A2 Assignment - Refugee Analysis

MBAN - Group 7

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Introduction

Refugee migration has been a significant global issue, with various countries experiencing fluctuations in the number of people seeking asylum. This report analyzes refugee data from multiple countries over a span of years to identify trends, patterns, and key insights. The study involves data cleaning, transformation, visualization, and statistical analysis to gain a deeper understanding of global refugee movements.

Data Preparation and Cleaning

The dataset initially contained raw refugee statistics, which required significant cleaning before analysis.

```
library(tidyverse)
library(readr)
# read data from database
raw_df <- read_csv("data/A2_refugee_status.csv", col_types = cols(.default = "c"))
```

Handling Missing and Inconsistent Values

The dataset contained placeholders for missing values, such as “D,” “X,” and “-”, which were converted to “0.” Numeric values were reformatted by removing commas and converting them into numerical data types.

```
# Set NULL value("D", "X", "-")as "0"
raw_df[raw_df == "D" | raw_df == "X" | raw_df == "-"] <- "0"
# set the value column as numbers value and delete comma and transfer to numeric value
raw_df[ , -1] <- lapply(raw_df[ , -1], function(x) as.numeric(gsub(",", "", x)))
# set cleaned data frame as df and use df in later operation
# combine "Congo, Democratic Republic" and "Congo, Republic"
congo_rows <- raw_df %>% filter(`Continent/Country of Nationality` %in% c("Congo, Democratic Republic",
congo_sum <- colSums(congo_rows[, -1], na.rm = TRUE)

#  remove the original duplicated Congo data
raw_df <- raw_df %>% filter(!`Continent/Country of Nationality` %in% c("Congo, Democratic Republic", "C

# add the new combined Congo data to the data frame
raw_df <- raw_df %>%
  add_row(`Continent/Country of Nationality` = "Congo", !!!as.list(congo_sum))
```

Standardizing Country Names

Countries with alternative naming conventions, such as “China, People’s Republic” and “Korea, North,” were renamed to “China” and “North Korea” for consistency.

```
# Replace the Countries' name with formal format
country_df <- raw_df %>%
  mutate(`Continent/Country of Nationality` = case_when(
    `Continent/Country of Nationality` == "China, People's Republic" ~ "China",
    `Continent/Country of Nationality` == "Korea, North" ~ "North Korea",
    TRUE ~ `Continent/Country of Nationality`
  ))
df <- country_df
```

```
# create the new dataframe 'contry_df',and remove the un-country row from the dataframe
# defined the name list that will be removed from the dataframe
non_countries <- c("Africa", "Asia", "Europe", "North America",
                   "Oceania", "South America", "Unknown", "Other", "Total")

# use filter to get the row that will be delete
removed_countries <- df %>%
  filter(`Continent/Country of Nationality` %in% non_countries)

# create a new dataframe that only containt the 'countries'
country_df <- df %>%
  filter(!`Continent/Country of Nationality` %in% non_countries)

# print the row that be deleted to make sure all of them are 'non-countries'
print("delete rows with non-contry:")
```

```
## [1] "delete rows with non-contry:"
```

```
print(removed_countries$`Continent/Country of Nationality`)
```

```
##  [1] "Africa"        "Asia"          "Europe"        "North America"
##  [5] "Oceania"       "South America" "Unknown"       "Other"
##  [9] "Unknown"       "Total"
```

```
# check the new dataframe
head(country_df)
```

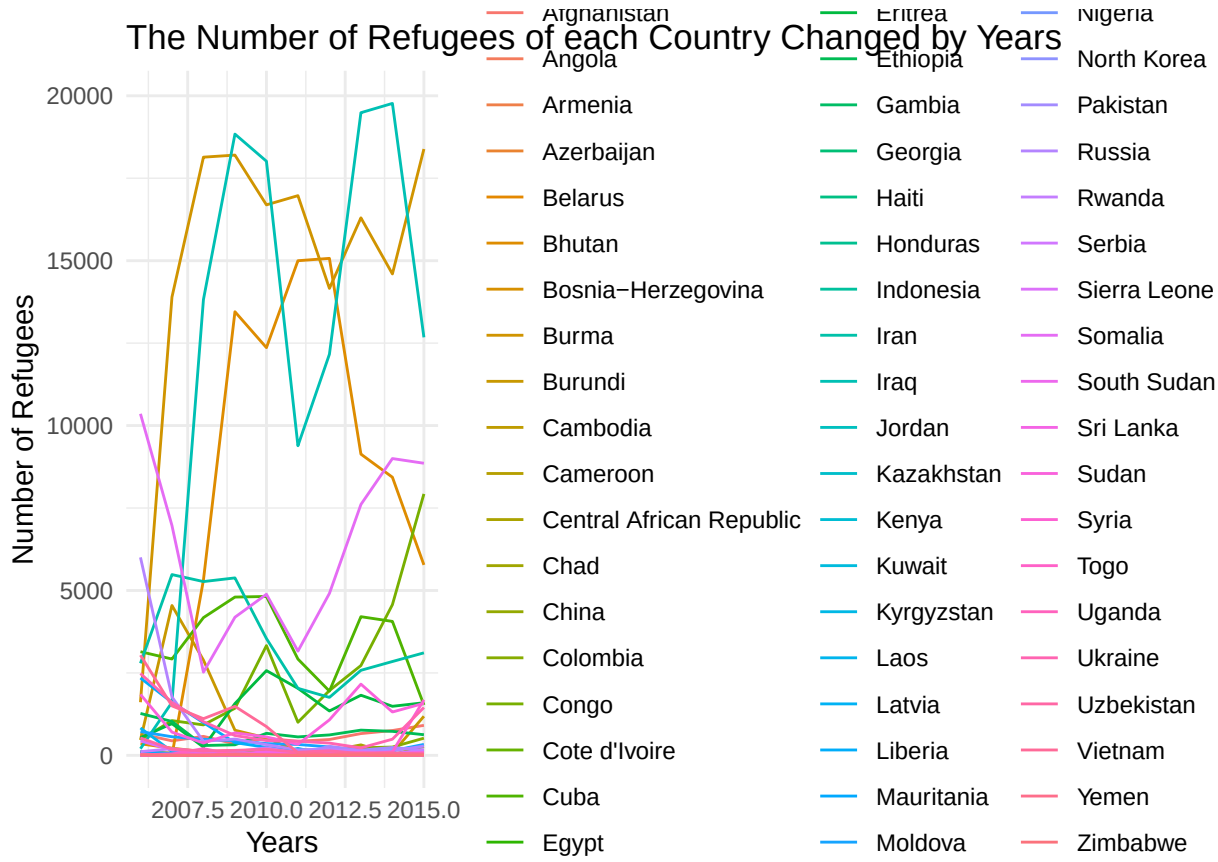
```
## # A tibble: 6 x 11
##   Continent/Country of~1 ‘2006‘ ‘2007‘ ‘2008‘ ‘2009‘ ‘2010‘ ‘2011‘ ‘2012‘ ‘2013‘
##   <chr>                   <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
## 1 Afghanistan               651    441    576    349    515    428    481    661
## 2 Angola                     13      4      0      8      0      0      0      6
## 3 Armenia                    87     29      9      4      0     15      8      3
## 4 Azerbaijan                 77     78     30     38     18     16     10      3
## 5 Belarus                   350    219    111    146    103     66     83     10
## 6 Bhutan                      3      0   5320  13452  12363  14999  15070   9134
## # i abbreviated name: 1: ‘Continent/Country of Nationality‘
## # i 2 more variables: ‘2014‘ <dbl>, ‘2015‘ <dbl>
```

