EDS-223 Homework Assignment #1

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Exploring an Environmental Justice Issue

Objective

Utilize the U.S. Environmental Protection Agency's EJ Screen data to produce two maps communicating an environmental justice issue.

Environment Set-up

```
# Load relevant libraries
library(sf) # For vector data
library(stars) # For raster data
library(tmap) # For static and interactive maps
library(here) # For importing data
library(tidyverse) # For data cleaning
library(dplyr) # For filtering data


# If the libraries are not installed, please install the below packages:

# install.packages("sf")
# install.packages("stars")
# install.packages("tmap")
# install.packages("here")
# install.packages("tidyverse")
# install.packages("dplyr")
```

Load in data

```
# Read in geodatabase of EJScreen data at the Census Block Group level

ejscreen <- sf::st_read(here::here("data", "ejscreen","EJSCREEN_2023_BG_StatePct_with_AS_CNM
```

```
Reading layer `EJSCREEN_StatePctiles_with_AS_CNMI_GU_VI' from data source
  `/Users/isabellasegarra/Documents/MEDS/EDS-223/HW-assignments/eds-223-hw-1/data/ejscreen/E
  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
```

```
# Read in California border

california_border <- sf::st_read(here::here("data", "ca_state", "CA_State.shp"))
```

```
Reading layer `CA_State' from data source
  `/Users/isabellasegarra/Documents/MEDS/EDS-223/HW-assignments/eds-223-hw-1/data/ca_state/CA
  using driver `ESRI Shapefile'
Simple feature collection with 1 feature and 18 fields
Geometry type: MULTIPOLYGON
Dimension:     XY
Bounding box:  xmin: -13857270 ymin: 3832931 xmax: -12705030 ymax: 5162406
Projected CRS: Popular Visualisation CRS / Mercator
```

```
# Read in California cities

california_cities <- sf::st_read(here::here("data", "California_Cities-shp", "d86f1c7b-1acd-4
```

```
Reading layer `d86f1c7b-1acd-4a0a-9413-ded642940daf202042-1-425xni.o5rsz' from data source `/
  using driver `ESRI Shapefile'
Simple feature collection with 444 features and 47 fields
Geometry type: POINT
Dimension:     XY
Bounding box:  xmin: -13821740 ymin: 3839458 xmax: -12756020 ymax: 5004586
Projected CRS: WGS 84 / Pseudo-Mercator
```

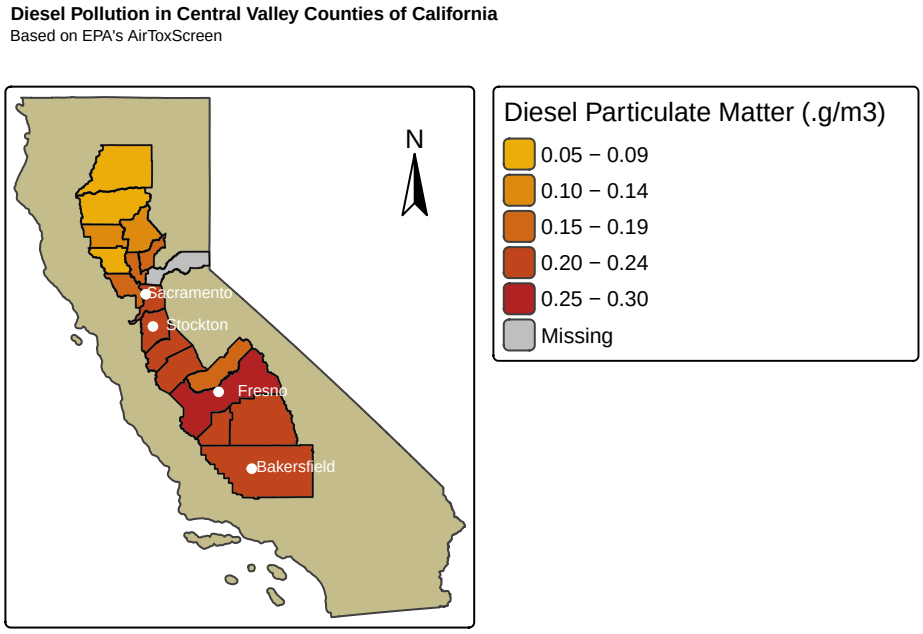
Filter Data

```
# Filter to all data from California
california <- ejscreen %>%
  dplyr::filter(ST_ABBREV == "CA") %>%
  janitor::clean_names()


# Filter to counties in the Central Valley

central_valley <- california %>%
  dplyr::filter(cnty_name %in% c("Merced County",
                                 "Butte County",
                                 "Kern County",
                                 "Colusa County",
                                 "Kings County",
                                 "Fresno County",
                                 "Madera County",
                                 "Glenn County",
                                 "Placer County",
                                 "Sacramento County",
                                 "San Joaquin County",
                                 "Shasta County",
                                 "Sutter County",
                                 "Tehama County",
                                 "Tulare County",
                                 "Yolo County",
                                 "Yuba County",
                                 "Stanislaus County"))

# Find the average values for all variables within counties
central_valley_counties <- aggregate(central_valley, by = list(central_valley$cnty_name), FU

# Filter california_cities to major central valley cities (Sacramento, Fresno, Bakersfield, a

central_valley_cities <- california_cities %>%
  dplyr::filter(AREANAME %in% c("Sacramento", "Fresno", "Bakersfield", "Stockton"))
```

