Tufts

Re-Thinking Environmental Justice: Expanding Zones of Vulnerability

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Background

In Massachusetts, the state evaluates the environmental injustice risk of a town by taking into account three factors[1]:

- Annual median household income is equal to or less than 65% of the statewide median
- 25% or more identify as minority
- 25% or more households having no one over the age of 14 who speaks English only or very well

Literature suggests that prioritizing efforts is critical to creating effective solutions.[2,3] How could we expand these parameters and understand how to prioritize our efforts? The following research aims to create a new environmental justice (EJ) risk assessment model to include the following criteria: percent of children under 4 years old with blood lead level greater than 5 µg/dL[4,5], amount of open space per person[6], population density, and percent of industrial land use.[7] How will communities be categorized if we include additional criteria? What communities are currently the most vulnerable for an environmental injustice? Would this change if we included additional criteria?

The focus for this research in Suffolk County, Massachusetts with a 5-mile buffer as there is a high concentration of EJ communities in this area.

Methods

Step One: Gathered, managed, and cleaned up data

Step Two: Sorted each data layer by Town (Joins, Clip, Union)

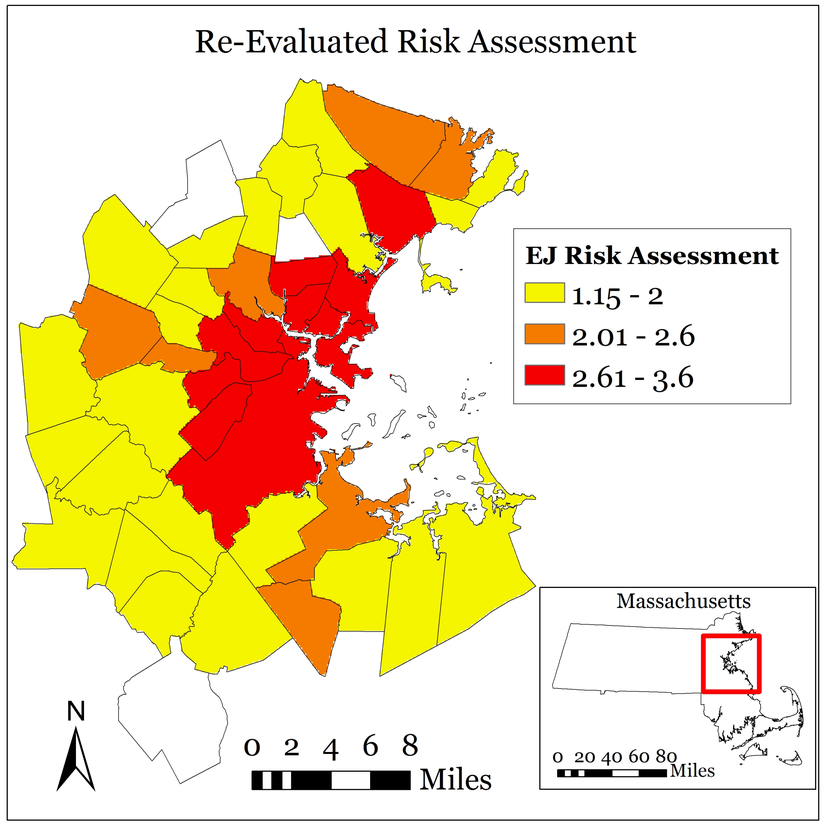
- I re-classified the Current EJ Criteria to High, Medium, and Low by taking into the account towns with high, medium, and low risk block groups.
- Open Space area by Town was calculated, then divided by the population of each Town to get Open Space Per Person

Step Three: Converted vector layers to rasters (Convert Polygon to Raster)

Step Four: Reclassified each raster layer to a ranking system for final risk assessment (Reclassify)

Step Five: Used the Raster Calculator Tool to create a new raster taking into account additional risk factors using the following weights: Current Risk (40%), Percent Blood Lead Level Greater than 5 µg/dL in children under 4 (15%), Population Density (15%), Percent Industrial Land Use (15%), Acres of Open Space Per Person (15%)

Step Six: Re-Evaluated High, Medium, and Low Risk communities



Medium Risk Communities

Medford	Waltham
Peabody	Watertown
Salem	

High Risk Communities

Brookline	Lynn
Boston	Malden
Cambridge	Revere
Chelsea	Somerville
Everett	

Results & Limitations

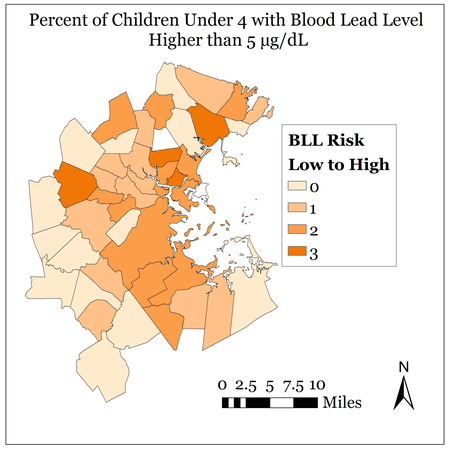
My final result was a raster for a re-evaluation of environmental injustice risk for the study area. I was interested in looking at which communities changed from/to low, medium, and high risk. The following communities changed risk levels: Salem (High to Medium); Watertown (Low to Medium), Quincy (Medium to Low). Although only a selection of communities changed risk levels, it is still important to think about when exploring funding opportunities. With the inclusion of more criteria, communities are able to apply for a more diverse group of grants and other sources of funding. Bringing these additional criteria in also serves as a platform for conversations about prioritizing efforts within communities with state government assistance.

