



Spatial Analysis of Residential Zoning Classifications and their Colocation with Microclimate Externalities



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Impetus for Research

- There is little to no research studying correlations between zoning and air pollution in American Cities
- This research fills a sizeable gap in existing literature
- Philadelphia is one of the most polluted cities in the nation, though air quality has improved from industrial levels in the early twentieth century
- Air pollution in Philadelphia today is mostly emitted from transportation (largely automobiles) and buildings
- Zoning plays a significant role in dictating transportation patterns (through density, street design, etc.) and the structure of buildings (through setback requirements, height restrictions, etc.)



<https://www.gettyimages.com/detail/stock-photo/Philadelphia-PA-USA-02042014-0016482221-Aerial-Exposure-Building>

Policy Recommendations

- As PM_{2.5}, PM₁₀, and CO₂ emissions largely come from vehicular sources, it is important to reduce vehicle miles traveled (VMT) and switch to low-emission transportation means in neighborhoods currently subjected to elevated air pollution levels. Lowering VMT is best done by providing fast and efficient alternative modes of transport and creating more walkable or bikeable neighborhoods. By introducing mixed-use zoning to neighborhoods now exclusively zoned residential or commercial, walking and biking can become more convenient. Connecting the most walkable and bikeable nodes of the city via public transportation is also vital for more long-distance travel. One example of this is the proposed Roosevelt Boulevard Subway in North Philadelphia.
- Another possible method of mitigating air pollution is through the planting of trees in neighborhoods subjected to elevated air pollution levels, as our preliminary analysis of the data shows correlation between tree cover lowered levels of PM_{2.5}, PM₁₀, and CO₂. Greenery can be introduced within neighborhoods or act as a buffer between neighborhoods and major pollution sources such as highways or waste disposal sites.

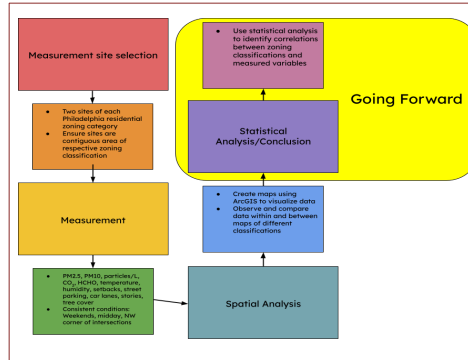


<https://photos.state.gov/libraries/pennsylvania/18893> The Urban Forest: More Trees Please Campaign Underway to Increase Philadelphia's Canopy

Research Questions

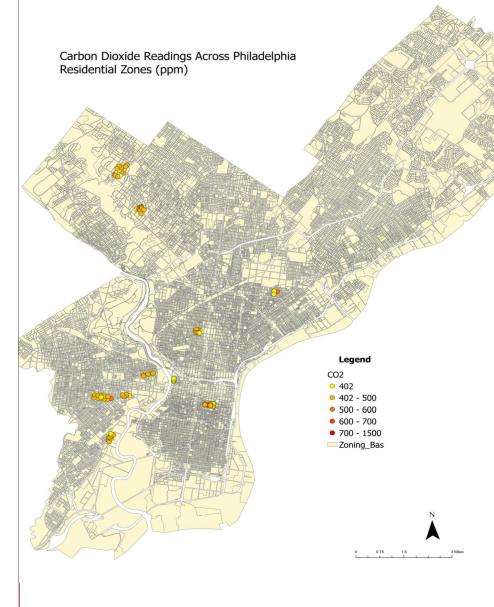
- How do residential zoning classifications correlate to air pollution and other conditions (e.g. street design, setbacks, building height, tree cover)?
- Is Philadelphia's current distribution of residential zoning reflective of environmental conditions?
- Going forward, can modifications to residential zoning classifications help neighborhoods mitigate the effects of air pollution?

Methodology



Outcomes

Carbon Dioxide Readings Across Philadelphia Residential Zones (ppm)



Observational Findings

Neighborhood	Average CO ₂ (ppm)	CO ₂ ranking	Front yard	Tree Cover (none/partial/full)	Street parking (one/ both/ no sides)	Residential Zone
Kensington	760.5	1	Concrete	None	Both sides	RSA-5
Center City	453.2	2	Concrete	Partial	One side	RM-4
Upsal	434.0	3	Grass	Complete	Both sides	RSD