INSH 2102: BOSTONOGRAPHY

EXPLORING ENVIRONMENTAL JUSTICE THROUGH CONSERVATION AND HEALTH

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Abstract

Open green spaces kept for conservation are not simply constrained to aesthetic purposes but have immense social value with respect to public health and other related positive externalities. The paper introduces equity and social justice with respect to the environment as well as how it pertains to public health outcomes. Consequently, the paper ponders if there exists a correlation between the number/existence of open spaces and elaborates on how the asking of such a question remains socially relevant with respect to urban planning and social justice. Next, to answer the above question, a data analysis in R was conducted using methods from Geographic Information System (GIS) mapping. Ultimately, it is concluded that neighborhoods with higher income and less minority populations tend to have more open spaces. Given the present literature on the importance of trees and conserved greenery with regards to health benefits, it shows that there do exist inequities in health outcomes with regards to socioeconomic status while using the number or existence of open spaces as a proxy variable for public health.

INTRODUCTION

With the outbreak of the COVID-19 pandemic, more and more attention is being paid to the field of Public Health. Ultimately, with regards to Public Health, the externalities and outcomes are not equitable. Minority and lower-income neighborhoods are consistently disadvantaged as shown in . Additionally, it requires . With societal outcomes being different for different individuals, it is reasonable to consider Public Health outcomes as being a measure of social and human development. While America's philosophical foundations rest upon the ideas of happiness and prosperity, It seems that some individuals are healthier and lead higher quality lives due to their socioeconomic status.

In fact, despite the racial gap in life expectancy narrowing, "Black Americans continue to die 4 years earlier, on average, than White Americans" Additionally, according to the Centers

for Disease Control and Prevention(CDC), the divides in other U.S. mortality measures remain starker, “Black mothers are three times as likely as White mothers to die from pregnancy-related causes and Black infants are more than twice as likely as White infants to die in their first year. The CDC also mentions that the rate of premature death, which is defined as being before 75 years of age, “is 30% higher among Black Americans than among White Americans”(Basset et al, 2020).

Meanwhile, anthropogenic climate change continues to remain an issue that will continue to have negative externalities across the globe, especially among “marginalized communities” which include “ communities of colors and indigeneous communities”. Martin Melosi writes that “few would deny-including the EPA-that poor people of color are often disproportionately impacted by some forms of pollution(Melosi 1995). Additionally, these disadvantaged socioeconomic communities “have fought for the right to live in environments free of toxic waste, pollution, and other hazards”, yet these communities “continue to face disproportionate harm from environmental pollution” as well as a lack of access to health care(Desikan et al, 2020)

Yet, there exist multiple solutions to take care of the environment as well as public health. For example, the planting of more trees offsets carbon dioxide emissions and produces more oxygen as a result. In neighborhoods with poor air quality, planting trees might improve public health outcomes. To add, one cannot separate the effects of the planting of a tree to one part of an area as the spread of oxygen remains a positive externality. Urban trees are noted to provide substantial public health as well as public environmental benefits as well.However, research has shown that city trees may be distributed unequally among poor and minority urban communities much like material wealth itself. Consequently, these communities could be deprived of the many positive benefits that trees provide including the positive health externalities that they provide. This lack of access to green spaces that trees provide is an example of "environmental injustice". Additionally, the urban forest is deemed

"a green infrastructure system that delivers multiple environmental, economic, social and health services" in cities(Wolf et al, 2020)

A study by a team of researchers from the Nature Conservancy found that 92 percent of low-income blocks have less tree cover and hotter average temperatures than high-income blocks. One alarming example is that of the metropolitan area of Bridgeport, Connecticut, which is also the city with largest income inequality. In fact, the poorest blocks in the area have 54 percent less tree cover and as such are 5 Celsius hotter on average(Grist 2021).

Additionally, walking is a cost-effective and affordable exercise available to people of all socioeconomic backgrounds. Consequently, it follows that the existence of public parks with trees and ample walking space would correlate or possibly cause higher public health outcomes including a healthier and longer-lived population.

There is immense social value and purpose in answering the question whether there exists a relationship between the number of open spaces and an area's socioeconomic status. As it has already been said, it is known that there exists inequity between different socioeconomic groups with respect to their health outcomes and it is known that neighborhoods with a higher POC percentage and or lower income populations have less access to proper healthcare and live in neighborhoods with less trees. Determining empirically if such a relationship exists is valuable to society as it may impact urban policy. The intention for focusing on this question is because I speculate that if urban planners built more open spaces across different neighborhoods in a more equitable manner then public health outcomes would also start becoming more equitable as a result.

