RACIAL DEMOGRAPHICS AND SOLID WASTE LANDFILLS IN NORTH CAROLINA

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Introduction:

In the initial stages of our project, we understood a shared commitment of the importance of environmental justice. Looking at an issue of a local scale was our best option given time limits and knowledge, and being from North Carolina, that is where we chose. After some research, we found an article on the prevalence of landfill sites in low-income and minority communities. This was such an important topic, and we were intrigued after further investigation. We found that low-income and minority communities have historically experienced a disproportionate amount of neglect and environmental disparities (Miller 2023). Certain groups are more vulnerable to the health impact of climate change due to factors such as income, healthcare access, and education (Climate change and the health of socially vulnerable people, 2023; Pros and cons of the Inflation Reduction Act, 2022). For these low-income and minority groups, such factors have been seen to affect respiratory and heat illness, mental health, and preparedness to climate hazards. It is vital to focus on moving towards equity and environmental justice in these communities.

Due to the importance of this issue, we investigated if this issue is currently prevalent in North Carolina. To do this we asked the question, "Is there a correlation between the racial demographics of an area and the number of solid waste landfills present in North Carolina counties?" and started our data collection process. The first variable is "racial demographic." In order to observe racial demographics within North Carolina counties, we chose to look at the percentage of white populations (with Latinx categorized as non-white) in each county. Our second variable was "number of solid waste landfills." The data for this variable includes the location of every solid waste facility in North Carolina, both currently operating and discontinued. A solid waste landfill is a "discrete area of land or excavation that receives household waste" (Municipal Solid Waste Landfills | US EPA, 2023). We chose to include the discontinued sites as well because the issue related to racial demographics and the supposed locations of landfills is historical. It is not a new problem.

Methods:

In order to begin investigating our research question, we started by loading a basemap of North Carolina counties. Through a shapefile provided by NCOneMap we were able to import a North Carolina State and County Polygon layer into QGIS. As for our racial demographic data, we utilized NC OSBM (North Carolina Office of State Budget and Management) data which specified the percentage of white populations in each North Carolina county. We then imported our csv data into excel and cleaned the column names and format of the numbers in order to prepare it for a geospatial merge. A geospatial merge is the process of combining datasets based on some geographic information that is similar in both. For our analysis we were able to use the county name column in order to join this new data with our previous county shapefile. Through this process we produced a choropleth map.

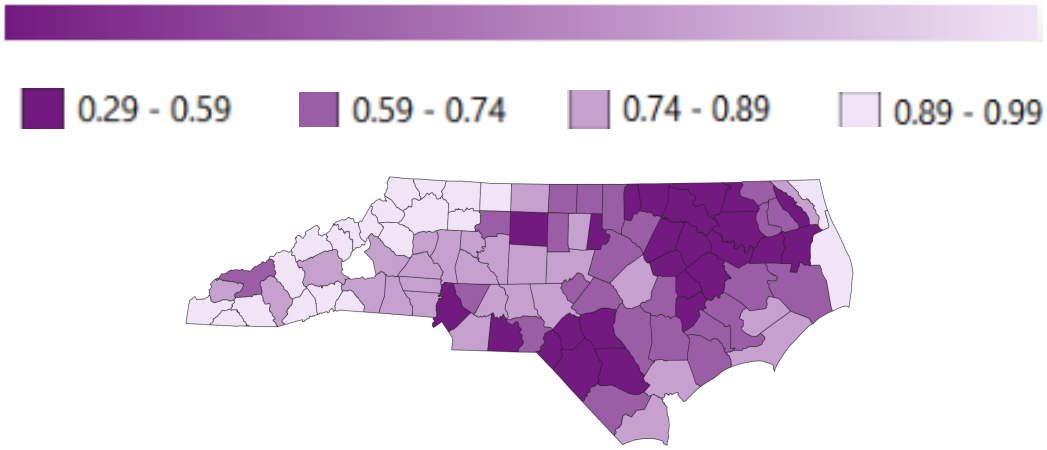

Figure 1: The choropleth map used equal count quantile and split the data into four classifications. The lighter purples represent areas with a larger white population and the darker purples represent areas with a smaller white population.

