

# Atmospheric Quality vs. Corn Quality Over Time

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Dataset Sources: U.S. Environmental  
Protection Agency, U.S. Department of  
Agriculture



# Motivations/Data



Environmental pollution is a pressing issue with varied effects; we sought to characterize air pollution and its effect on crop health

1. How has the concentration of atmospheric pollutants changed over time?
2. In what ways do geography and human activity affect air pollution levels?
3. How has corn crop quality changed over time?
4. Can a relationship be observed between atmospheric and corn crop health over time?

To answer this, we looked at data from the last 30 years in the U.S.

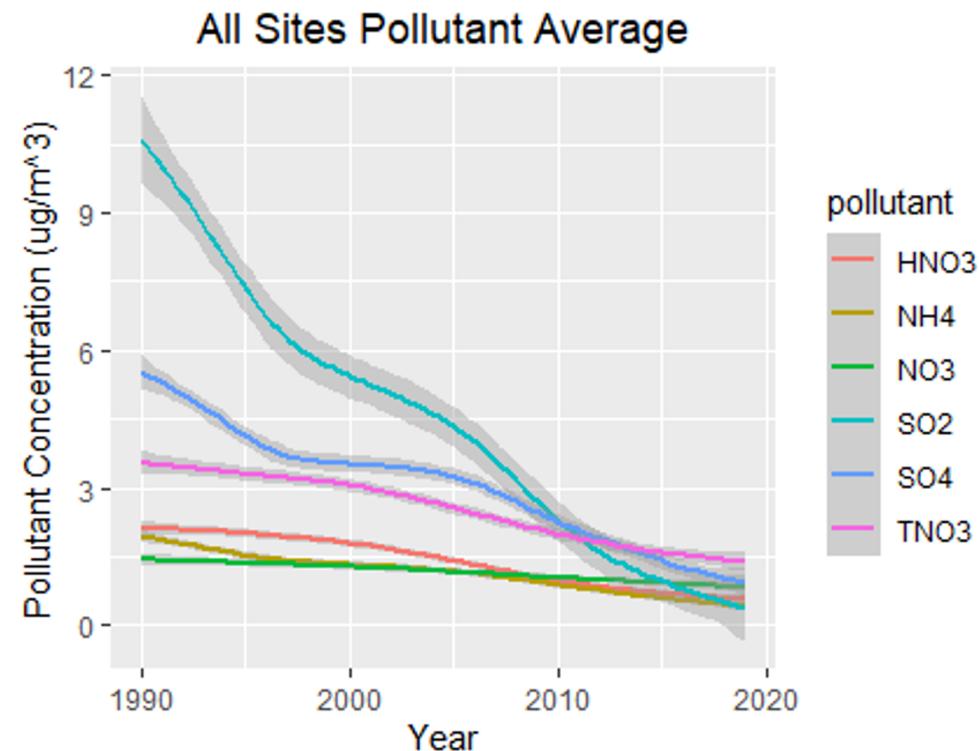
EPA CASTNET - Atmospheric climate and pollutant data  
- 19,754 observations of 17 variables from 54 sites

USDA - NASS - Weekly corn crop quality data  
- 79,389 observations of 13 variables from 45 states

