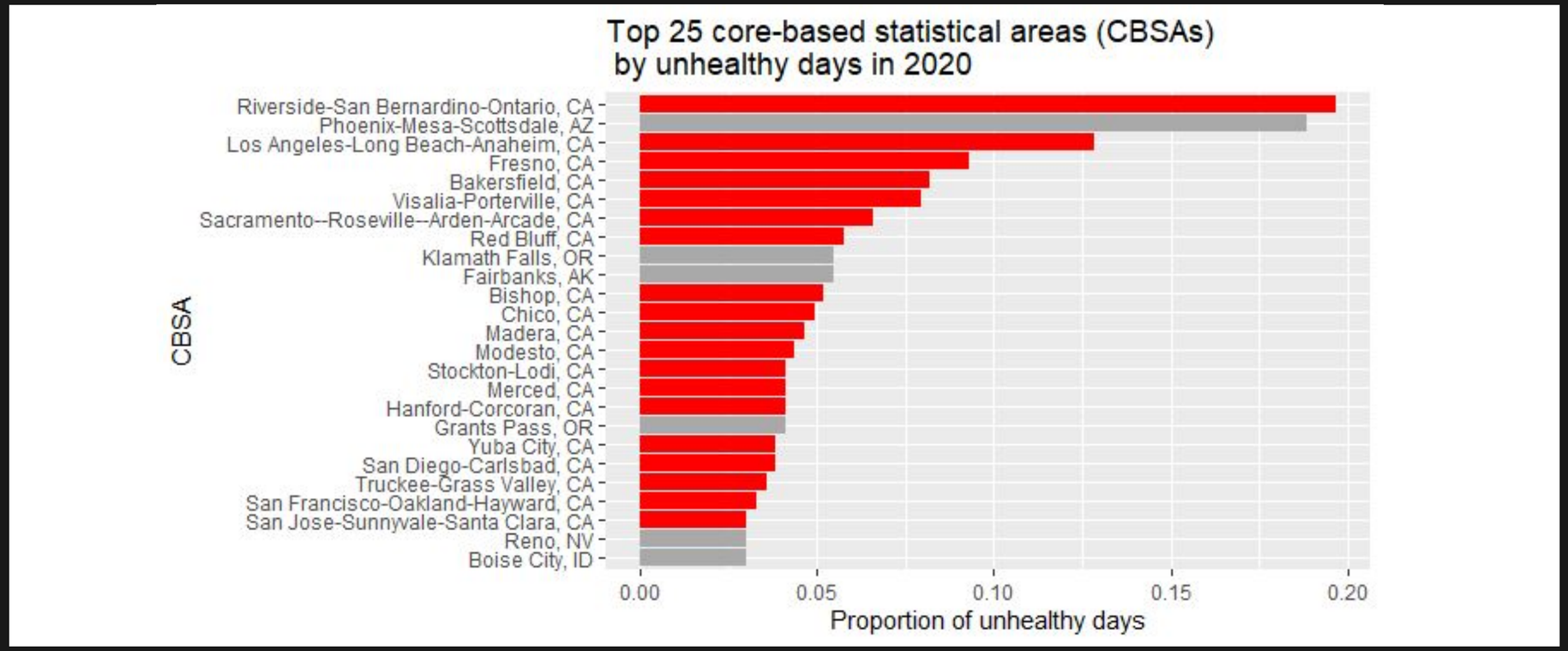
What is Air Quality Index (AQI)?