Trends in Refugee Migration

1. Overall Refugee Trends by Country

A line chart visualizes the refugee numbers from each country over time.

```
library(ggplot2)

# convert the data to the 'long' varibale type, which will be easy to make the plots
country_long <- country_df %>%
  pivot_longer(cols = -`Continent/Country of Nationality`,
               names_to = "Year", values_to = "Value")

# plot the line chart
ggplot(country_long, aes(x = as.numeric(Year), y = Value, color = `Continent/Country of Nationality`)) +
  geom_line() +
  theme_minimal() +
  labs(title = "The Number of Refugees of each Country Changed by Years",
       x = "Years",
       y = "Number of Refugees",
       color = "Countries") +
  theme(legend.position = "right")
```




```
# Calculate the number of refugees for each state by year
continent_df <- df %>%
```

```
  filter(`Continent/Country of Nationality` %in% c("Africa", "Asia", "Europe",
                                                   "North America", "Oceania", "South America")) %>%
  pivot_longer(cols = -`Continent/Country of Nationality`,
               names_to = "Year", values_to = "Value") %>%
  group_by(`Continent/Country of Nationality`, Year) %>%
  summarise(Total_Refugees = sum(Value, na.rm = TRUE))

# make sure the 'year' value is in Number data format
continent_df$Year <- as.numeric(continent_df$Year)
```

Refugee Trends Across Presidential Terms (2006–2015)

The analysis of refugee data from 2006 to 2015 provides valuable insights into global migration patterns and highlights the influence of leadership periods on refugee numbers. By combining stacked bar charts with trend lines and presidential term overlays, the visualization effectively tells a compelling story of refugee distribution across continents during the George W. Bush and Barack Obama administrations.

Key Insights: Presidential Term Influence:

The data is segmented into two distinct presidential periods:

- George W. Bush (2006–2008): This period shows a steady increase in refugee numbers, indicating global conflicts or crises that led to heightened migration.
- Barack Obama (2009–2015): The refugee numbers initially declined but later stabilized at higher levels, reflecting the impact of sustained geopolitical challenges during this time.

Stacked Bar Chart for Continental Trends:

