Assignment 4

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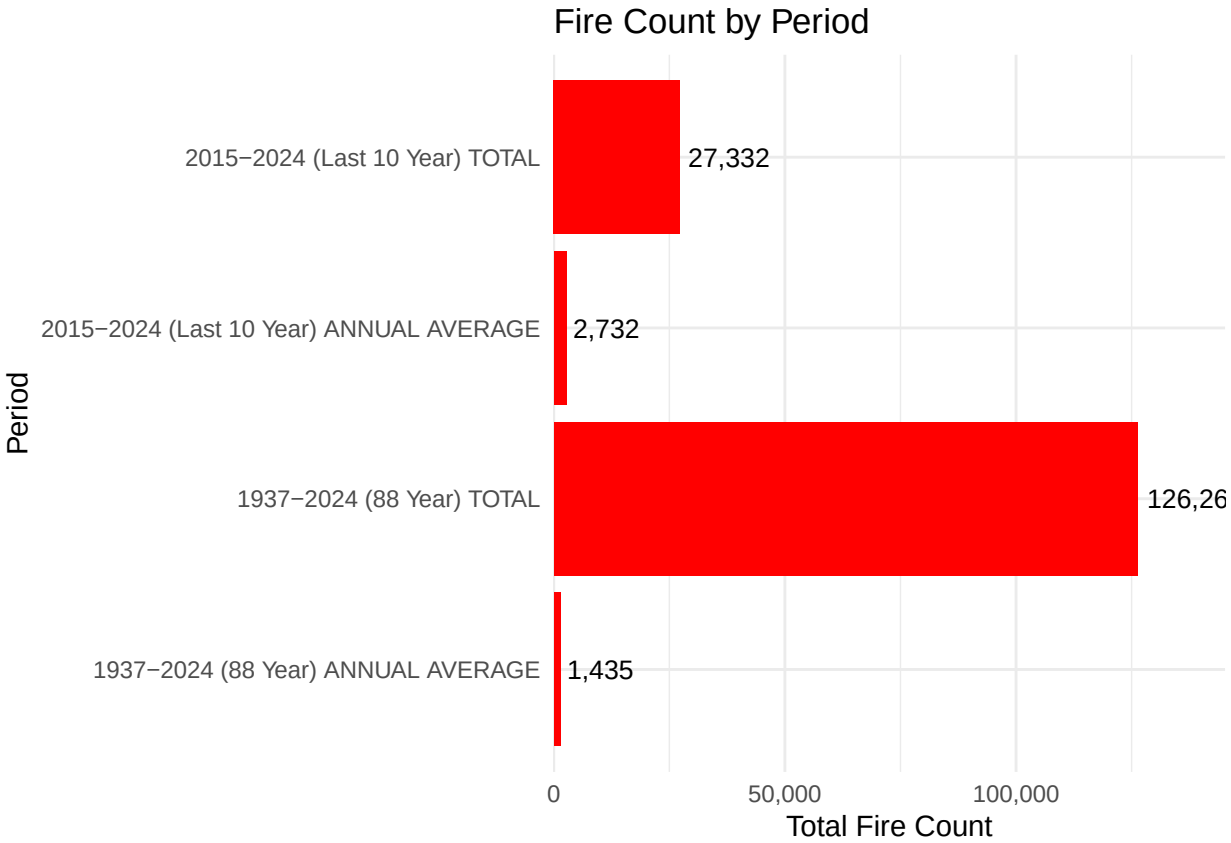
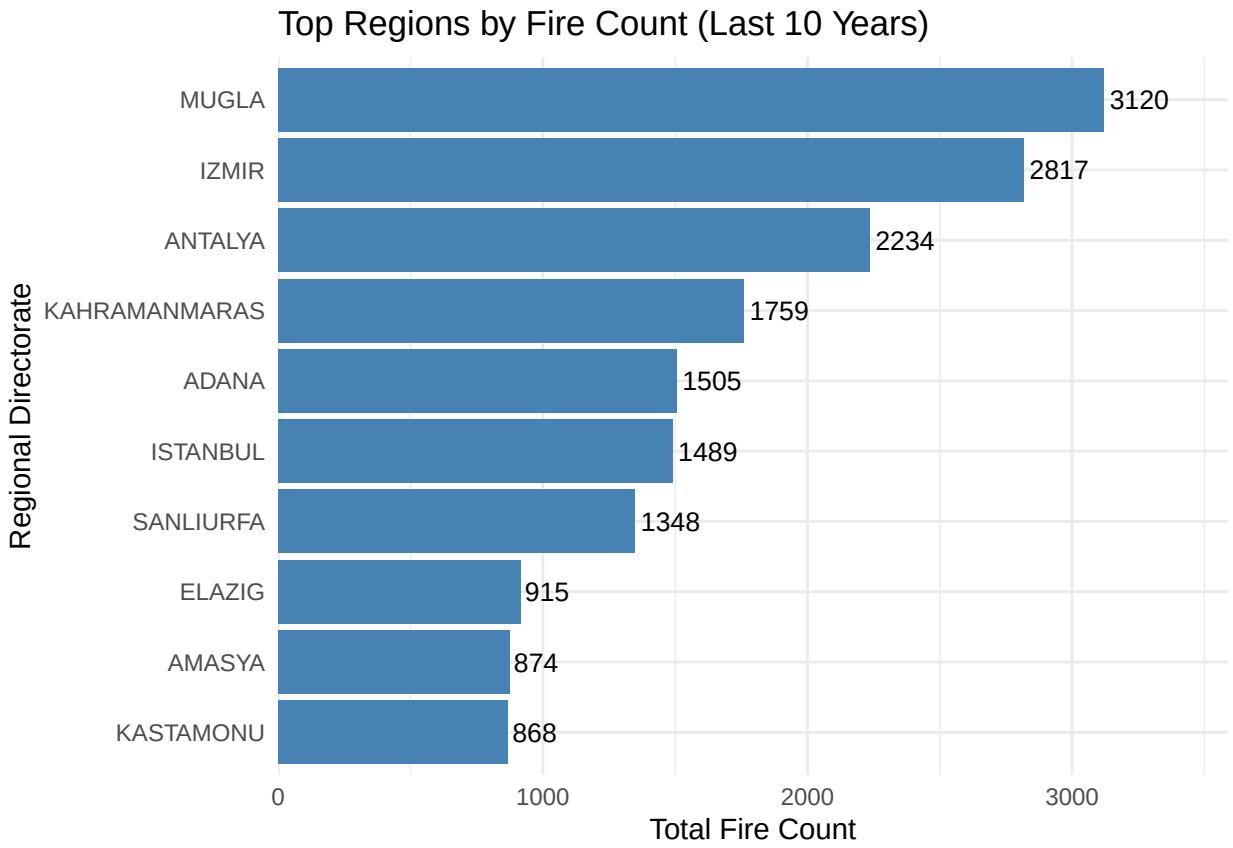
Summary: Analysis of Forest Fire Statistics in Turkey