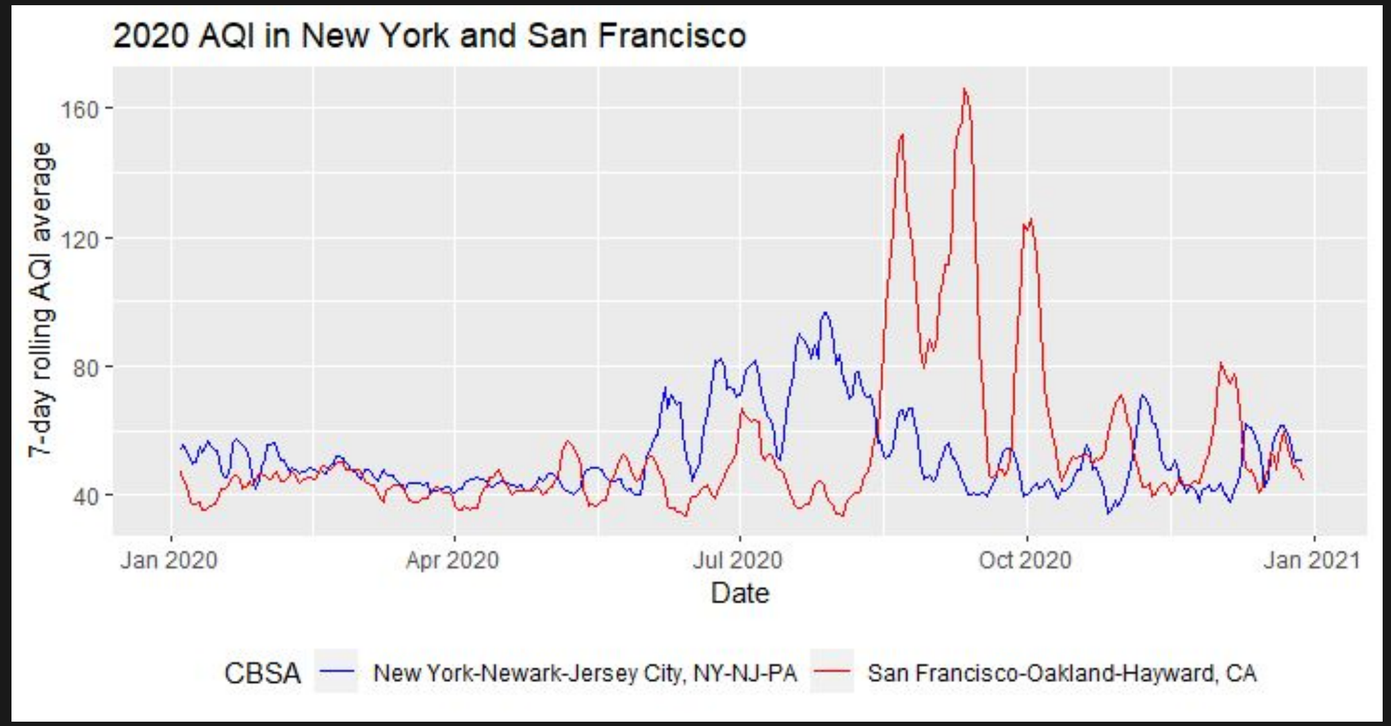




In 2020, median AQI indices were dangerously high in California counties.

Areas in California dominated the top 25 areas in the US with the highest proportion of “unhealthy” days