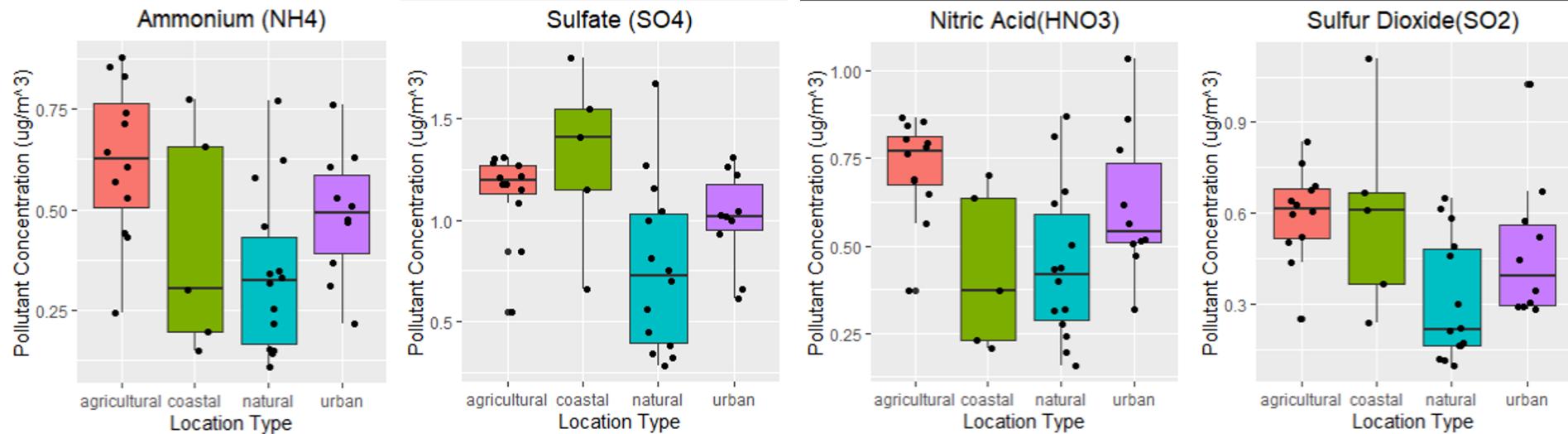
# 1. Atmospheric Pollutants Over Time

Most notable man-made pollutants are recorded. The output of these pollutants are almost entirely man-made, and are responsible for reduced air quality, acid rain, and environmental damage.

Overall, the concentration of pollutants in U.S. air has dropped steadily since 1990 due improved green technology and environmental regulations, but how do pollutants vary due to local geography and human activity?



## 2. Notable Pollutant Concentrations in 2019 based on location type



To analyze the impact of human activity on air pollutants, we separated the data by location type. Natural areas are defined as those away from human settlements, such as forests and national parks. In general, coastal sites have the greatest variance in pollutants. Pollutant types reflect human activity; for example, sulfur dioxide, an automobile pollutant, is lowest in areas with few roads (natural areas), while ammonium, a major component and by-product of crop fertilizers is highest in agricultural sites.

