



The byproducts of wildfire:

- particulate matter
- carbon oxides (CO_x)
- hydrocarbons
- Water vapor
- other organic chemicals
- nitrogen oxides
- trace minerals

A photograph of a lush green tropical forest. In the lower-left and central areas, thick white and grey smoke is rising from the ground, partially obscuring the dense foliage. The smoke appears to be coming from a fire, possibly a controlled burn or a wildfire. The trees are tall and have thick canopies. The overall scene suggests a natural event occurring within a forested area.

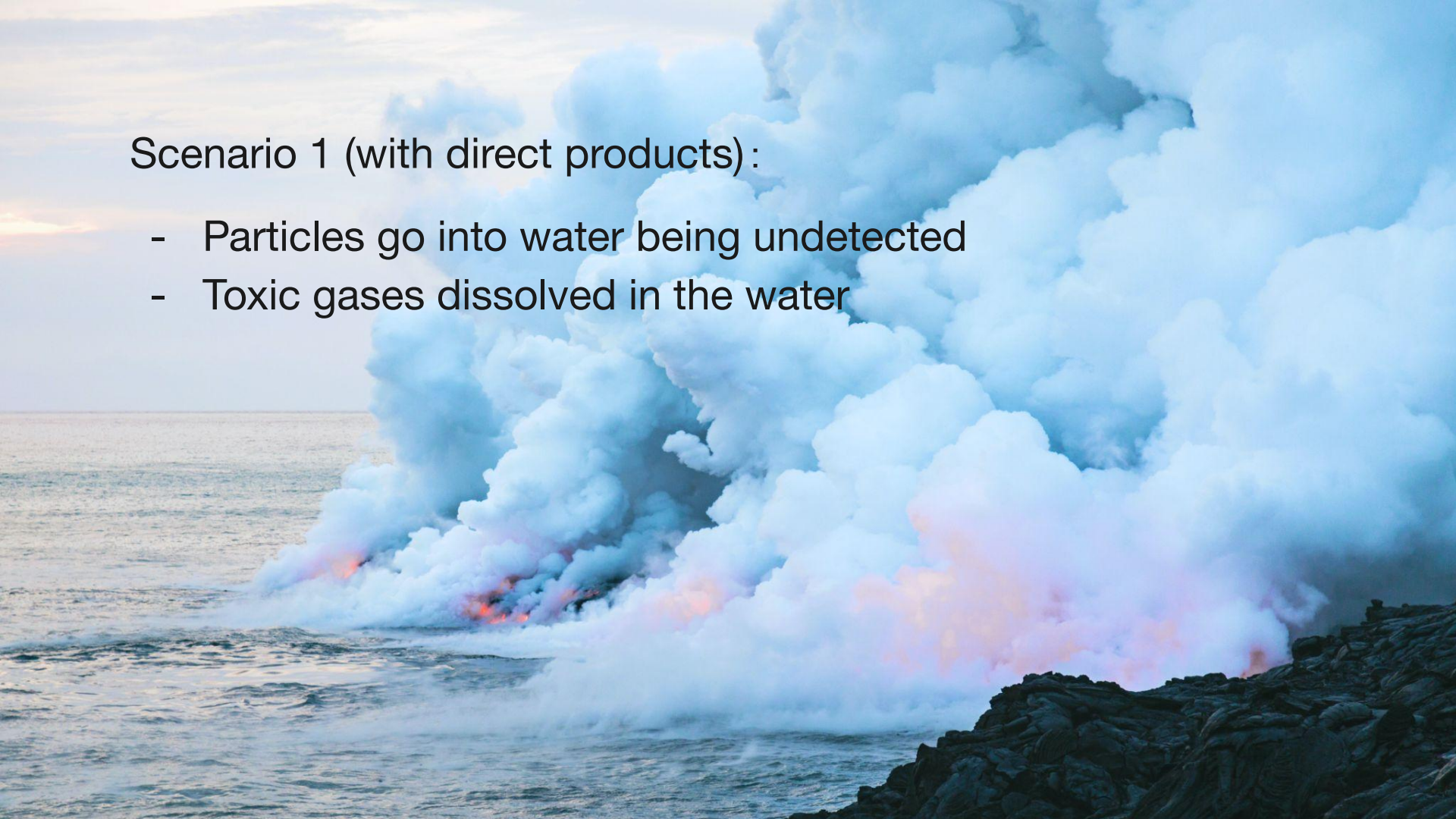
Sources of toxic substances:

- Wildfires in the city
- Smoke from wildfires in nearby cities

But they are not there just for the fire season!

Scenario 1 (with direct products):

- Particles go into water being undetected
- Toxic gases dissolved in the water



A photograph of a large fire burning on a city street. The fire is intense, with bright orange and yellow flames rising from a pile of debris. Thick black smoke billows upwards from the fire, filling the upper portion of the frame. In the background, several people are visible, some standing and others moving, suggesting an emergency response. There are cars parked or stopped on the street, and buildings line the sides. The overall scene is one of a major urban fire incident.