The initial choropleth map (Figure 1) visualizes the percentage of white populations in North Carolina counties with the lighter colors representing counties with a higher percentage of white populations and darker colors representing counties with a lower percentage of white populations. To visualize the location of solid waste landfills in comparison to racial demographics, we introduced vector data from the NC Department of Environmental Quality in which each point represented a solid waste landfill in North Carolina. We downloaded this vector data as a shapefile and simply overlaid it on the existing choropleth map in order to visualize trends between our race and landfill variables. Just by visually analyzing the map that we created, we were able to see clusters of landfills in some specific counties with the lowest percentage of white population indicating a potential relationship between increased number of minorities relating to increased number of landfills in that area.

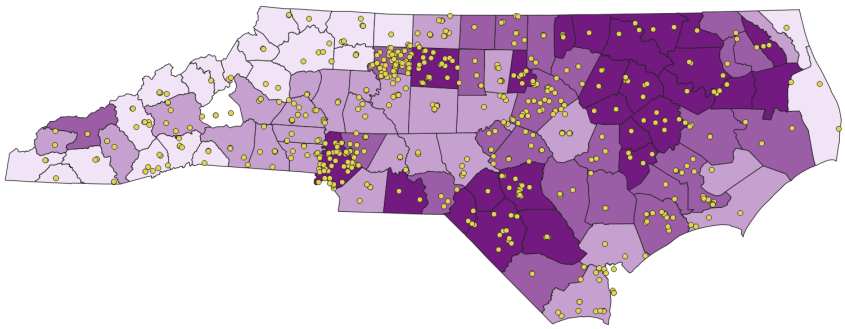

Figure 2: This map shows figure 1 with points that each represent a solid waste landfill. There is an observable clustering of landfills in counties of low white populations such as Mecklenburg, Forsyth, Robeson.

For the purpose of adding a more statistical element to our analysis, we collected raw numbers for how many solid waste landfill sites are within each county. In order to obtain this data, we utilized the vector analysis tool in QGIS labeled as “Count Point in Polygon” which totaled how many points were in each county and added that number to the attribute table of the county polygon layer. To work with this data further, we exported this attribute table into Jupyter Notebook which is a computing platform that can use Python programming for services such as cleaning and analyzing data. To quantify the visual trends that we were seeing

Results:

To quantify the visual trends that were evident to us, we identified our counties with the ten highest white populations and ten lowest white populations. We then calculated our average number of solid waste landfills for each group. Following a similar trend to what was observed in figure 2 the counties with the ten lowest white population had a higher average of ~ 4.59 compared to our counties with the ten lowest white population which had a lower average of ~ 2.80. Additionally, we calculated a correlation coefficient for the percentage of white population and number of solid waste landfill sites in each county. A correlation coefficient is useful for providing a measure that indicates how closely and in what way two variables are related. Our output when running this test was -0.146, rounded to the thousands. This shows a slightly negative correlation between our two variables which indicates that as the percentage of white population increases, the number of landfills decreases and vice versa. However, with such a low coefficient, this also indicates that this relationship is likely not that strong. Asides from calculating this correlation coefficient we also plotted a scatter plot (figure 3) with the y-axis defined by the number of landfills and the x-axis defined by the percentage of white population. We can see a similar relationship between the variables in the plot with a weak negative correlation.