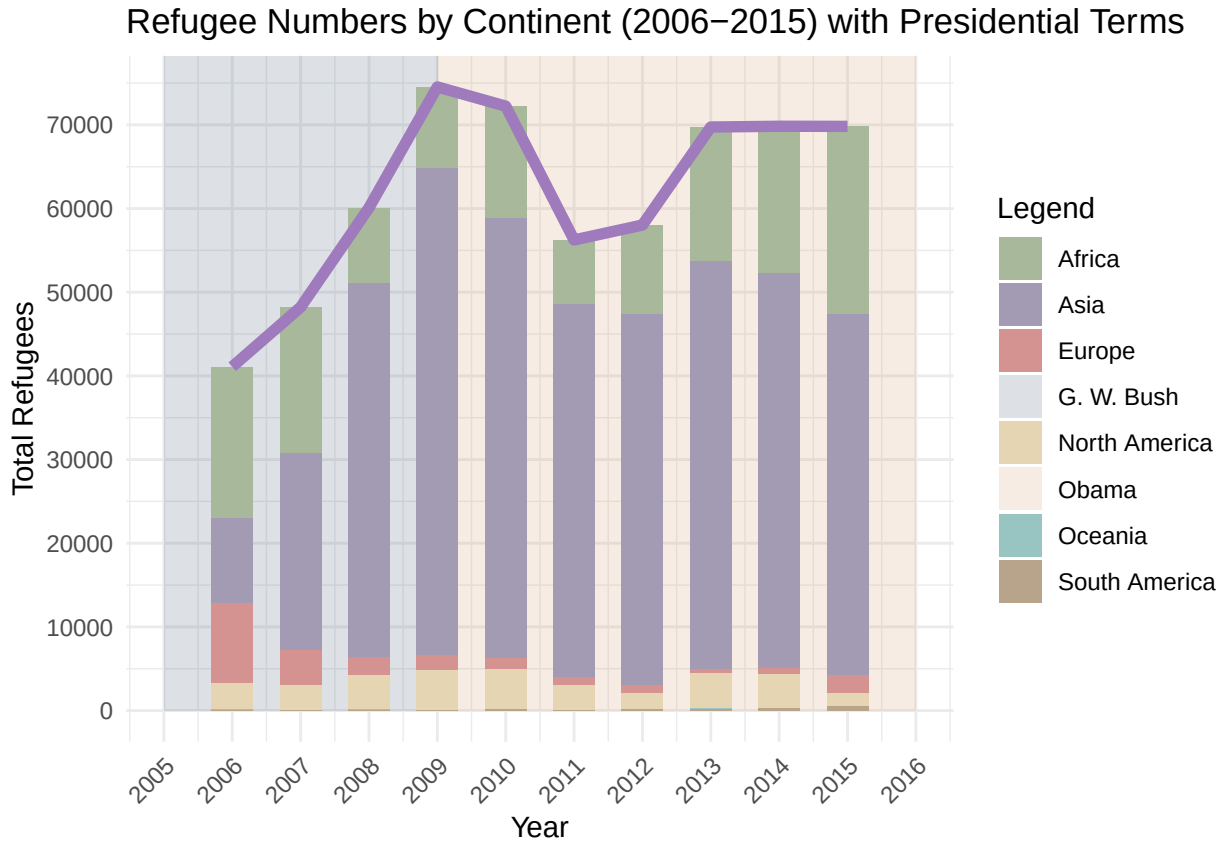
The stacked bar chart provides a breakdown of refugee numbers by continent. Notably:

- Asia and Africa consistently contributed the highest numbers of refugees, driven by ongoing conflicts and socio-political instability.
- Europe and the Americas saw comparatively smaller contributions, reflecting differences in regional refugee patterns.

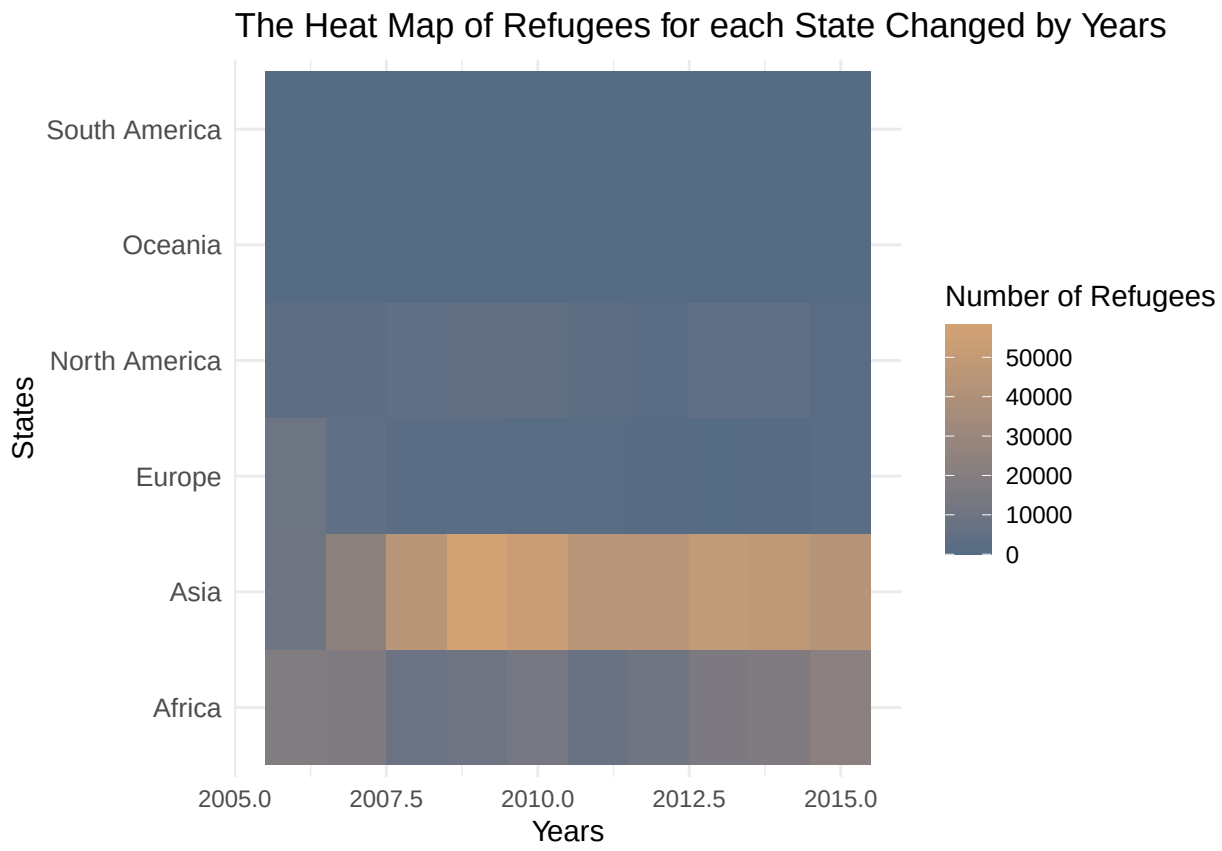
```
library(ggplot2)
library(dplyr)

presidents <- data.frame(
  President = c("G. W. Bush", "Obama"),
  Start_Year = c(2005, 2009),
  End_Year = c(2009, 2016)
)

continent_df <- continent_df %>%
  mutate(
    Year = as.numeric(Year),
    Total_Refugees = as.numeric(Total_Refugees)
  )
```

```r
yearly_refugees <- continent_df %>%
  group_by(Year) %>%
  summarise(Total_Refugees = sum(Total_Refugees, na.rm = TRUE))


ggplot() +

  geom_rect(data = presidents, aes(xmin = Start_Year, xmax = End_Year, ymin = 0, ymax = Inf, fill = Pres

  geom_bar(data = continent_df, aes(x = Year, y = Total_Refugees, fill = `Continent/Country of Nationali
           stat = "identity", position = "stack", width = 0.6) +
  geom_line(data = yearly_refugees, aes(x = Year, y = Total_Refugees, group = 1),
            color = "#9f7abc", size = 2) +
  scale_fill_manual(
    name = "Legend",
    values = c(
      "G. W. Bush" = "#556b84",  # color the president
      "Obama" = "#d4a373",
      "Africa" = "#a8b89a",
      "Asia" = "#a29bb3",
      "Europe" = "#d49391",
      "North America" = "#e5d5b2",
      "Oceania" = "#98c4c1",
      "South America" = "#b8a38b"
    )
  ) +

  scale_y_continuous(breaks = scales::pretty_breaks(n = 10)) +
  scale_x_continuous(limits = c(2005, 2016), breaks = 2005:2016) +

  theme_minimal() +
  labs(
    title = "Refugee Numbers by Continent (2006-2015) with Presidential Terms",
    x = "Year",
    y = "Total Refugees"
  ) +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1),
    legend.position = "right"
  )
```

```
## Warning: Using ‘size‘ aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use ‘linewidth‘ instead.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.
```

