

# Exploring environmental (in)justice in the State of California

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## Background

This assignment is part of the course EDS 223: Geospatial Analysis & Remote Sensing, which aims to explore an environmental justice topic and create two maps that communicate an environmental justice issue.

In my case, I want to explore injustices related to low income and health. So, I'm going to use the variables National Scale Air Toxics Assessment Air Toxics Cancer Risk (cancer) and Proximity to Treatment, Storage, and Disposal Facilities (PTSDF) to identify how these variables affect low-income communities in California counties.

## Data

The data used in this assignment is the EJSCREEN dataset, which is an environmental justice mapping and screening tool that provides the EPA with a nationally consistent dataset and approach for combining environmental and demographic indicators.

The data are available through the U.S. Environmental Protection Agency. You can find it here: [Ejscreen](#)

## Load Packages

```
# Load libraries
library(sf)
library(here)
library(dplyr)
library(tmap)
library(janitor)
```

## Import and Filter data

1. Import the EJScreen: Environmental Justice Screening and Mapping Tool data, clean and filter the variables of interest

```
# Read in geodatabase of EJScreen data at the Census Block Group level
ejscreen <- sf::st_read(here::here("data",
                                "EJSCREEN_2023_BG_StatePct_with_AS_CNMI_GU_VI.gdb")) %>%
  clean_names()
```

```
Reading layer `EJSCREEN_StatePctiles_with_AS_CNMI_GU_VI' from data source
`C:\Users\hyllae\Downloads\MEDS\EDS-223\eds-223-homework-assignment-1\data\EJSCREEN_2023_BG'
using driver `OpenFileGDB'
Simple feature collection with 243021 features and 223 fields
Geometry type: MULTIPOLYGON
Dimension:      XY
Bounding box:   xmin: -19951910 ymin: -1617130 xmax: 16259830 ymax: 11554350
Projected CRS: WGS 84 / Pseudo-Mercator
```

```
# Filter to a state you are interested in
california <- ejscreen %>%
  dplyr::filter(st_abbrev == "CA")
```

## Subset Data

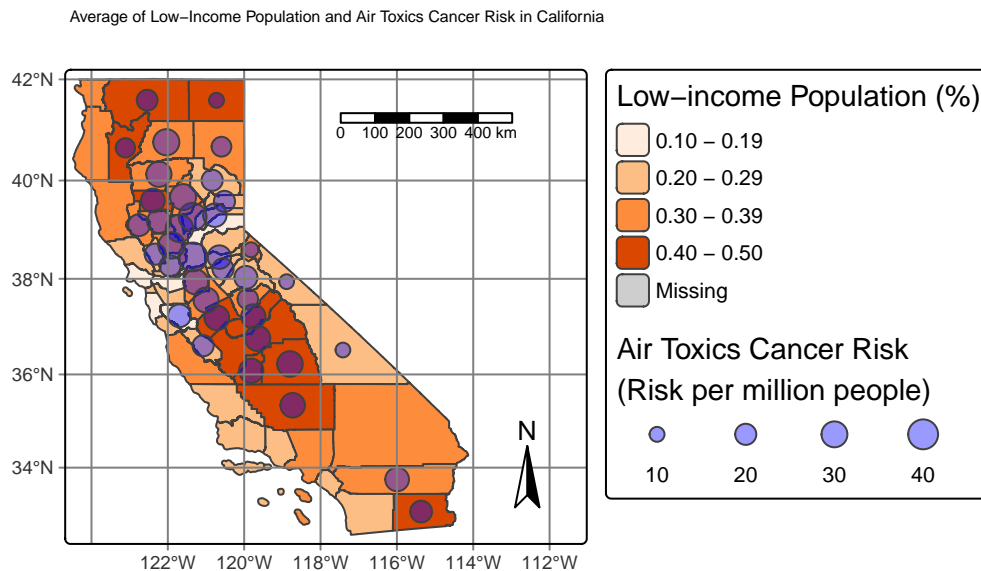
2. Aggregate the state of California by county and calculate the mean for each variable

```
# Find the average values for all variables within counties
california_counties <- aggregate(california, by = list(california$cnty_name), FUN = mean)
```

## Visualize Data

3. Use tmap to plot the **Figure 1**, “Average Low-Income Population and Air Toxics Cancer Risk”.

```
# Plot Figure 1 using tmap
tm_shape(california_counties) +
  tm_polygons("lowincpct",
              palette = "brewer.oranges",
              title = "Low-income Population (%)") +
  tm_symbols(size = "cancer",
            col = "blue",
            title.size = "Air Toxics Cancer Risk
(Risk per million people)",
            alpha = 0.4,
            ) +
  tm_title("Average of Low-Income Population and Air Toxics Cancer Risk in California",
          size = 1) +
  tm_graticules() +
  tm_scalebar(position = c("right", "top")) +
  tm_compass(position = c("right", "bottom")) +
  tm_layout(inner.margins = c(0.02, 0.02, 0.02, 0.3))
```