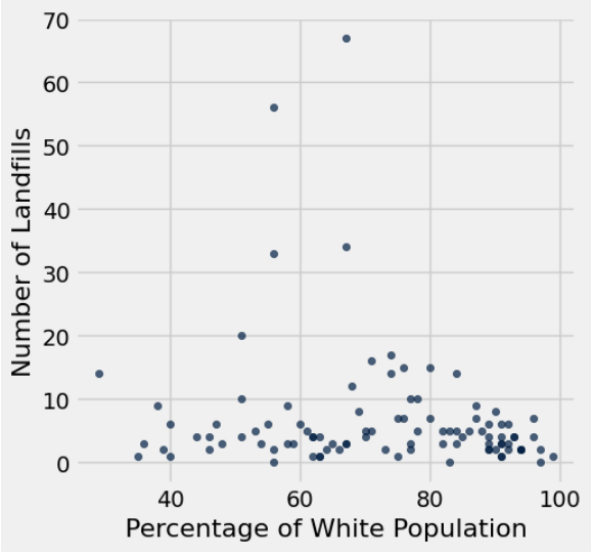

Figure 3:The Scatterplot shows the relationship between our Number of Landfill variable and our Percentage of White Population variable. There is a slight negative relationship between the two variables.

Discussion:

In contrast to prior research, the moderate correlation identified in our study diverges from the consistently strong correlations often observed in investigations exploring the connection between racial demographics and the placement of solid waste management sites in North Carolina (Nunn, 2018). This departure is noteworthy, especially considering the existing evidence that shows the disproportionate concentration of solid waste facilities in both communities of color and low wealth in the state. As reported by WRAL in 2018, the unequal distribution is influenced by various factors such as privately owned landfill companies, the dynamics of public waste disposal, and the lacking regulatory landscape

In addition to regulatory influences, numerous social factors contribute to the strong correlation observed between racial demographics and the location of solid waste management sites. Notably prevalent among these factors is the 'Not in My Backyard' (NIMBY) effect (Kinder, 2023). This phenomenon is defined as "the unwillingness of individuals to accept the construction of large-scale projects by corporations or governmental entities nearby, which might affect their quality of life and the value of their property" (Kinder, 2023). The NIMBY effect is a result of basic human psychology and is therefore common among members of every community. However, not every person who is influenced by the NIMBY effect has the power and resources to act on it. The people who do, because of various historical and systemic influences, are disproportionately white. This causes the waste management sites to be placed in areas where the people nearby do not have the power to fight against its development- generally economically disadvantaged communities largely populated by people of color.

Specifically in North Carolina, the NIMBY effect is even further perpetuated by the state regulations regarding waste management site development (Nunn, 2018). North Carolina law requires that the local government "hold at least one public meeting…advertised 30 days in advance to inform citizens of the proposed waste management facility" (Nunn, 2018) and "after a potential new waste disposal site is found to be suitable, the local government must hold another public comment period" (Nunn, 2018). While it may seem that this would equitably allow for citizens to protest the development of any undesired waste management sites. These public meetings are much more accessible in areas with higher rates of education which, unfortunately, tend to be largely populated by white people.

While our study got close to being accurate, if we implemented adjustments such as refining the data categorization, accounting for specific demographic nuances, and incorporating additional variables, we believe we could further improve our results. This refined approach could potentially unveil an even stronger negative correlation, aligning more closely with existing research on the subject.

Firstly, the data on racial demographics was sorted by county, leading to significant overgeneralizations regarding the demographic composition of a given area. Enhancing precision is crucial, and a more effective approach would involve utilizing racial demographics data categorized by census tracts—smaller regions that offer a more precise representation of the racial composition across North Carolina.

Secondly, to account for specific demographic nuances it would be beneficial to integrate multiple county-level analyses in the form of case studies. This approach allows for a more

granular examination of individual counties, shedding light on unique factors that might influence the correlation between racial demographics and the placement of solid waste management sites in North Carolina. By delving into these case studies, we can uncover localized patterns, disparities, and contextual factors that contribute to a more nuanced understanding of the complex interplay between demographics and waste management site placement.

Lastly, to further advance the discussion of our analysis we could incorporate additional variables to add complexity and therefore more accurately reflect the trend. No social trend is created by one variable, there are generally numerous phenomena all intertwining to create an overarching pattern. In the case of waste management site placement, socioeconomic factors are also contributing components. To comprehensively investigate this aspect, we suggest introducing variables such as median household income, employment status, and education rates. These added dimensions would provide a more comprehensive understanding of the intricate interplay between demographic elements and socioeconomic factors, contributing to a more insightful analysis.

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