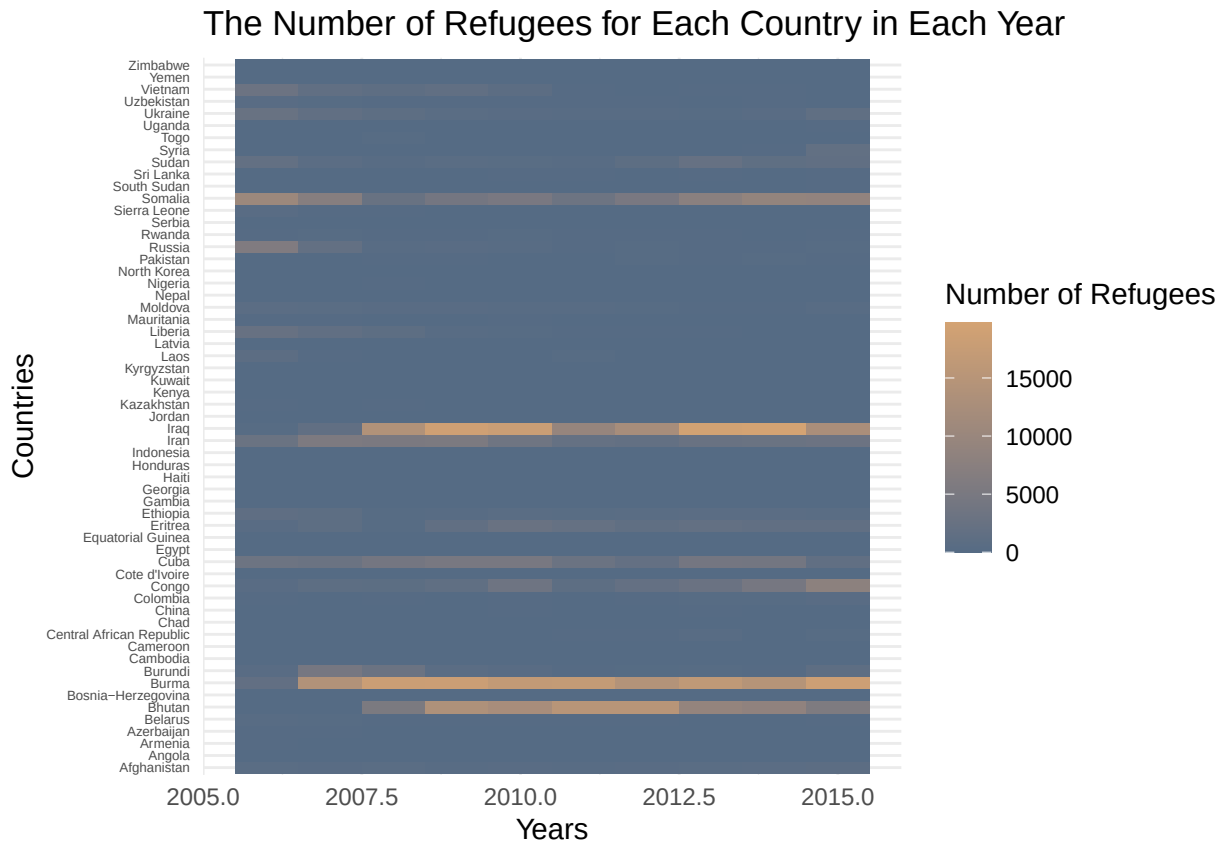



```
ggplot(continent_df, aes(x = Year, y = `Continent/Country of Nationality`, fill = Total_Refugees)) +
  geom_tile() +
  scale_fill_gradient(low = "#556b84", high = "#d4a373") +  # set the color
  theme_minimal() +
  labs(title = "The Heat Map of Refugees for each State Changed by Years",
       x = "Years",
       y = "States",
       fill = "Number of Refugees") +
  theme(legend.position = "right",
        axis.text.y = element_text(size = 10))
```