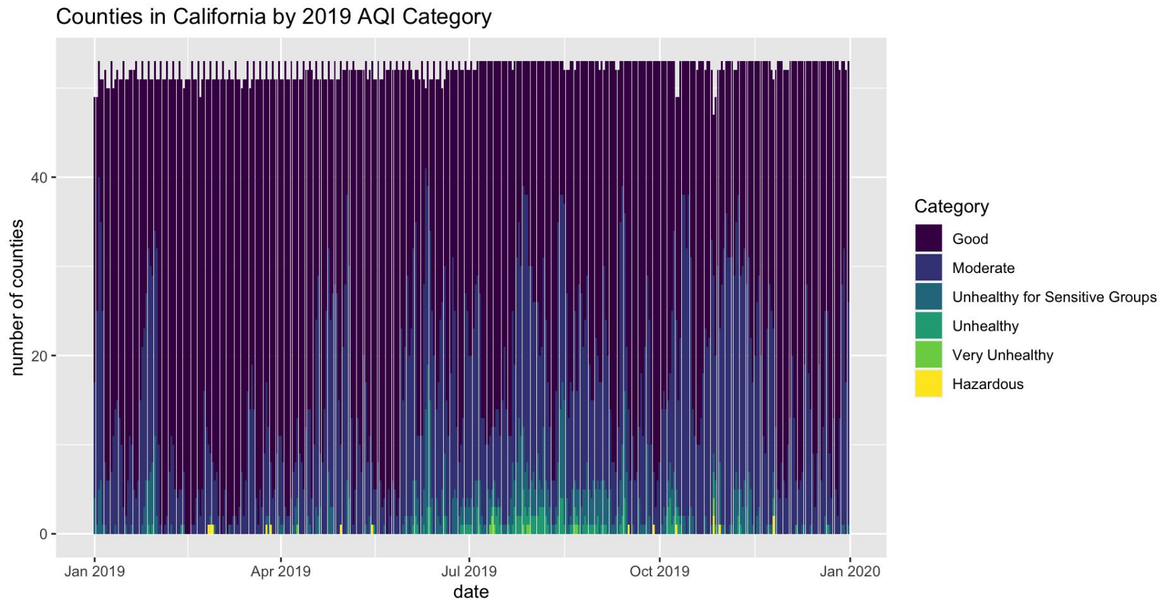


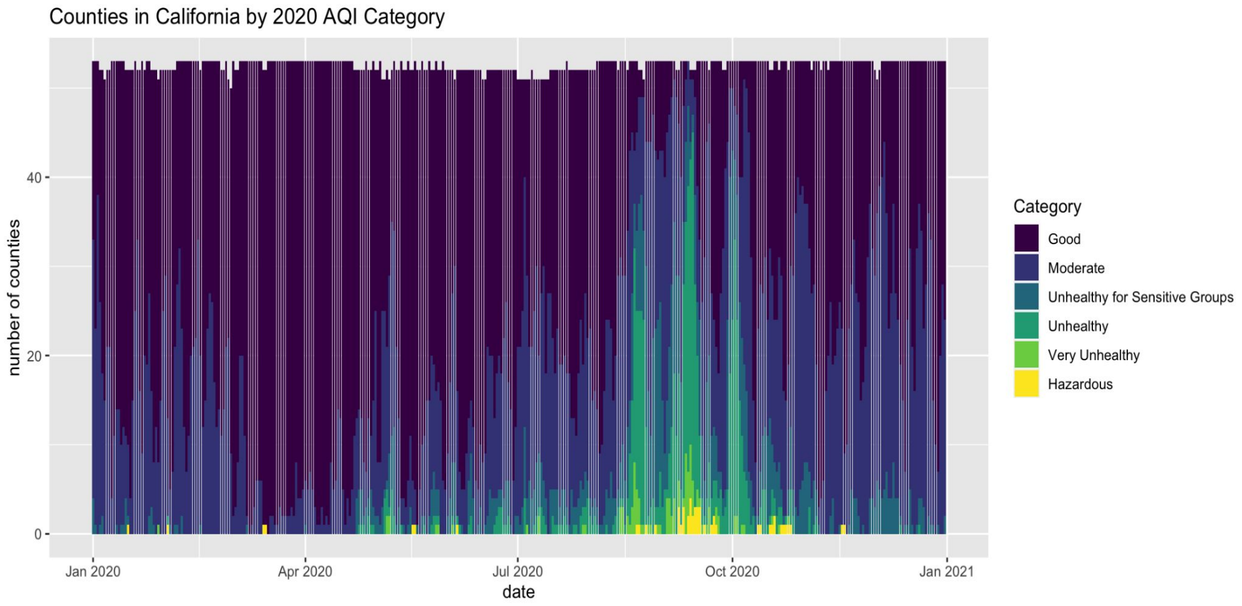


This is especially true from August onwards