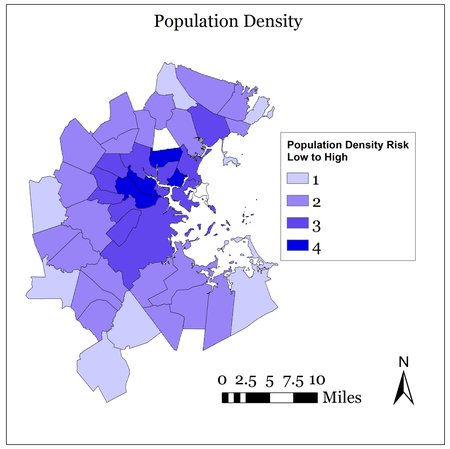
One flaw in this research is the level at which the data is available. The additional criteria is not publicly available on a block group level or census tract level. It is available on a Town level, therefore, I chose to generalize and evaluate each town's EJ Risk as a whole. This re-prioritization would be more effective if this data were available on a smaller scale, so as to align with current Environmental Justice criteria. Also, I would like to recognize that Boston was not broken up into neighborhoods, which could easily skew my results. In the event that we were to re-evaluate just Boston, this information could be gathered by neighborhood, presenting more accurate results. A source of error in this research is that there was an issue gathering data for the town of Melrose. Because some data were unavailable, I chose to leave Melrose out of the final calculation.

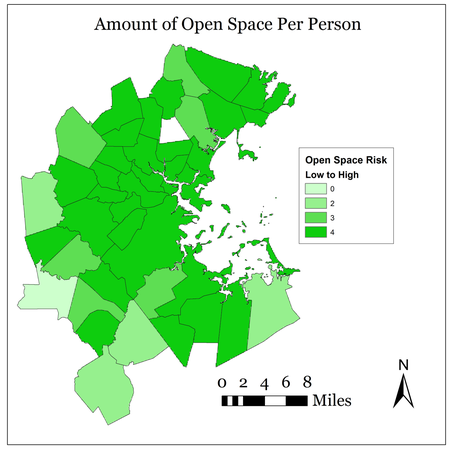
Sources

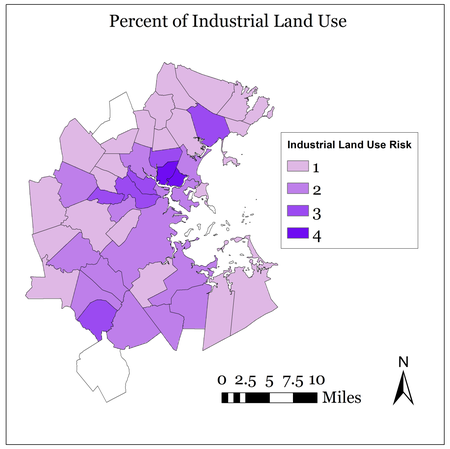
1. Environmental Protection Agency. (2016). Environmental justice timeline. Accessed December 2016 from https://www.epa.gov/environmentaljustice/environmental- justice-timeline
2. Faber, Daniel and Eric Krieg. October 2005. "Unequal Exposure to Ecological Hazards 2005: Environmental Injustices in the Commonwealth of Massachusetts. Executive Summary." Philanthropy and Environmental Justice Research Project of Northeastern University, pp. iii-vi, 1-11
3. Faber, Daniel, Penn Loh, and James Jennings. November 2002. "Environmental Injustices in Massachusetts: Forging Greater Community Participation in the Planning Process." *Projections: MIT Journal of Planning*, vol 3:1, pp. 109-131.
4. Massachusetts Department of Public Health. (2015). Screening and prevalence of childhood blood lead levels for children 9 months to less than 4 years of age by community.
5. World Health Organization. (2016). Lead poisoning and health. Accessed December 2016 from https://www.ncbi.nlm.nih.gov/pubmed/19121124
6. Berman, M., Jonides, J., and Kaplan, S. (2008). Cognitive benefits of interacting with nature. *Psychological Science, 19, 12:* 1207-1212
7. Curtis, L., Rea, W., Smith-Willis, P., Fenyves, E., Pan, Y. (2006). Adverse health effects of outdoor air pollutants. *Journal Environment International. Vol. 32, Issue 6*, pp. 815-830

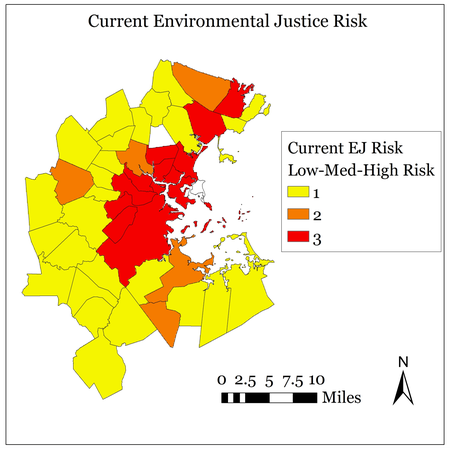
Risk Assessment Criteria











Projection: Lambert Conformal Conic

Projected Coordinate System: MA State Plane Mainland

Map Data Sources: MassGIS, US Census, Mass DEP