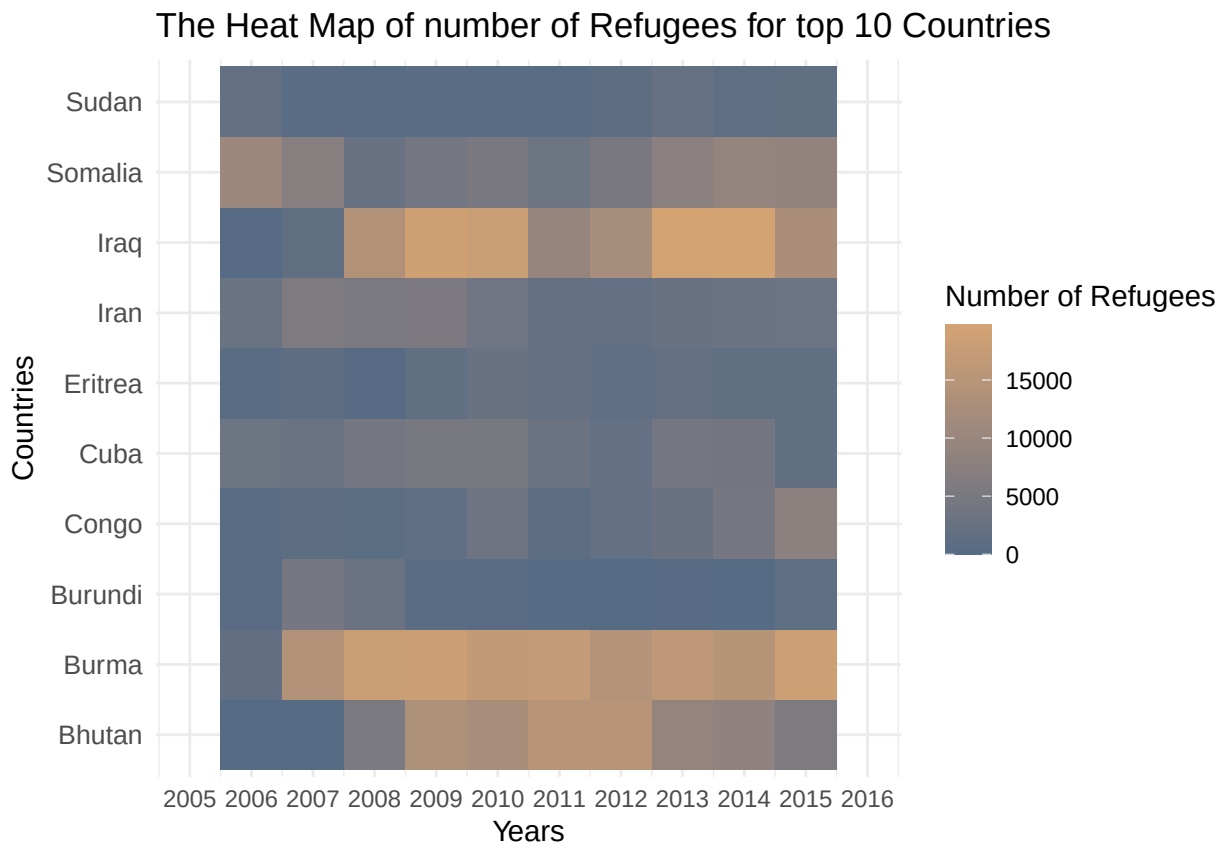


3. Heatmap of Refugee Numbers

```
ggplot(country_long, aes(x = as.numeric(Year), y = `Continent/Country of Nationality`, fill = Value)) +
  geom_tile() +
  scale_fill_gradient(low = "#556b84", high = "#d4a373") +
  theme_minimal() +
  labs(title = "The Number of Refugees for Each Country in Each Year",
       x = "Years",
       y = "Countries",
       fill = "Number of Refugees") +
  theme(legend.position = "right",
  axis.text.y = element_text(size = 5))
```




```r
# Calculate the number of Refugees for each country in Total
top_countries <- country_long %>%
  group_by(`Continent/Country of Nationality`) %>%
  summarise(Total_Refugees = sum(Value, na.rm = TRUE)) %>%
  arrange(desc(Total_Refugees)) %>%
  slice_head(n = 10)  #  pick top 10

# get the name of country in top 10
top_country_names <- top_countries$`Continent/Country of Nationality`

# filter the data with top 10
filtered_df <- country_long %>%
  filter(`Continent/Country of Nationality` %in% top_country_names)

ggplot(filtered_df, aes(x = as.numeric(Year), y = `Continent/Country of Nationality`, fill = Value)) +
  geom_tile() +
  scale_fill_gradient(low = "#556b84", high = "#d4a373") +
  scale_x_continuous(limits = c(2005, 2016), breaks = 2005:2016) +
  theme_minimal() +
  labs(title = "The Heat Map of number of Refugees for top 10 Countries",
       x = "Years",
       y = "Countries",
       fill = "Number of Refugees") +
  theme(legend.position = "right",
        axis.text.y = element_text(size = 10))
```