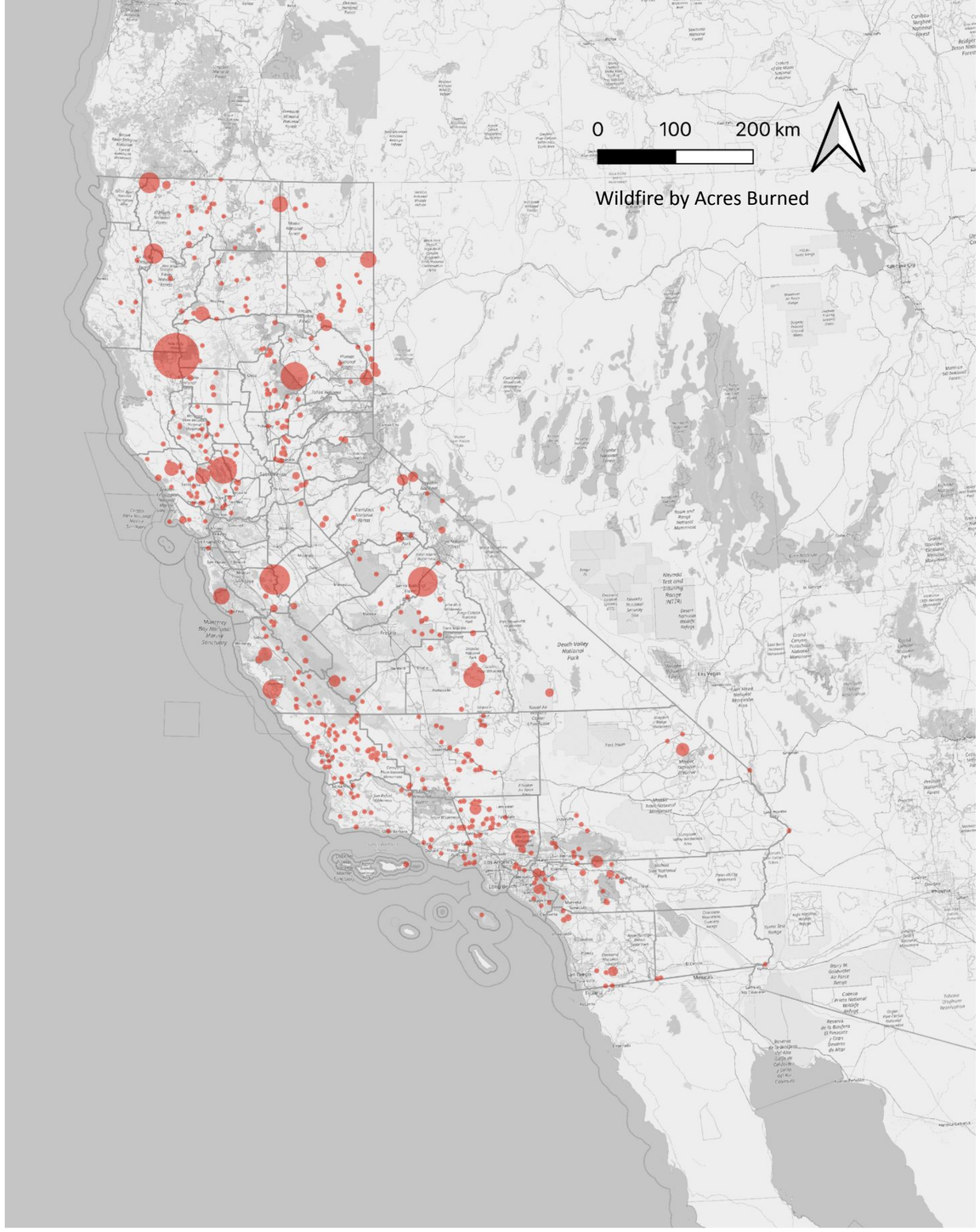
The increase is consistent with the California wildfire season between August and late October.