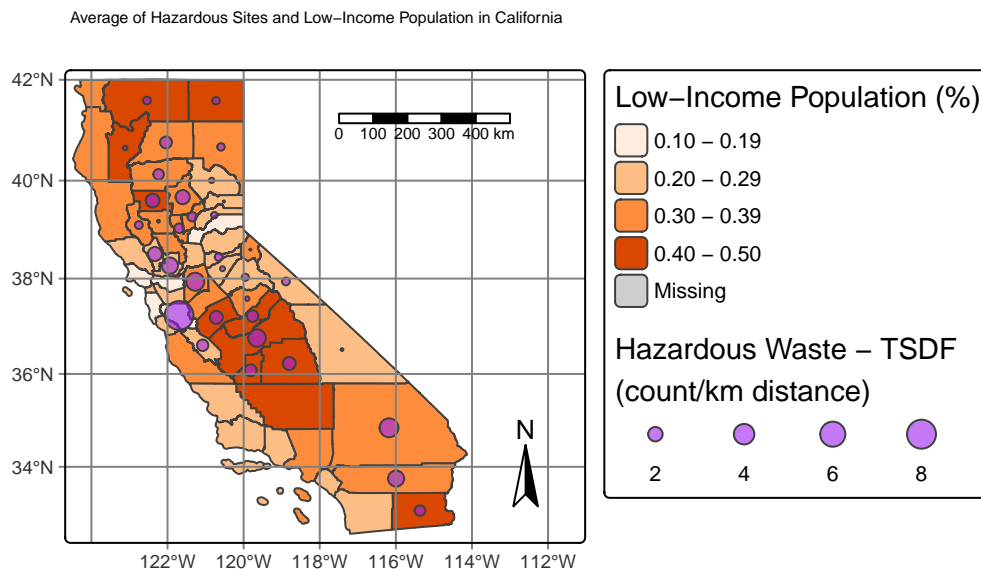
4. Use tmap to plot **Figure 2**, “Average of Hazardous Sites and Low-Income population”.

```
# Plot Figure 2 using tmap
tm_shape(california_counties) +
```

```

tm_polygons("lowincpct",
            palette = "brewer.oranges",
            title = "Low-Income Population (%)") +
tm_symbols(size = "ptsdf",
            col = "purple",
            title.size = "Hazardous Waste - TSDF
(count/km distance)",
            alpha = 0.6,) +
tm_title("Average of Hazardous Sites and Low-Income Population in California",
        size = 1) +
tm_graticules() +
tm_scalebar(position = c("right", "top")) +
tm_compass(position = c("right", "bottom")) +
tm_layout(inner.margins = c(0.02, 0.02, 0.02, 0.3))

```



## Maps Interpretation

The **Figure 1**, “Average of Low-Income Communities and Air Toxics Cancer Risk,” represents California counties by low-income population percentage levels (orange gradient). Purple circles represent cancer risk from air toxics, with circle size scaled to the risk per million people.

It is observed that there are higher concentrations of low-income populations in Central and Northern California, with some overlap between high cancer risk and high low-income populations in these areas, suggesting possible environmental justice concerns.

The **Figure 2**, “Average of Hazardous Sites and Low-Income Communities,” analyzes hazardous waste TSDF sites in relation to low-income communities, separated by county. The purple circles represent hazardous waste TSDF sites (Treatment, Storage, and Disposal Facilities).

There is some overlap between areas with high low-income populations and the locations of hazardous waste sites, highlighting potential disproportionate exposure for vulnerable groups, mostly in the central area of California. However, further analyses are still necessary to draw definitive conclusions.

**Further analysis steps could include:**

- Statistical correlation/association tests.
- Zooming in further to measure distances between hazardous sites and low-income communities.
- Comparing exposure levels between low-income and high-income areas.

**Data Citations**

EJScreen. Azurewebsites.net. <https://pedp-ejscreen.azurewebsites.net/>

EJSCREEN Fact Sheet. [https://www.epa.gov/sites/default/files/2016-07/documents/ejscreen\\_fact\\_sheet.pdf](https://www.epa.gov/sites/default/files/2016-07/documents/ejscreen_fact_sheet.pdf)