Scenarios 2 (with less direct products):

- through burning materials and turning into Volatile Organic Compounds (VOC)
- Burned plastic get into water
- Cable that powers water systems get melted
- Water tank gets overheat due to fire

A photograph of a large fire burning on a city street. The fire is intense, with bright orange and yellow flames rising from a pile of debris. Thick white smoke billows upwards from the fire, partially obscuring the sky. In the background, several people are visible, some standing and others moving. There are cars parked or driving on the street, and buildings line the sides. The overall scene suggests a major incident or protest.

Focus of this analysis:

- Concentration of compounds that could get into the water system in different ways
 - HAA5 (VOC)
 - Nitrate (through air)

Correlation between Concentrations of Compounds in the water system and

- GIS_Acres (year average)
- 0.41
- Count of Fires in the year
- 0.55
- AQI_Gas (year average)
- 0.74

- Avg_distance (miles) (year average)
- -0.84
- Count of Fires in the year
- 0.67
- AQI_Gas (year average)
- 0.38

Weighted HAA Count (mcg/L)	
Year	0.372843
avg_distance (miles)	-0.219202
GIS_Acres	0.412659
Count	0.550811
Estimator	0.564357
Mean_Water_Discharge	-0.279302
AQI_Particle	-0.098744
AQI_Gas	0.741473
Weighted HAA Count (mcg/L)	1.000000

Weighted Nitrate Means (mcg/L)	
Year	0.338557
avg_distance (miles)	-0.844739
GIS_Acres	-0.079851
Count	0.669609
Estimator	0.672903
Mean_Water_Discharge	-0.264754
AQI_Particle	-0.167777
AQI_Gas	0.379603
Weighted Nitrate Means (mcg/L)	1.000000



Hypotheses from the Analysis with Correlation

- The count of fires over the year has relatively high correlation
- Area might play a greater role in having more VOC in the water
- Average distance might play a greater role in carrying toxic gases