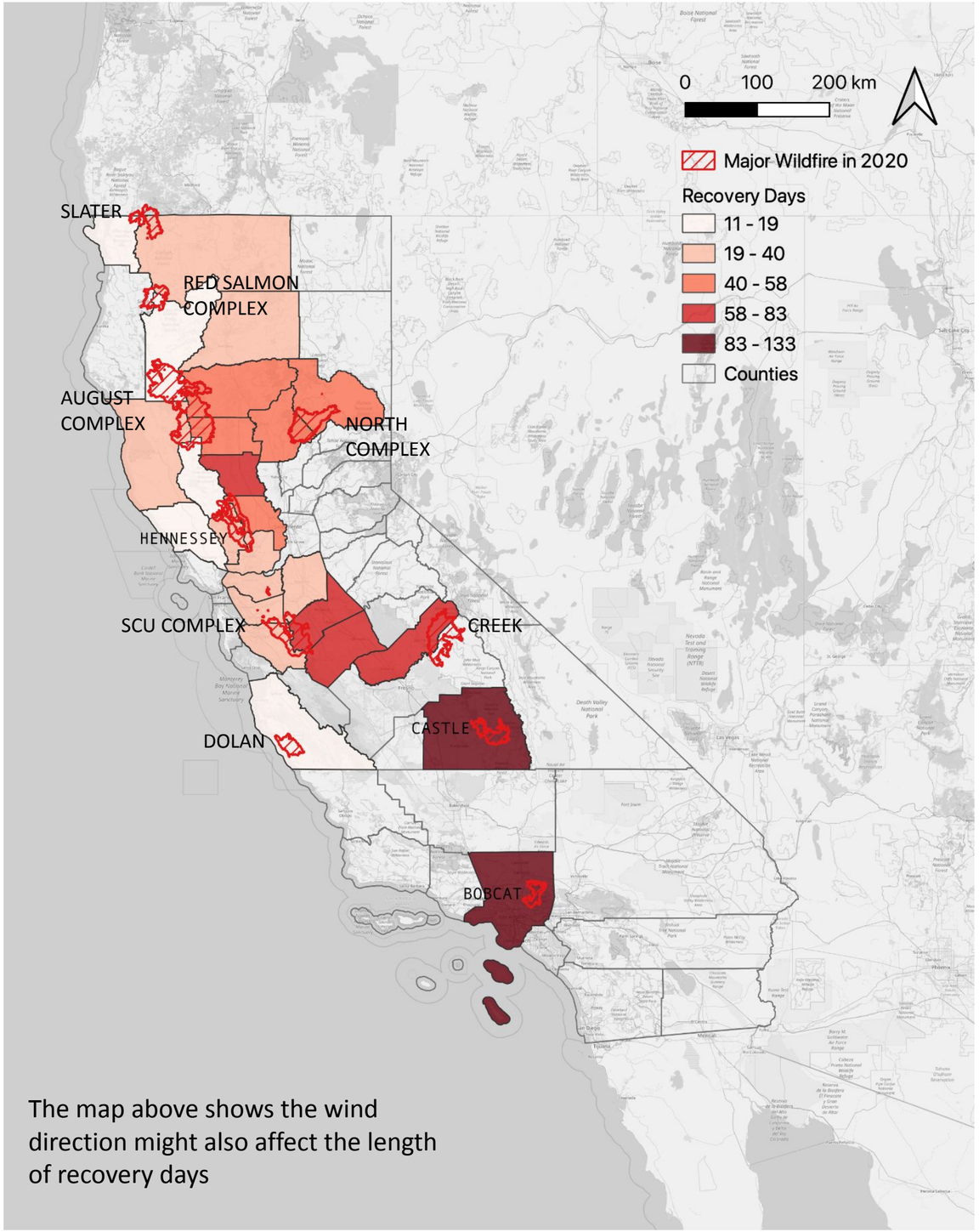
The daily index is worse compared to the year before





The number of days with counties having less than “Good” AQI increased significantly in 2020 from 2019.





