Homework 1: Environmental Justice in The Bronx, NY

Sofia Sarak

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The following document contains visualizations of environmental justice issues in The Bronx, New York.

README (for grading purposes)

README

EDS223 Homework 1: Environmental Justice in The Bronx, NY

This repository contains the response to Homework 1 in EDS223 - *Geospatial Analysis & Remote Sensing*, completed by Sofia Sarak.

This analysis aims to explore environmental justice issues using data from the United States Environmental Protection Agency (EPA). It focuses specifically on The Bronx, New York, comparing percentage of low income residents to PM2.5 concentration. The link used to access this data originally is no longer in operation, but more EPA data can be found here. An unofficial EJScreen tool using the same data is still available.

For more information on the homework assignment itself, reference the assignment description.

Course Information

- **Course Title:** EDS 223 - Geospatial Analysis & Remote Sensing
- **Term:** Fall 2025
- **Program:** UCSB Masters in Environmental Data Science.

Teaching Team:

- **Instructor:** Annie Adams
- **Teaching Assistant:** Alessandra Vidal Meza

Complete materials for the discussion sections and additional resources can be found on the course website.

This README was adapted from the README template provided in EDS220; see course details and original repository here.

Loading in Necessary Packages

```
library(tidyverse)
library(sf)
library(here)
library(tmap)
library(dplyr)
```

Reading in and Wrangling of Data

```
# Reading in geodatabase of EJScreen data at the Census Block Group level
ejscreen <- st_read(here("data", "ejscreen","EJSCREEN_2023_BG_StatePct_with_AS_CNMI_GU_VI.gdb
```

```
# Filtering for New York State data
ny <- ejscreen %>%
  filter(ST_ABBREV == "NY")
```

```
# Filtering for Bronx County data
bronx <- ejscreen %>%
  filter(CNTY_NAME %in% c("Bronx County"))

# Ensuring our filtering worked! (Can also run head(bronx) in the console)
unique(bronx$CNTY_NAME)
```

```
[1] "Bronx County"
```

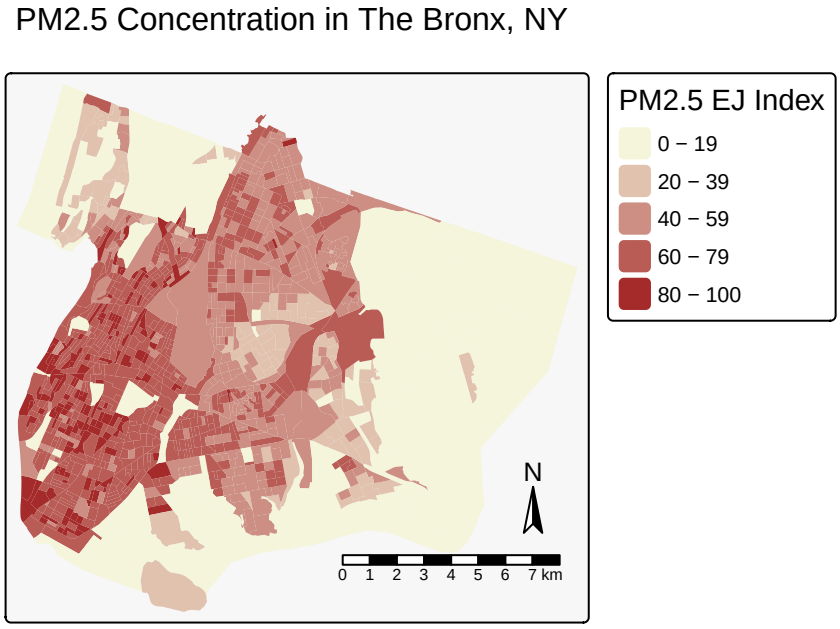
```
dim(bronx)
```

```
[1] 1182  224
```

Mapping

PM2.5 Concentration

```
# Mapping bronx dataframe, using the 'D2_PM25' column as fill
tm_shape(bronx) +
  tm_fill("D2_PM25",
          fill.legend = tm_legend(title = "PM2.5 EJ Index"),
          fill.scale = tm_scale(values = c("beige", "brown"))) +
  tm_title(text = "PM2.5 Concentration in The Bronx, NY") +
  tm_compass(size = 1.5) +
  tm_scalebar() +
  tm_layout(bg.color = "grey97")
```



The **EJ Index** combines PM2.5 Concentration with demographic indices to calculate a percentile which indicates the contribution to disparity in PM2.5 Concentration. Specifically, being in the 80-100th percentile in this map suggests that that Census Block is one of the highest contributors to disparity in PM2.5 Concentration between the local population's demographic and the national average.