The reason that there will be a predominant focus on health outcomes is because health is impacted by many factors in a person's life, including a person's diet, environment, stress level, job, and income level among other things, and as such is a good proxy variable for a person's quality of life.

METHODS

Initially, I had tried to find out public health outcomes by looking at the count of trees in a neighborhood and if there existed a strong positive correlation between that and the health of a community. Ultimately, this proved to be challenging at the computer level. Ultimately, there are just too many trees in Boston to be accurately and meaningfully represented in a data visualization and analysis.

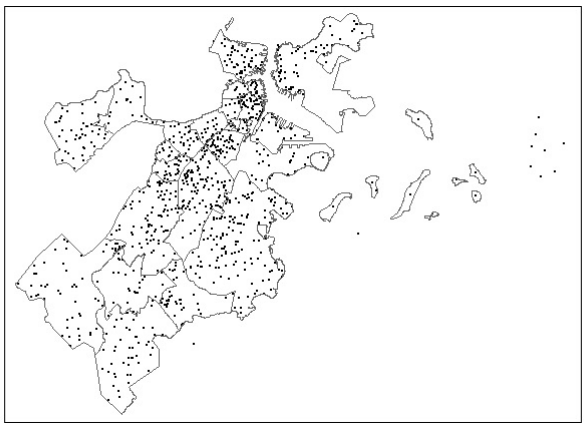
As such, I endeavored to use methods from GIS to perform an accurate dataset analysis. The datasets I used in question are the Climate Ready Boston Social Vulnerability dataset, which tries to measure the levels of Social Vulnerability within the city of Boston's neighborhoods.

According to the description of the dataset at data.boston.gov, social vulnerability is defined as " the disproportionate susceptibility of some social groups to the impacts of hazards, including death, injury, loss, or disruption of livelihood". Using the dataset makes sense as Climate Ready Boston states the groups identified as specifically vulnerable are among the elderly and children, "people of color, people with limited English proficiency, people with low or no incomes, people with disabilities, and people with medical illnesses"(Climate Ready Boston). All groups who are particularly relevant to measuring the disparity in public health outcomes across race, class, and income. Specifically, rather than directly look at medical illness, I will look at the race and income columns in order to conduct the data analysis.

With regards to collecting and being able to analyze public health outcomes in Boston with regards to public parks, I used the Boston Neighborhoods dataset from data.boston.gov. This is a valid dataset to use as the website mentions that the "data layer is a combination of zoning neighborhood boundaries, zip boundaries and 2010 Census tract boundaries"(Boston Neighborhoods). Thus, using this dataset will allow us to look at public health outcomes and public spaces within the context of different Boston neighborhoods.

The dataset used to analyze and identify the number of parks or in this case open spaces,

Figure 1: The number of open spaces around all Boston neighborhoods plotted using RStudio.



is the Open Spaces dataset from the same website. Here, an open space is simply identified as " open spaces of conservation and recreation interest in Boston, Massachusetts, USA, regardless of ownership", which does not necessarily preclude private tracts, but because of the positive externality of having an open space, it will be used(Open Space). To elaborate, people are not able to wall off or block the oxygen or any other environmental impacts given by an open space.

Lastly, to conduct the analysis, I will use R in RStudio and the respective shapefiles for each dataset and use GIS techniques such as overlaying to determine whether my hypothesis holds true: that a positive correlation between public health/social vulnerability and the number of open space/public parks within different neighborhoods in the city of Boston. I plan on plotting every open space within the city of Boston across every neighborhood to see if the existence or number of open spaces, specifically kept for conservation.

The Social Vulnerability dataset accounts for many different perspectives that can be explored. Furthermore, overlaying the number of open spaces over the different socioeconomic perspectives will help determine the potential correlation between different minority groups and the existence of open spaces preserved for conservation and recreational purposes. To conduct a proper thorough data analysis that explores different socioeconomic perspectives, I applied methods from R's tmap library ,using plot mode, rather than the interactive view

