Atmospheric Impacts in a Semi-Arid Climate

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Abstract

The goal of this research is to acquire a better understanding of how air quality is affected by population growth, climate, and other factors in the Boise Metropolitan area. This research is relevant as it assesses the concentration of harmful particles in the air, specifically those under ten microns in diameter (PM2.5 and PM0.3-2.5). Due to the small size of these particles, they are extremely harmful to the human body. PM2.5 is under 2.5 microns in diameter which enables it to become lodged deep in the lungs.

Relevance

PM2.5 lodges in the lungs and is absorbed into the bloodstream.
PM0.3-2.5 are combustion particles (car and factory emissions).

Our Question

If the amount of PM in the air of the Boise Metropolitan area has increased over the past three summers, is population growth correlated?

Methods

MOUDI
What: Two, Eleven-stage Micro-Orifice Uniform Deposit Impactors (MOUDI)
Where: The roof of the Experimental Watershed Building at Boise State University
When: June and July of 2014-2016
PM Diameter Ranges:
- Stages 2-11 collect particles with diameters less than or equal to 10 µm
- Stages 5-11 collect particles with diameters less than or equal to 2.5 µm.

What is AQI? AQI was established by the US EPA and stands for Air Quality Index. The index transposes the concentrations of PM2.5 onto a scale ranging from 0-500, where values greater than 100 are considered unhealthy.

Where: Dry Creek Experimental Watershed in the Boise Foothills.
When: The masses of PM were collected from each of these locations over June and July of 2014-2016.
Why: To compare the atmospheric impacts in rural and urban semi-arid environments.

Who: Other data was obtained for comparison from the EPA, US Census, and the Boise State Geoscience database.

Our Question

If the amount of PM in the air of the Boise Metropolitan area has increased over the past three summers, is population growth correlated?

Project Results

Population Growth

60,248
The Total Population Change for the Boise Metro Area from 2010 to 2015
10,058
The average Total Population Change per year for the Boise Metro Area from 2010-2015
88.5%
The percentage of workers in the Boise Metro Area who commuted to work in an automobile in 2013

PM2.5 AQI Averages

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
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<tr>
<td>2014</td>
<td>38.4</td>
<td>30.0</td>
<td>29.6</td>
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<tr>
<td>2016</td>
<td>47.8</td>
<td>35.4</td>
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</tr>
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Conclusions

- June and July of 2016 had the highest number of Moderate AQI days when compared to 2014 and 2015.
- Initial air quality values were the worst in 2016. However, because summer of 2015 started out with the best air quality, one cannot associate population growth with greater AQI values.
- The average amount of PM2.5 is highest for Summer of 2016.

Acknowledgements

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Actions & Recommendations

Immediate Action
Educate the public on the causes of PM2.5, the negative effects it has on the human body, and ways to reduce it.
Possible Correlations
Natural: wind, topography
Mannmade: population growth, growing vehicle use, factory practices

Shift in Thinking
Encourage the community to recognize that cleaner air is important and obtainable.

Future Planning
Assess correlations and develop solutions. Incentivize factories and vehicle buyers to lower their harmful emissions.