I got the data from the Turkish Foresters Association. I used the R language and the ggplot2 package to make my graphs. My main goal was to see the trends over time and find out which areas had the worst fire problems. I wanted to know where fires happen most often and where they cause the most damage.

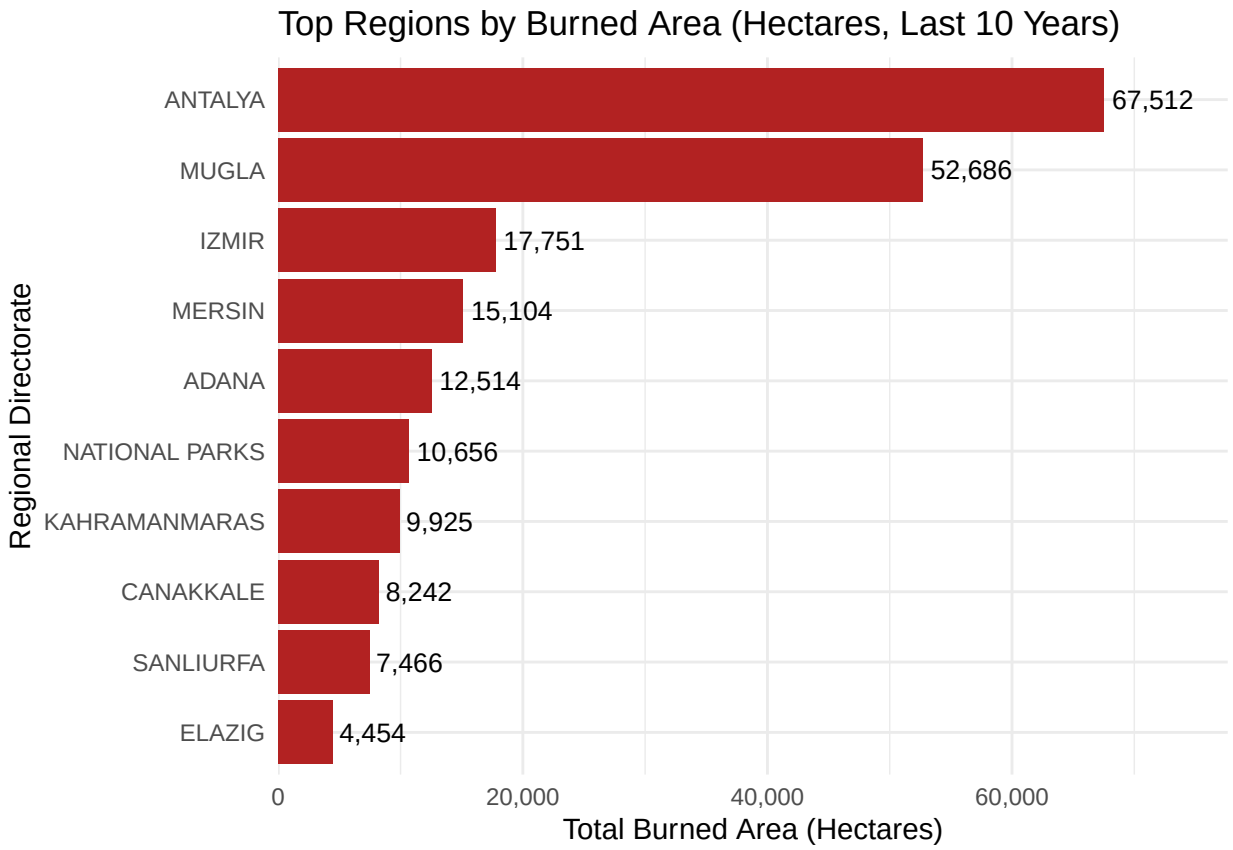
I split my analysis into three parts. First, I looked at the past.