Figure 2: Neighborhoods represented as polygons differentiated by income level

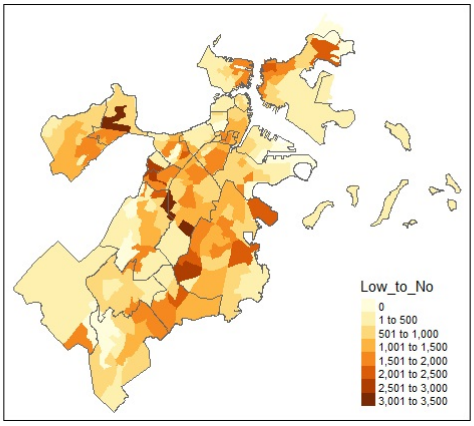
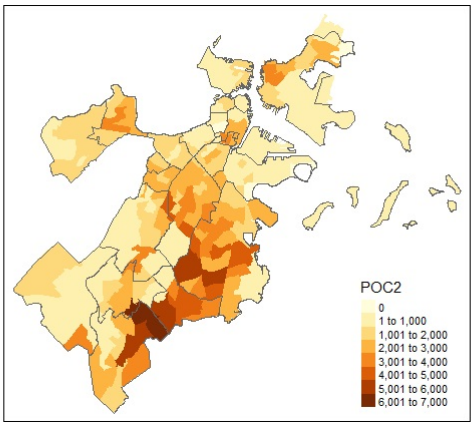


Figure 3: Neighborhoods represented as polygons differentiated by percentage of minority/POC population

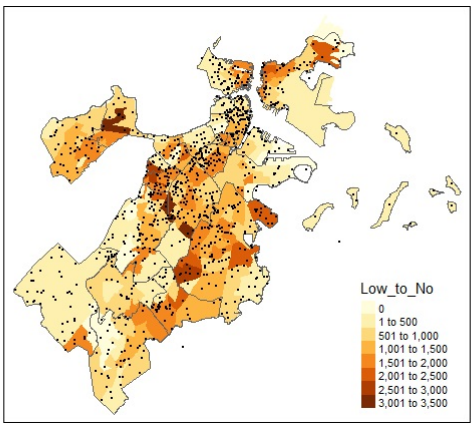


mode. Rather than use csv files, I chose to use shapefiles for the data analysis as the aim was to visualize the correlation rather than find a numerical answer as this would make it easy for any individual to see if any sort of relationship exists between the pertinent datasets.

RESULTS

After applying the raster overlay methods using the shapefile datasets, one can come to see that low to no income neighborhoods of Boston have very few open spaces available and ultimately that as such these individuals are the most likely to have been most socially vulner-

Figure 4: Boston neighborhoods differentiated by their average income levels overlayed with the number of open spaces

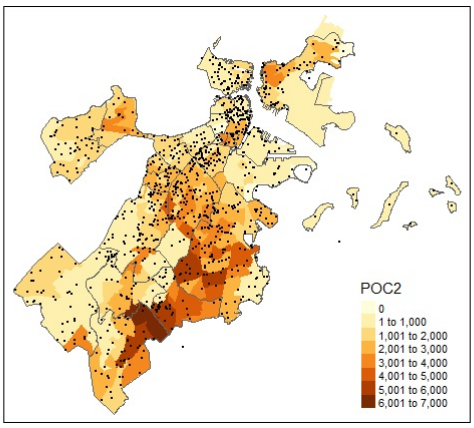


able and are more prone to poorer health outcomes including increased risk of hazards. Most interestingly, it does not seem to be the exact number of open spaces within a neighborhood does not correlate with the income bracket of a neighborhood, but rather the density of open spaces within a neighborhood.

With regards to the percentage of minority populations and the existence of open spaces it seems that when a neighborhood has a high population of people of color, the number of open spaces is lower as evidenced in the visualization below. Thus, based on the data analysis, one can conclude that there exists a negative correlation between the number of open spaces, as defined by the website, data.boston.gov, and the percentage of minority/POC within a neighborhood's population.

The results are not necessarily surprising as it was mentioned in the Introduction section that low-income and minority neighborhoods have less trees and therefore less of an "urban forest". However, it is surprising that there does not exist as many open green spaces that do not have as many trees in these neighborhoods. If one were to think that prior to establishing a neighborhood, open green space was the natural state, then it seems strange that there would be less green spaces in these neighborhoods as one might think that less infrastructure was built in these neighborhoods. Ultimately, that is simply not the case. Unfortunately,

Figure 5: Boston neighborhoods differentiated by the percentage of POC/minority in their communities population overlayed with the number of open spaces



the truth is that the excesses of urbanization are often at the expense of the most socially vulnerable.

Consequently at the moment, open green spaces in lower income and minority neighborhoods have not been historically a priority during city planning efforts. To many individuals in these neighborhoods, access to better education or healthcare might be far more important as there is a more tangible relationship between them and an increased quality of life.