Determining New Estimator

Let A = Average Distance in Miles

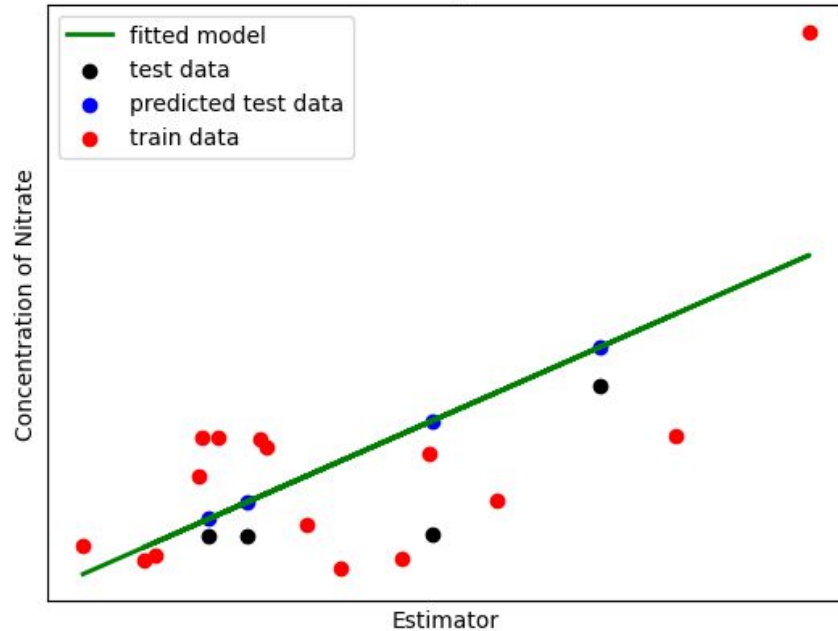
Let B = Average Acres Burned

Let C = Count of Fires

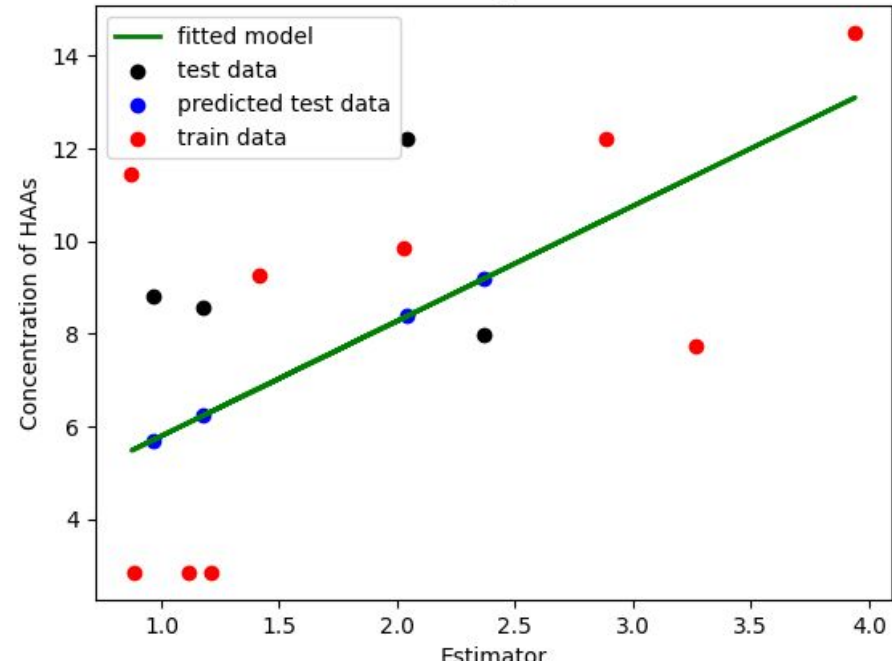
Estimator = `pd.Series(B*C**2/np.sqrt(A)/1e7)`

Fitted Models

Fitted Linear Regression Model

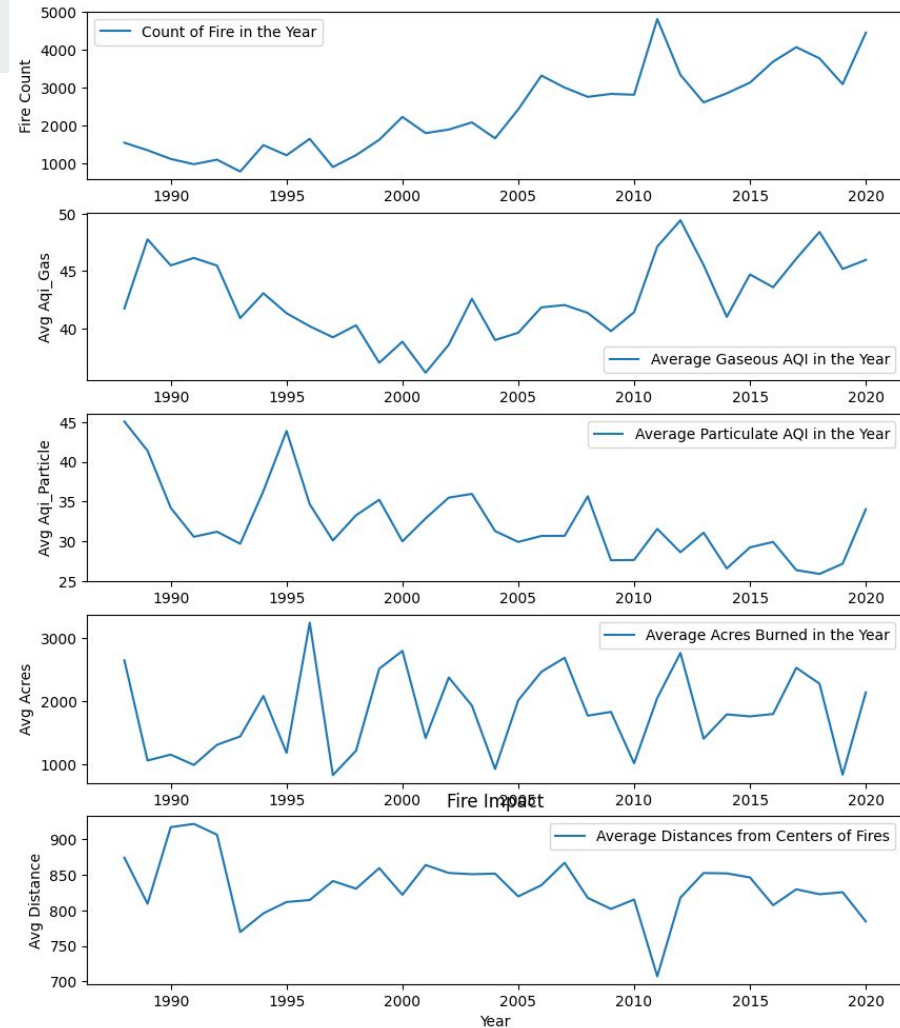


Fitted Linear Regression Model



Conclusion

- Growing trend in the yearly count of fires could make the concentration of toxic compounds in water system higher
- Long-term exposure to toxic chemicals could lead to higher risk of cancers
- Purification should be placed more in water system after fire seasons





Possible Issues with the Analysis

- AQI data was collected from sites in nearby city
- The data about concentrations has only quarterly or yearly data, and are limited (since late 1990s)
- Hard to determine how long do the compounds stay in water
- Estimator for new models needs further tuning and to distinguish from each other