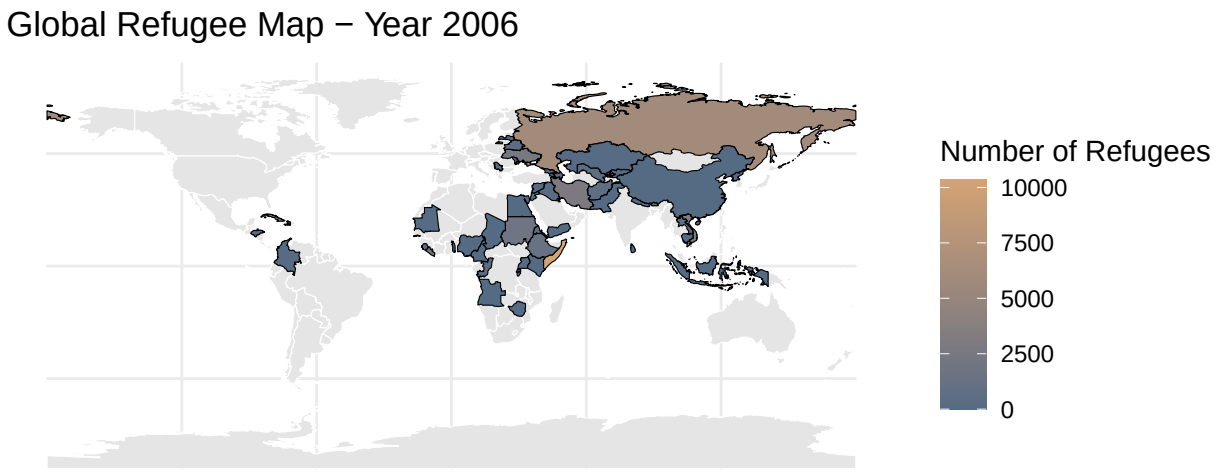


The World Map with Refugees number

```
library(gganimate)
library(sf)
library(rnaturalearth)
library(rnaturalearthdata)
library(gifski)
library(transformr)

country_long <- country_df %>%
  pivot_longer(cols = -`Continent/Country of Nationality`,
               names_to = "Year", values_to = "Value")
country_long$Year <- as.numeric(country_long$Year)


# load the world map
world_map <- ne_countries(scale = "medium", returnclass = "sf")

# adjust the name of countries
country_long <- country_long %>%
  rename(country = `Continent/Country of Nationality`)

# combine the map data and refugees data
map_data <- world_map %>%
```

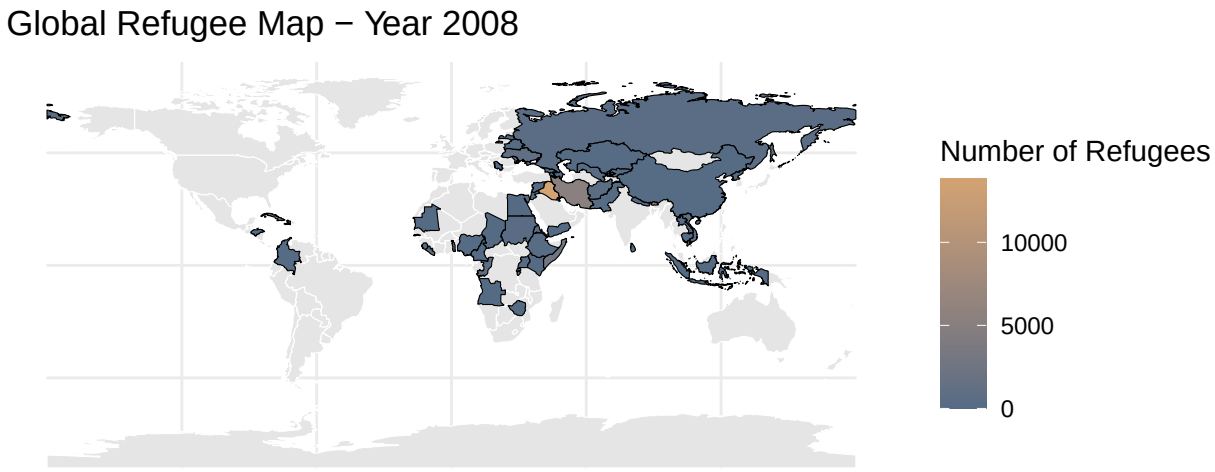
```
  left_join(country_long, by = c("name" = "country"))
```

```
library(ggplot2)
library(sf)
library(dplyr)

#
country_long$Year <- as.numeric(country_long$Year)

#
plot_yearly_maps <- function(year) {
  yearly_data <- map_data %>% filter(Year == year)

  ggplot() +
    geom_sf(data = world_map, fill = "gray90", color = "white") +
    geom_sf(data = yearly_data, aes(fill = Value), color = "black") +
    scale_fill_gradient(low = "#556b84", high = "#d4a373", na.value = "gray90") +
    theme_minimal() +
    labs(title = paste("Global Refugee Map - Year", year), fill = "Number of Refugees")
}

#
plot_yearly_maps(2006)
```