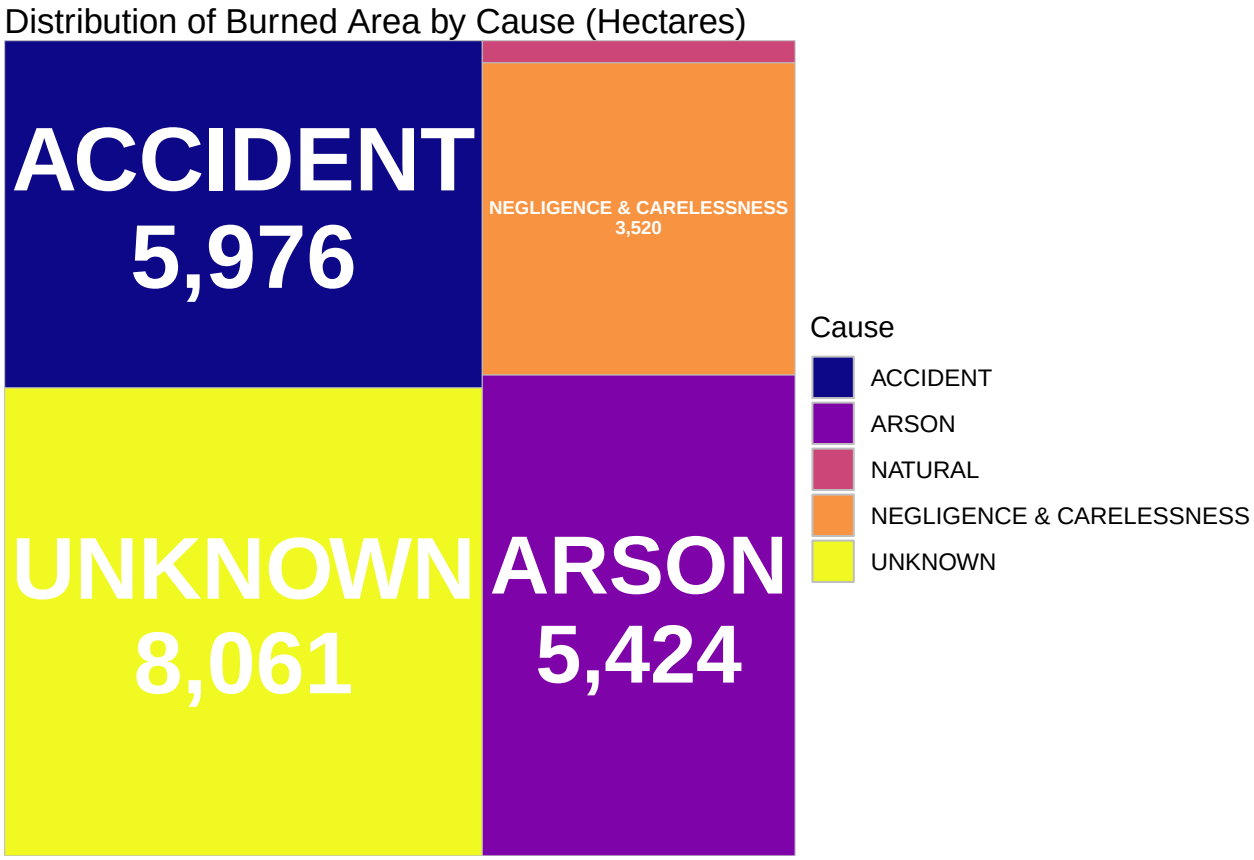
I compared the 88-year period (1937-2024) to the last 10 years (2015-2024). My graphs show a big trend: the 88-year average was 1,435 fires per year, but in the last 10 years, this went up to 2,732 fires. This means we are getting almost twice as many fires now. At the same time, the average size of one fire went down (from 15.1 to 9.42 hectares). This could mean that we have more fires, but maybe we are getting better at stopping them faster.