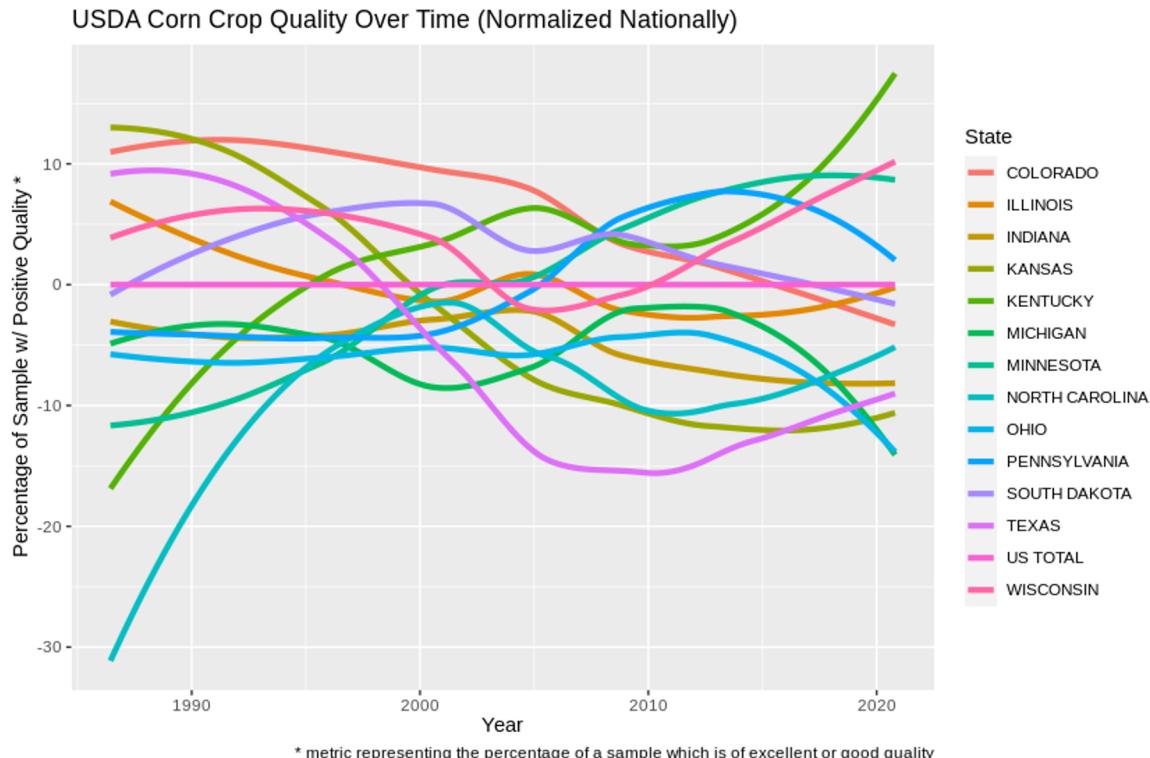
# 3. Corn Quality Over Time

The USDA takes weekly samples of corn crops from around the country and sorts into 5 quality categories

Here, we engineer a metric which represents each state's performance in growing “excellent” or “good” quality corn (relative to the national average)

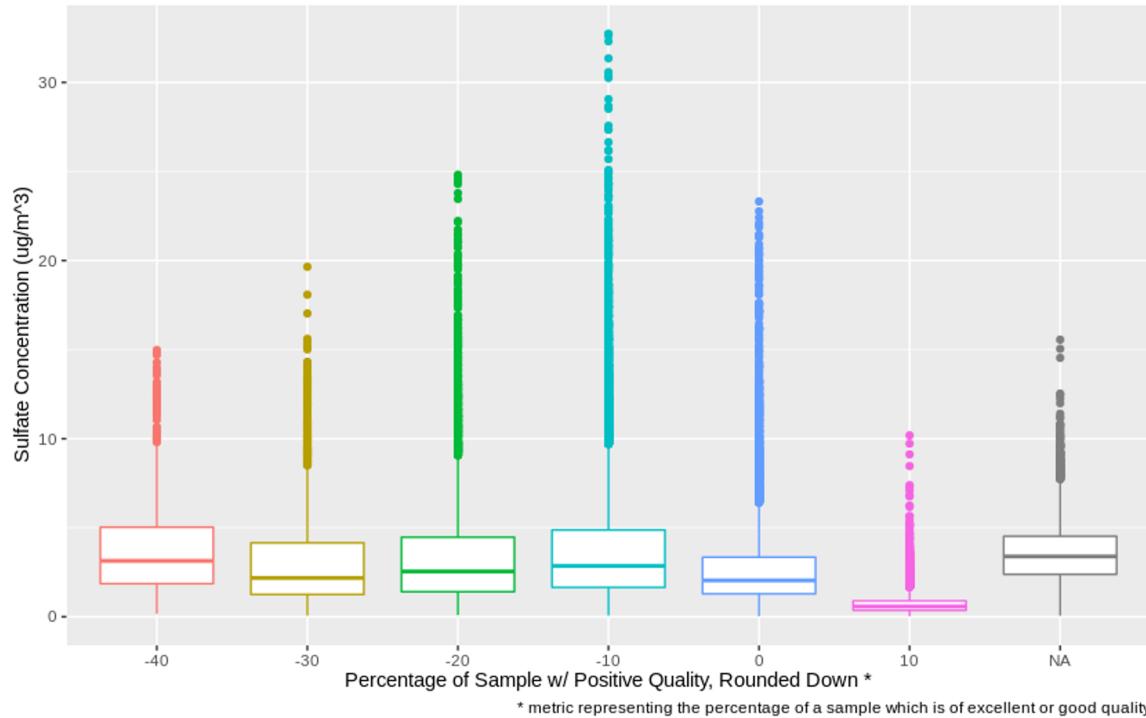
Using this, we can see which states under- or over-perform in corn quality over time (relative to the national average)

- *Can this be correlated to any external conditions?*



# 4. Atmospheric vs. Crop Quality (Example)

Distributions of Sulfate ( $\text{SO}_4$ ) Concentrations Grouped by Crop Quality



There were a number of weak correlations between our crop quality metric and the atmospheric pollutant concentrations

Here, we see a sample relationship between **low sulfate concentrations and high crop quality**

- *Inverse relationship*
- *Only at high crop qualities (those at least 10% above the national average)*

It is possible that this could be attributed to lower acid rain levels

# Ideas for Future Work

1. What role do climate and weather conditions play in air quality and pollutants?
2. To what extent is the concentration of nitric acid and sulfates in the atmosphere responsible for acid rain? How has human activity changed these factors? Is acid rain another way corn quality is affected by man made pollutants?