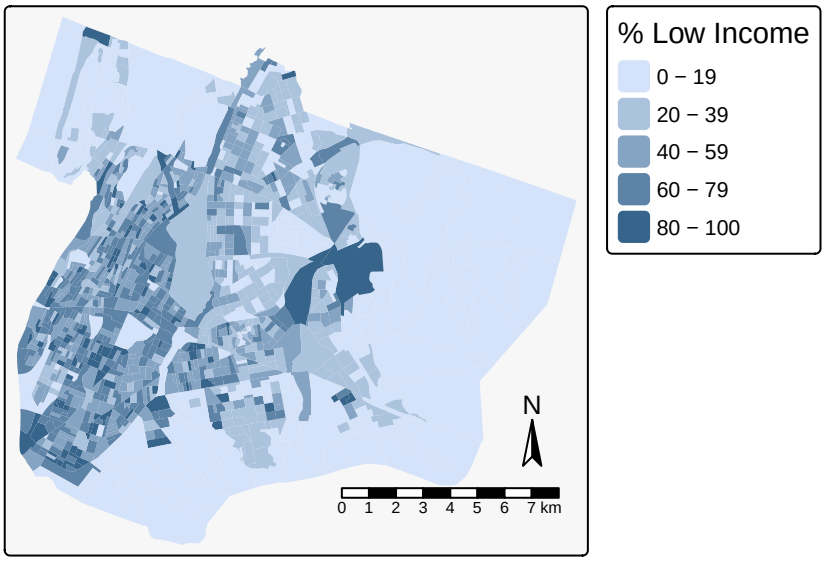
Low Income Percentage

```
# Mutating the low income percentage column ('LOWINPCT')
# As the current values are proportions, not percentages

bronx$LOWINCPCT <- bronx$LOWINCPCT * 100
```

```
# Mapping bronx dataframe, using the mutated 'LOWINCPCT' column as fill
tm_shape(bronx) +
  tm_fill("LOWINCPCT",
          fill.legend = tm_legend(title = "% Low Income"),
          fill.scale = tm_scale(values = c("#d4e3fa", "steelblue4"))) +
  tm_title(text = "Low Income Percentage in The Bronx, NY") +
  tm_compass(size = 1.5) +
  tm_scalebar() +
  tm_layout(bg.color = "grey97")
```

Low Income Percentage in The Bronx, NY



What do these maps tell us?

These maps provide visualizations of EJ Screen's environmental justice data at a Census Block Group Level (which are the delineations visible in each map). The area of interest – The Bronx, New York – is one of the five boroughs of New York City; it contains the poorest congressional district in the United States and has recently experienced threats to it environmental justice funding (Seattle Times article). Here, we have plotted particulate matter 2.5 concentrations and the percentage of low income residents in the area.

Particulate Matter 2.5 refers to fine, inhalable particles, with diameters that are generally 2.5 micrometers and smaller. They are known to cause harmful health effects such as decreased lung function. Major causes of particle pollution include transportation and manufacturing. PM2.5 data was sourced from the EPA's Office of Air Quality Planning and Standards (OAQPS) in 2019. Low Income data was sourced from the US Census Bureau.

These two maps explore the relationship between air quality and low income status in the borough. It appears that areas with higher percentages of low income residents also have higher PM2.5 indices. In other words, areas with higher percentages of low income Bronx residents contribute the most to the disparity in air quality between low income residents and the national average. This pattern is particularly distinct in the southwest Bronx as well as Census Blocks 284 and 276 (see below). Both of these areas border busy roads: the southwest Bronx is bordered by the Major Deegan and Bruckner Expressways, and the two census blocks by the Hutchinson Parkway. Therefore, the suggested findings of these map corroborate the

environmental justice issue of infrastructure that contributes to low air quality – such as roads and highways – being built and present in areas with many low income residents, who may not have the resources to fight for their right to healthy air quality. As indicated by the EJ Index, this issue is particularly prevalent in The Bronx compared to the national average.

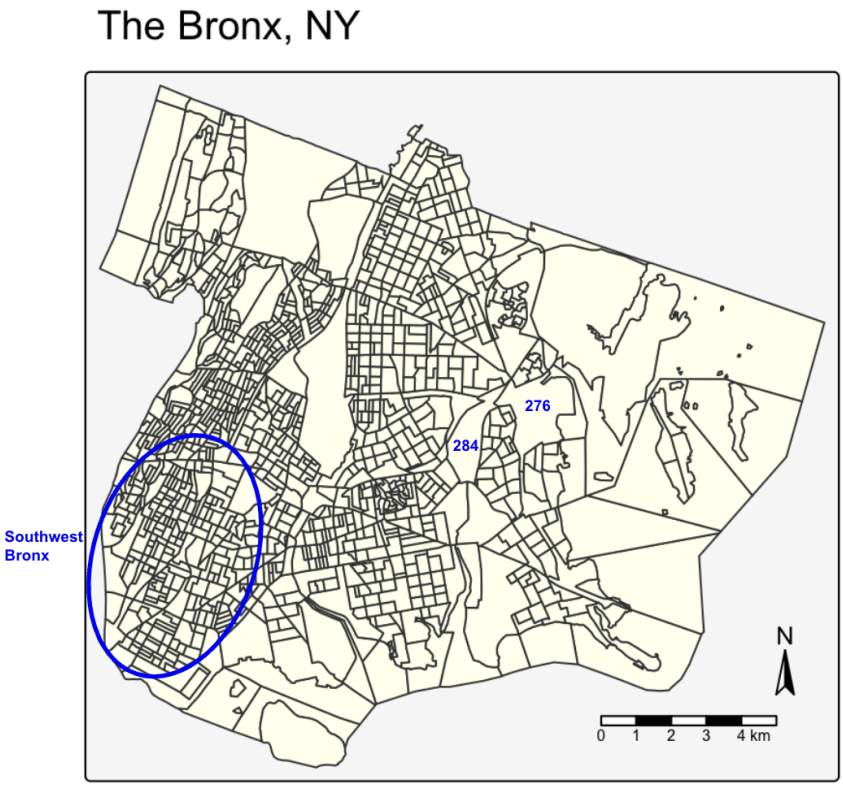


Figure 1: Map of The Bronx, New York showing the areas of interests discussed.

Code for the base map used for the image above:

```
tm_shape(bronx) +
  tm_polygons(fill = "ivory") +
  tm_title(text = "The Bronx, NY") +
  tm_compass(size = 1.5) +
  tm_scalebar() +
  tm_layout(bg.color = "grey97")
```

Source: https://www.nyc.gov/assets/planning/download/pdf/about/publications/maps/bx-census-tracts-map.pdf