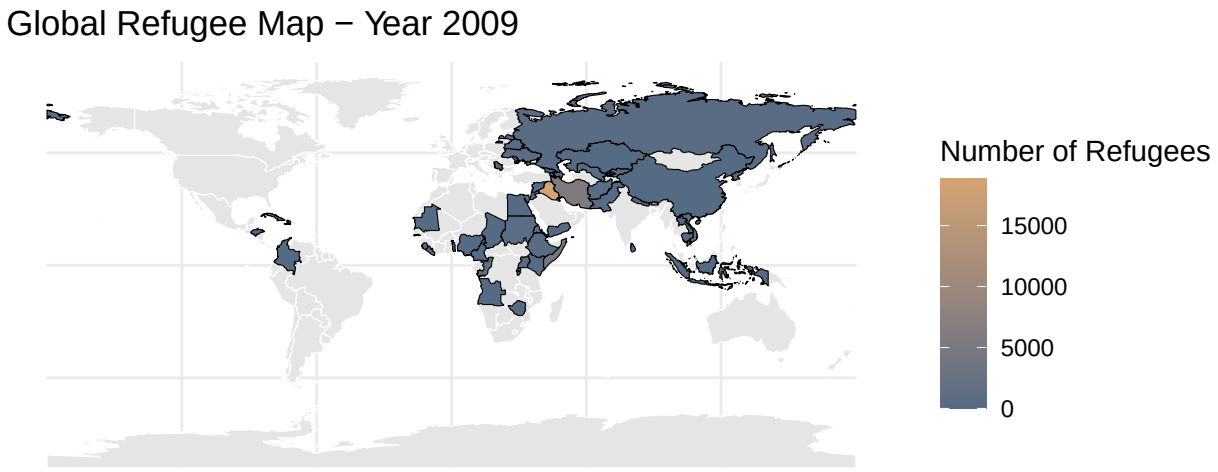


```
plot_yearly_maps(2007)
```

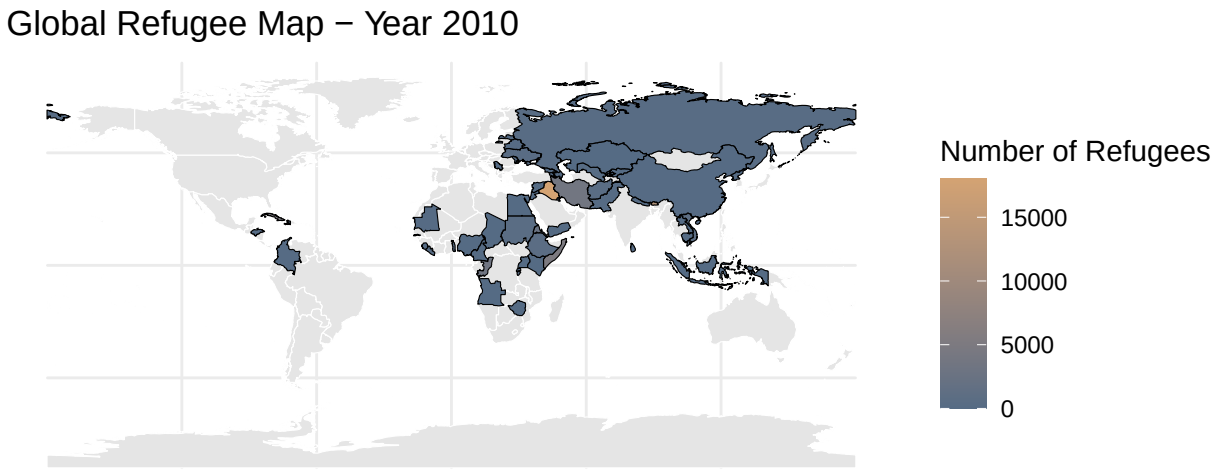

```
plot_yearly_maps(2008)
```




```
plot_yearly_maps(2009)
```

