GES486 Project 1 Write-Up: Time Series

Abstract:

In most cities in the modern day, trees are planted every year for a multitude of reasons. Reasons can include supporting biodiversity, or offsetting carbon emissions produced by humans. This project's aim is to answer the question "how many trees are planted each year in the community statistical areas of Baltimore City?" This project uses data collected by the Baltimore City government across 7 years: 2013 to 2019. Ultimately the goal of this section of the project is to be able to create a gif that displays each map to show a comparison of trees planted each year.

Methods:

The methods for completing this project are as follows. The data was collected from Open Baltimore, which is the Baltimore City government website that contains data collected by the government and partners of the government. On this website, I searched for tree data to find anything I could learn about trees in Baltimore City. The dataset that was used for this project can be found at this link[1]. This dataset includes the number of trees planted in each of the 55 community statistical areas located in Baltimore City. The dataset was downloaded, and ready to use in R Studio.

After the data was collected, the map making process began. The data was brought into R Studio. After the data was brought into R Studio, the data for each year was symbolized using the ggplot function to display the data. One of the main issues of using this data and ggplot is that when the maps were created the scale of the legend would set the minimum and the maximum of the legend scale to the minimum and maximum amount of trees that were planted

that year. This meant that the legends did not match up, and would not look good in the gif as this inconsistency would make it difficult for the viewer to distinguish the amount of trees planted each year. This was worked around by setting the minimum and maximum values of the scale manually so that each map image had the same scale. After the maps were created, I used the ggsave function to save each map image from each year as a .jpg to my directory.

After manually visualizing the data of trees planted for each year, I decided I wanted to learn how to make this code more time efficient. To do this, I learned how to create a for loop to create the maps for each year with the use of one function. Two for loops were created: one to create and visualize the maps within R Studio using ggplot, and the other to save my maps as .jpg images in my work directory using ggsave. This creates a more efficient code to perform the same task multiple times with multiple columns of data. This method was not the most efficient for this project as I had already written code for each year manually, but this method of coding was beneficial to learn for future projects. After the maps for each year were created, the images were put into a gif creator, and a gif was made. This allows the viewer to compare how many trees were planted in each community statistical area in Baltimore City.

Results:

The data shows that most of the CSA's that plant more trees are located in the central/south central area of Baltimore City. Each year, different CSAs tend to plant anywhere between 0 and 400 trees. There are some years where there is no data for some of the CSAs and that is especially prevalent in 2017. The reason for the lack of data was unable to be found, but could be due to data being lost, or just not being reported. This project does bring up more questions that would be fascinating to accomplish. One question that arises is "why the areas that

seem to be receiving the most trees located in central/south central Baltimore? Does this trend correlate with other factors such a the median income of residents in these areas”

Citations

1. *Number of trees planted - community statistical area*. Open Baltimore. (n.d.). Retrieved March 22, 2022, from https://data.baltimorecity.gov/datasets/bniajfi::number-of-trees-planted-community-statistical-area/about

Trees Planted in Community Statistical Areas in Baltimore City From 2013 to 2019

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```
library(sf)
```

```
## Warning: package 'sf' was built under R version 4.1.3
```

```
## Linking to GEOS 3.9.1, GDAL 3.2.1, PROJ 7.2.1; sf_use_s2() is TRUE
```

```
library(ggplot2)
library(patchwork)
```

```
trees_plant <- st_read("Number_of_Trees_of_Planted/Number_of_Trees_of_Planted.shp")
```

```
## Reading layer `Number_of_Trees_of_Planted' from data source
##   `C:\Users\sarah\OneDrive\Documents\GES486\Project1\Number_of_Trees_of_Planted\Number_of_Tre
es_of_Planted.shp'
##   using driver `ESRI Shapefile'
## Simple feature collection with 55 features and 11 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 1393927 ymin: 557733.6 xmax: 1445503 ymax: 621406.8
## Projected CRS: NAD83 / Maryland (ftUS)
```

```
for (i in 13:19) {
  nam <- paste0("twenty", i, sep = "")
  assign(nam, ggplot(data = trees_plant, aes_string(fill = paste("treeplnt", i, sep = ""))) +
    geom_sf() +
    scale_fill_distiller(palette = "Greens", limits = c(min(0), max(400)), direction = 1) +
    labs(title = paste("Trees Planted in 20", i, sep = ""),
         caption = "Data Source: Open Baltimore",
         fill = "Number of Trees") +
    theme_void()
    )
}
```

```
twenty <- lapply (13:19, function(i) ggplot(data = trees_plant, aes_string(fill = paste("treepln
t", i, sep = ""))) +
     geom_sf() +
      scale_fill_distiller(palette = "Greens", limits = c(min(0), max(400)), direction = 1) +
     labs(title = paste("Trees Planted in 20", i, sep = ""),
          caption = "Data Source: Open Baltimore",
          fill = "Number of Trees") +
     theme_void())
```

```
for (i in 1:7){
   ggsave(plot = twenty[[i]], file = paste("treeplnt",i,".jpg", sep = ""))
 }
```

```
## Saving 7 x 5 in image
## Saving 7 x 5 in image
## Saving 7 x 5 in image
## Saving 7 x 5 in image
## Saving 7 x 5 in image
## Saving 7 x 5 in image
## Saving 7 x 5 in image
```