CONCLUSION

As the evidence shows, it is clear that the existence of parks has a positive relationship with public health outcomes in neighborhoods. A lack of open spaces or "urban forest" ultimately does correlate with lower public health outcomes. Consequently, it is important to consider what this entails for society as a whole. It goes without saying that investment in public health infrastructure including health education, increased access to healthcare through government subsidies, as well as an increased regard for the environment are all steps that need to be taken to decrease inequities within public health. Thus, keeping land open for conservation for recreational use such as parks and open spaces has an immense

social value. At the same time, the creation of these spaces needs to be done in an equitable fashion. All members of society should have ample access to these open spaces or parks. As mentioned earlier, trees absorb ambient heat and as such provide immense benefit to excessively high-temperature neighborhoods, much of which tend to lower-income or POC neighborhoods where urbanization has denied green spaces.

Furthermore, this reality brings up a couple of crucial questions that the members of society need to ask including why neighborhoods tend to organize and coalesce around ethnic and socioeconomic lines and if these behaviors are socially enforced or if previous laws still impact the way people choose to congregate. Ultimately, questions such as these may be outside the scope of the data analysis, it is imperative that regardless of neighborhood people have access to the same baseline environmental opportunities. Access to open green spaces should be accessible to everyone in every neighborhood regardless of socioeconomic status. The purpose of the data analysis was to shine a light on the inequity when it came to public health as recorded by the number of open spaces a neighborhood has. Logically, people may ask how the results of this endeavor can be useful to others. As mentioned above in the introduction, it is important for everyone, especially people living in neighborhoods with fewer open spaces to know the importance and lack thereof of having an open space in their neighborhoods. Individuals have a right to know about their health and how their communities can alleviate suffering and increase quality of life within the neighborhoods.

Without a doubt, it can be said that simply building open green spaces will not change everything affecting the health outcomes of minority and lower-income neighborhoods, but it will be a step in the right direction with regards to equitable city planning and public health outcomes. Tackling one part of the problem makes an impact and may potentially shine a bigger light on striving for better health for everyone.

Additionally, it is important that there are more open spaces conserved not only for recreation, but simply for the sake of preservation because anthropogenic climate change is

a reality and any way to reduce a city's carbon footprint by creating open spaces with trees will improve everyone's health everywhere. At the end of the day, one cannot cordon off the positive externality of more clean air from shifting across to other neighborhoods, more trees in one neighborhood will undoubtedly impact other neighborhoods as well. One might think that climate change may not directly correlate with health outcomes, but in fact it does. In the long run, unfettered climate change will lead to massive changes to human habitation which will undoubtedly impact health outcomes. Human health is deeply reliant on the environments in which human beings live and if the air is filled with carbon dioxide and other pollutants, then health outcomes for most human beings will be adversely affected.

Nevertheless, there are significant limitations working with these datasets. While using the Boston Neighborhood shapefile was absolutely required, using the number of open spaces may have not been the best way to capture public health outcomes. While the environment has a significant impact on an individual's health directly looking at the numerical correlation between the "average health" of a neighborhood and the number of open spaces within the neighborhood may have been more peritent for directly looking at the relationship between public health and the existence of open spaces in a neighborhood. However, this does not mean that looking at socioeconomic perspectives was invalid or inconsequential. In fact, a more thorough analysis of collating the number of open spaces in a neighborhood from a shapefile or another dataset as well as available health statistics and other socioeconomic factors would be very useful. By doing these things, one could construct a regression model and actually find a numerical relationship between health and the number of open spaces with respect to other socioeconomic factors. Yet, this would be a distinctly challenging task due to privacy concerns. In this day and age gathering personal health information, even anonymously, is difficulty and not ethically sound. Additionally, one also has to consider the how much of an correlated independent variables such as income, race, and other socioeconomic factors are. To conduct a proper statistical analysis, one should aim to minimize

strongly correlated independent variables. Furthermore, visually trying to determine the correlation between the number/existence of open spaces and socioeconomic factors would remain a valid way in determining impact on public health outcomes.

All in all, looking to see the relationship between the number of open spaces in the city of Boston and socioeconomic status of a neighborhood with respect to income and race revealed a lot about how rooted inequitable outcomes are, especially with respect to the environment. Nevertheless, the aim is for there not to be any correlation between socioeconomic status and the number of open spaces within neighborhoods as the construction, development, and maintenance of these open spaces should have no relationship to demographics of a neighborhood, but should exist equally across all neighborhoods in a city. The access to open spaces should not be constrained by socioeconomic status and moving forward city planners, politicians, and community leaders may come together to make this idea a reality and improve the public health of all neighborhoods.

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