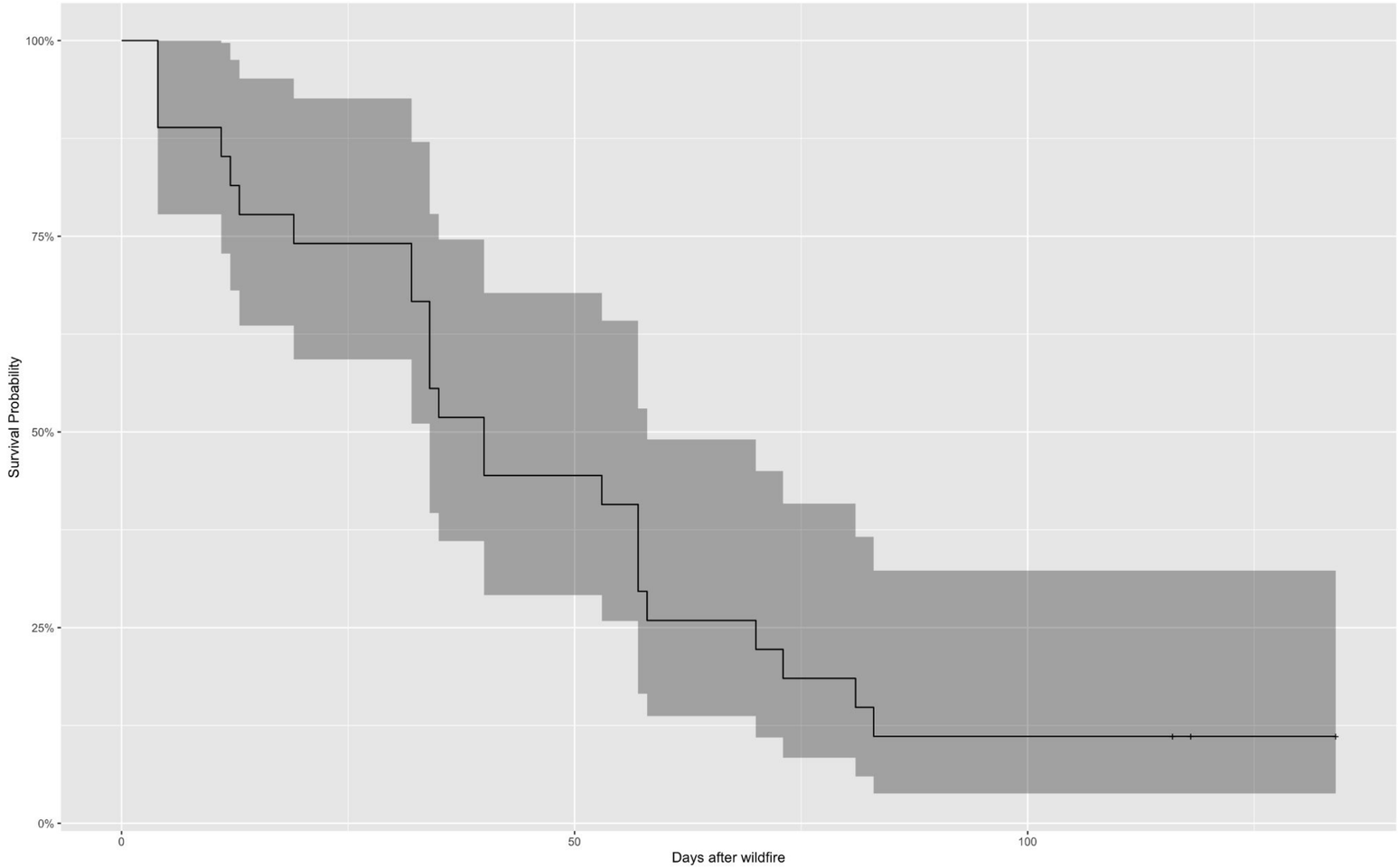
The map above shows the wind direction might also affect the length of recovery days

How long until the AQI is safe again?

We are looking at the survival analysis on how AQI is recovered for counties that are impacted by the top-10 wildfires in California.

It takes a long time for AQI to return to “Good”.

The recovery takes a long time for counties that are affected by the wildfires. Using Kaplan Meier Analysis we found that in day 30, the probability of a county to survive (in this case is **stay in bad AQI**) is 70%, indicating the probability to recover is after 30 days is only 30%