The second part of my project looks at just the last 10 years by region. I checked the top 10 regions for both the number of fires and the total area burned. My graphs show a big difference. Muğla (3,120) and Izmir (2,817) had the most fires.



But when I looked at the graph for area burned, the story was different. Antalya (67,512 ha) and Muğla (52,686 ha) were the most damaged, by far. This means its fires are much bigger. Other regions, like Mersin, were not in the top 10 for fire count, but they showed up in the top 10 for burned area. This suggests they have fewer fires, but the ones they do have are very large.



Third, I looked the causes of the fires based on the average annual area burned. The treemap graph clearly shows that the most frequent causes are not always the most destructive. The largest portion of burned area comes from fires where the cause is Unknown (Bilinmeyen), at 34.6%. After that, 'Accidents' (Kaza) at 25.6% and 'Arson' (Kasıt) at 23.3% are responsible for huge amounts of damage, even though they are among the least frequent causes. In contrast, 'Negligence' (İhmal ve Dikkatsizlik) is the second most common cause of fires, but it accounts for a smaller portion of the area burned (15.1%). 'Natural' (Doğal) fires, while common, have almost no impact on the total burned area (1.1%).

In conclusion, my analysis shows three main things: forest fires are happening more often, the damage is concentrated in specific regions like Muğla and Antalya, and the causes of the most destructive fires (Accidents and Arson) are not the most frequent ones. This suggests that while negligence causes many small fires, accidents and arson lead to far larger disasters.

Data set Description:

The data set used in this analysis was obtained from the official website of the Turkish Foresters Association (Türkiye Ormancılar Derneği).

Source: Turkish Foresters Association

Access Link: https://www.ormancilardernegi.org/Yangin

Appendix: R Codes for Graphs

"Below are the R codes for the graphs used in this report."

Graph 1: Fire Count by Period

```
ggplot(fire_periods, aes(x = Count, y = Period)) +
  geom_col(fill = "red") +
  geom_text(aes(label = comma(Count)),
            hjust = -0.1,
            color = "black",
            size = 3.5) +
  scale_x_continuous(
    labels = comma,
    expand = expansion(mult = c(0, 0.15))
  ) +
  labs(
    title = "Fire Count by Period",
    x = "Total Fire Count",
    y = "Period"
  ) +
  theme_minimal()
```

Graph 2: Top Regions by Fire Count (Last 10 Years)

```
ggplot(fire_counts_by_region, aes(x = Total_Count, y = fct_reorder(Region, Total_Count))) +
  geom_col(fill = "steelblue") +
  geom_text(aes(label = Total_Count),
            hjust = -0.1,
            size = 3.5,
            color = "black") +
  scale_x_continuous(expand = expansion(mult = c(0, 0.15))) +
  labs(
    title = "Top Regions by Fire Count (Last 10 Years)",
    x = "Total Fire Count",
    y = "Regional Directorate"
  ) +
  theme_minimal()
```

Graph 3: Top Regions by Burned Area (Hectares, Last 10 Years)

```
ggplot(fire_area_by_region, aes(x = Total_Area_Ha, y = fct_reorder(Region, Total_Area_Ha))) +
  geom_col(fill = "firebrick") +
  geom_text(aes(label = comma(Total_Area_Ha)),
            hjust = -0.1,
            size = 3.5,
            color = "black") +
  scale_x_continuous(
    labels = comma,
    expand = expansion(mult = c(0, 0.15))
  ) +
  labs(
    title = "Top Regions by Burned Area (Hectares, Last 10 Years)",
```

```
    x = "Total Burned Area (Hectares)",
    y = "Regional Directorate"
  ) +
  theme_minimal()
```

Graph 4: Distribution of Burned Area by Cause (Treemap)

```
ggplot(fire_causes,
       aes(area = Avg_Annual_Area_Ha,
           fill = Cause,
           label = paste(Cause,
                         comma(Avg_Annual_Area_Ha, accuracy = 1),
                         sep = "\n"))) +
  geom_treemap() +
  geom_treemap_text(
    color = "white",
    fontface = "bold",
    place = "centre",
    grow = TRUE,
    min.size = 2
  ) +
  scale_fill_viridis_d(option = "C") +
  theme_void() +
  theme(legend.position = "right") +
  labs(title = "Distribution of Burned Area by Cause (Hectares)")
```