Map 1: Mapping Central Valley Diesel Particulate Matter

In the Central Valley, diesel pollution, primarily from heavy diesel trucks traveling throughout Highway 99 and the I-5, contribute to the region's significant air pollution (EPA, 2025). I decided to investigate which counties in the Central Valley see higher concentrations of diesel pollution. From the map, southern Central Valley counties experience higher levels of pollution.

```
diesel_map <- tm_shape(california_border) + # Add border of California
  tm_borders(fill = "#c4bd8b") +
tm_shape(central_valley_counties) + # Add the central valley counties layer
  tm_polygons(fill = "dslpm", # Fill the counties based on diesel pollution
              fill.scale = tm_scale(values = c("#ECAD09","#D97F12", "#C5501A", "#B22222")),
              fill.legend = tm_legend(title =
                                        "Diesel Particulate Matter ( g/m3)",
                                      size = 0.5)) +
  tm_borders(col = "black", lwd = 0.5 ) + # Add borders for the counties
  tm_title("Diesel Pollution in Central Valley Counties of California",
           size = 1,
           fontface = "bold") +
  tm_title("Based on EPA's AirToxScreen", size = 0.5)+
tm_shape(central_valley_cities) + # Add central valley city names
  tm_dots(fill = "white") +
  tm_text("AREANAME",
          col = "white",
          size = 0.5,
          xmod = 2.3,  # Shift labels to the right
    ymod = 0.1 ) +  # Shift labels up/down
  tm_compass(position = c("right", "top"))

diesel_map # View diesel map
```



Map 2: Mapping Central Valley Ozone

Diesel pollution is linked to increased ozone production (EPA, 2025). Increased ozone in the atmosphere impacts the health of the ecosystem and surrounding communities. Due to this linkage, I decided to map the ozone (ppb) levels in Central Valley counties. From the map, southern Central Valley counties have increased ozone levels showing a possible connection between diesel and ozone pollution.

```
ozone_map <- tm_shape(california_border) + # Add border of California
  tm_borders(fill = "#c4bd8b") +
tm_shape(central_valley_counties) + # Add the central valley counties layer
  tm_polygons(fill = "ozone", # Fill the counties based on ozone pollution
              fill.scale = tm_scale(values = c("#C0C6CB","#7688BB", "#304FAF", "#073763")),
              fill.legend = tm_legend(title =
                                        "Ozone (parts per billion)",
                                      size = 0.5)) +
  tm_borders(col = "black", lwd = 0.5 ) + # Add borders for the counties
  tm_title("Ozone Pollution in Central Valley Counties of California",
           size = 1,
           fontface = "bold") +
  tm_title("Ozone annual mean top 10 of daily maximum 8-hour concentration in air. EJScreen v
tm_shape(central_valley_cities) + # Add central valley city names
```

```
  tm_dots(fill = "white") +
  tm_text("AREANAME",
          col = "white",
          size = 0.5,
          xmod = 2.3,  # Shift labels to the right
    ymod = 0.1 ) +  # Shift labels up/down
  tm_compass(position = c("right", "top"))

ozone_map # View ozone map
```