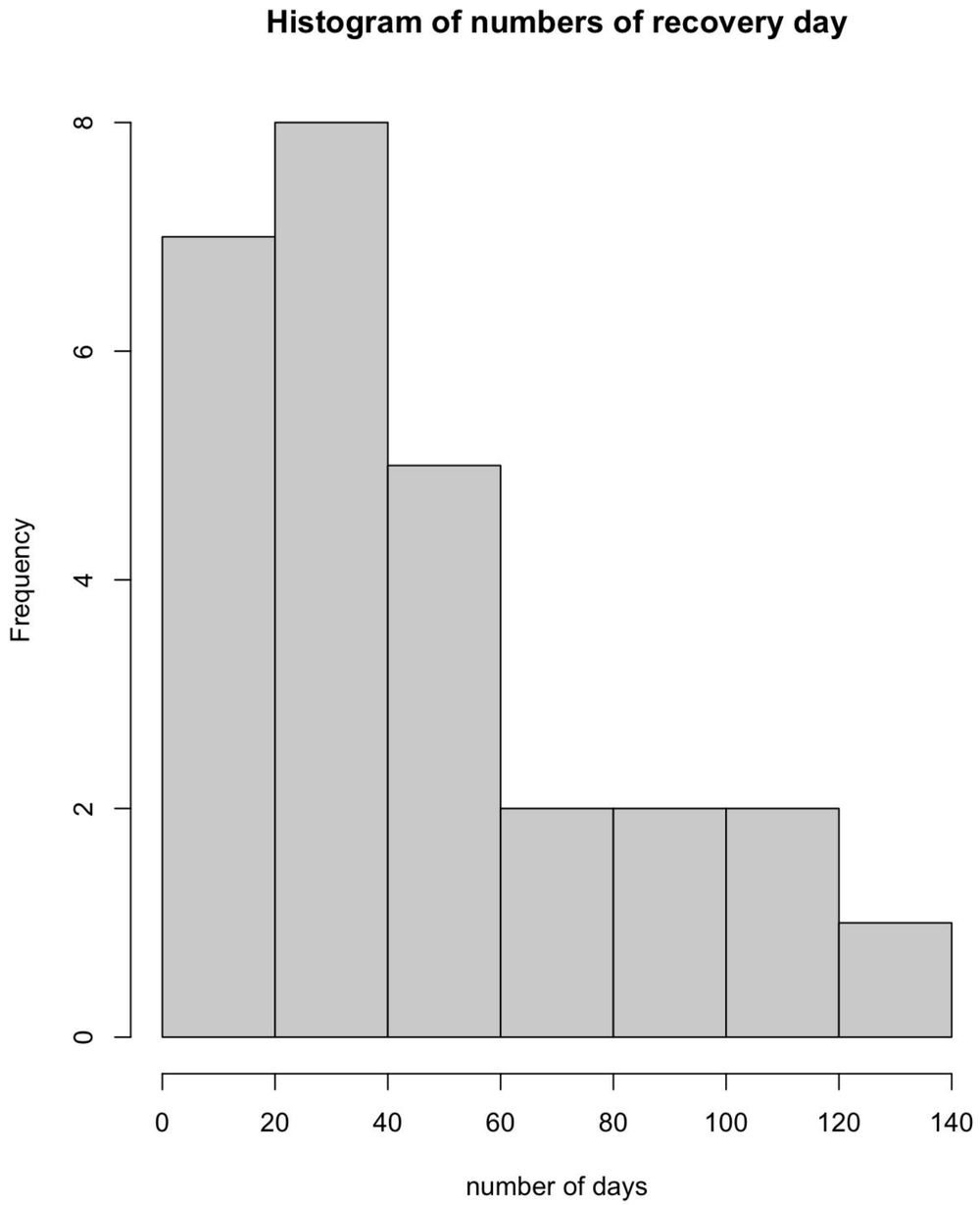
Population Density and AQI status in the last year makes good predictor of recovery days

1 population per area → 0.12% increase in likelihood of recovery

1 more unhealthy days in 2019 → 15% decrease in likelihood of recovery

Cox Proportional Hazards Model

	exp(coef)	lower 95	Upper 95	Pr(>|z|)
Duration until it is contained	1.0102	0.9886	1.0323	0.356
Number of counties affected	0.8363	0.5935	1.1785	0.307
Population density	1.0015	1.0001	1.0028	0.03*
No. of unhealthy days 2019	0.8334	0.7177	0.9678	0.0169*
Poverty rate	1.062	0.8798	1.2818	0.531



Distribution of recovery days is Poisson Distribution

Similar pattern is found when using Poisson regression

1 more unhealthy days in 2019 → 2.2% increase in number of recovery days

Regression of Recovery Day

	Dependent variable:			
	day_recover			
	(1)	(2)	(3)	(4)
unhealthy_2019	0.016***			0.023***
	(0.001)			(0.001)
day_until_containment		0.006***		-0.008***
		(0.001)		(0.001)
population_density			0.0002***	-0.0002***
			(0.00004)	(0.0001)
poverty_rate				0.007
				(0.011)
Constant	3.588***	3.428***	3.812***	4.078***
	(0.035)	(0.079)	(0.033)	(0.160)
Observations	27	27	27	27
Log Likelihood	-253.612	-396.551	-408.175	-231.001
Akaike Inf. Crit.	511.224	797.103	820.350	472.002
Note:				*p<0.1; **p<0.05; ***p<0.01

Conclusion + Policy Recommendation

Keeping the AQI index as low as possible in the present can help with recovery in case of wildfire.

Double down on policies to control air pollution, e.g. emission standards, as forest fires become more common and severe with climate change.

More studies need to be done to determine the actual effect of other variables on number of days to recovery.

Thank You

Reference

- Air Quality Data from United States Environmental Protection Agency
- California Land Area County Rank (source)