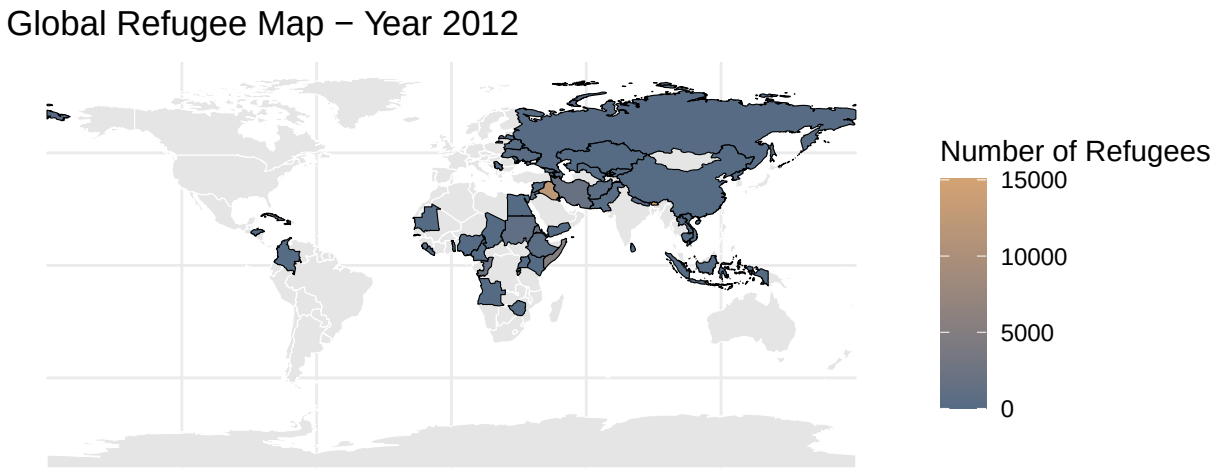



```
plot_yearly_maps(2010)
```

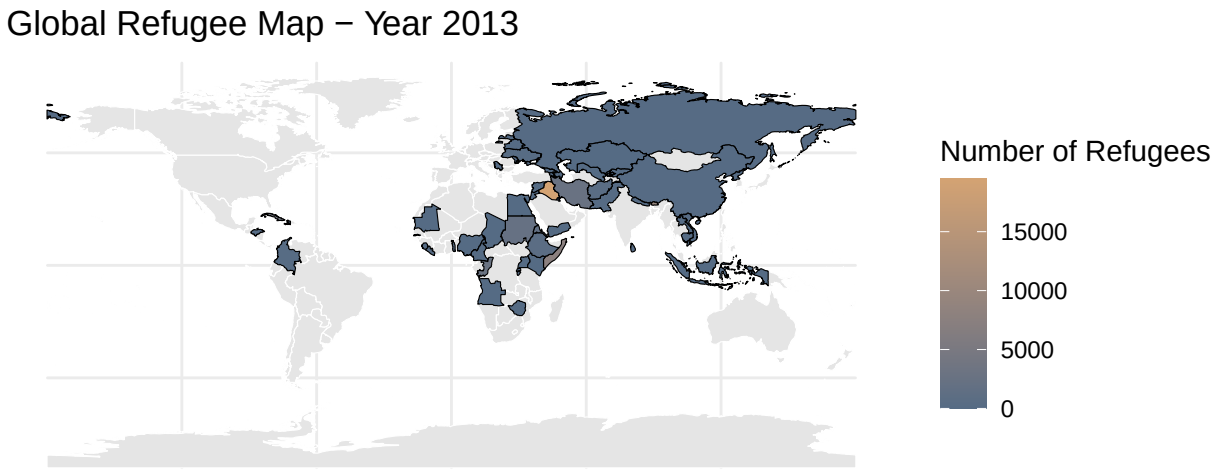



```
plot_yearly_maps(2011)
```

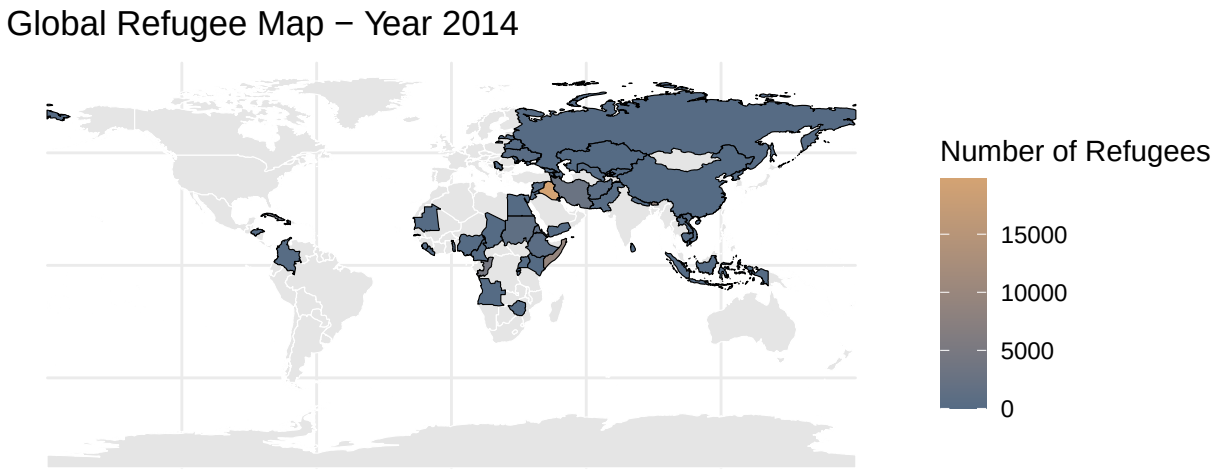

```
plot_yearly_maps(2012)
```



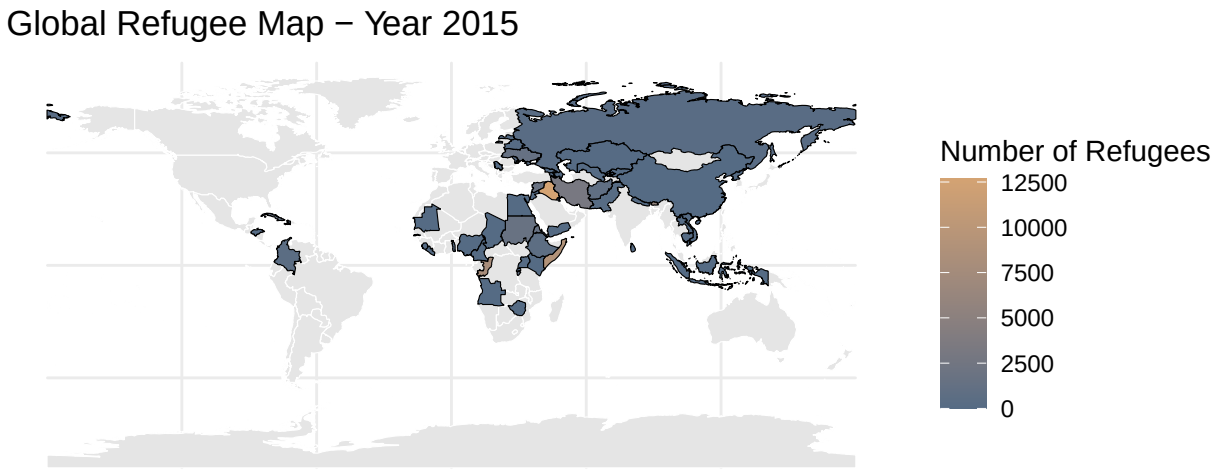

```
plot_yearly_maps(2013)
```




```
plot_yearly_maps(2014)
```




```
plot_yearly_maps(2015)
```



below code is for generate the GIF library(gganimate)

p <- ggplot() + geom_sf(data = world_map, fill = "gray90", color = "white") + # the world map geom_sf(data = map_data, aes(fill = Value), color = "black") + # data refugees scale_fill_gradient(low = "blue", high = "yellow", na.value = "gray90") + theme_minimal() + labs(title = "Global Refugees data Map (Year: {frame_time})", fill = "Number of Refugees", x = " ", y =" ") + transition_time(Year) + # change the plot by year ease_aes('linear') # change smoothly

generate the GIF

anim <- animate(p, duration = 10, fps = 40, width = 800, height = 500, renderer = gifski_renderer()) anim_save("refugees_map_smooth.gif", animation = anim)

Conclusion

This analysis provides a comprehensive look at global refugee movements, highlighting key trends, high-risk regions, and changes over time. The combination of data cleaning, visualization, and statistical analysis allows for an in-depth understanding of the factors driving refugee migration, which can support future policy-making and humanitarian efforts.