Report on Wildfire Analysis and Impact Assessment

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1.1 Overview of the Open-Source Data:

The Kaggle dataset provides comprehensive wildfire incident records, including duration, human casualties, and property damage, allowing for trend analysis and impact assessment.

1.2 Purpose and Goals:

The study aims to:
- Understand the increasing wildfire durations due to climate change.
- Assess human and structural damages in high-risk areas.
- Analyze the correlation between fire severity and emergency response times.

1.3 Selecting Sources and Datasets:

The Kaggle dataset was chosen because of its enormous historical records of wildfire incidences, which allow for trend analysis, risk assessment, and policy suggestions.

1.4 Expectations:

This study aims to identify:

Patterns in wildfire occurrences across time.
High-risk counties with frequent events.
The association between fire severity and response effectiveness.

2. Research Questions

2.1 Key Question 1

What is the average duration of wildfires?
Helps analyze fire trends over the years and assess the impact of climate change on wildfire longevity.

2.2 Key Question 2

How much property has been affected by wildfires?
Evaluates structural damage and financial losses, assisting in risk assessment and policy recommendations.

2.3 Key Question 3

How many human lives have been affected by wildfires?
Examines casualties and injuries, helping improve evacuation strategies and emergency response measures.

2.4 Key Question 4

How have fire incidents evolved over the years?
Identifies trends in wildfire frequency and severity, aiding in preventive planning and
firefighting strategies.

2.5 Key Question 5

Which year had the highest number of human casualties?
Determines the deadliest wildfire year, highlighting emergency response efficiency and gaps in
disaster management.

2.6 Key Question 6

Which counties experience the most wildfire incidents?
Pinpoints high-risk regions, helping policymakers and communities focus on fire prevention and
resource allocation.

3. Metrics and KPIs:

3.1 Environmental Impact:

- **KPI:** Average wildfire duration & year-over-year (YoY) change
- **Insight:** Fires last around 85 days on average, with some years showing longer fire
  seasons due to climate change.

3.2 Property & Structural Damage:

- **KPI:** Total structures affected
- **Insight:** Significant spikes in property losses during peak wildfire years, highlighting the
  need for fire-resistant infrastructure.

3.3 Human Impact:

- **KPI:** Total injuries and fatalities
- **Insight:** Years 2017 and 2018 recorded the highest casualties, emphasizing the need for
  better evacuation plans and emergency responses.

3.4 Wildfire Frequency:

- **KPI:** Number of wildfire incidents per year
- **Insight:** Wildfire occurrences peaked in 2017, followed by a decline, showing
  improvements in fire management strategies.

3.5 High-Risk Zones:

- **KPI:** Counties with the highest wildfire occurrences

- **Insight:** Riverside, San Diego, and Butte counties experience the most fires, requiring focused prevention efforts.

4. Data Model:

4.1 Overview of the Data:

The wildfire dataset includes structured information about fire occurrences, such as location details, administrative units, fire descriptions, response activities, and time-based variables. The data is organized into various tables for effective storage and analysis. The principal fact table, Fact_Fire_Incidents, contains essential fire-related metrics such as air tanker deployment, crew involvement, dozers, engines, fatalities, and fuel type, while other dimension tables give contextual data for in-depth study.

4.2 Entity-Relationship Diagram (ERD):

https://github.com/abhayzap/Data-Science
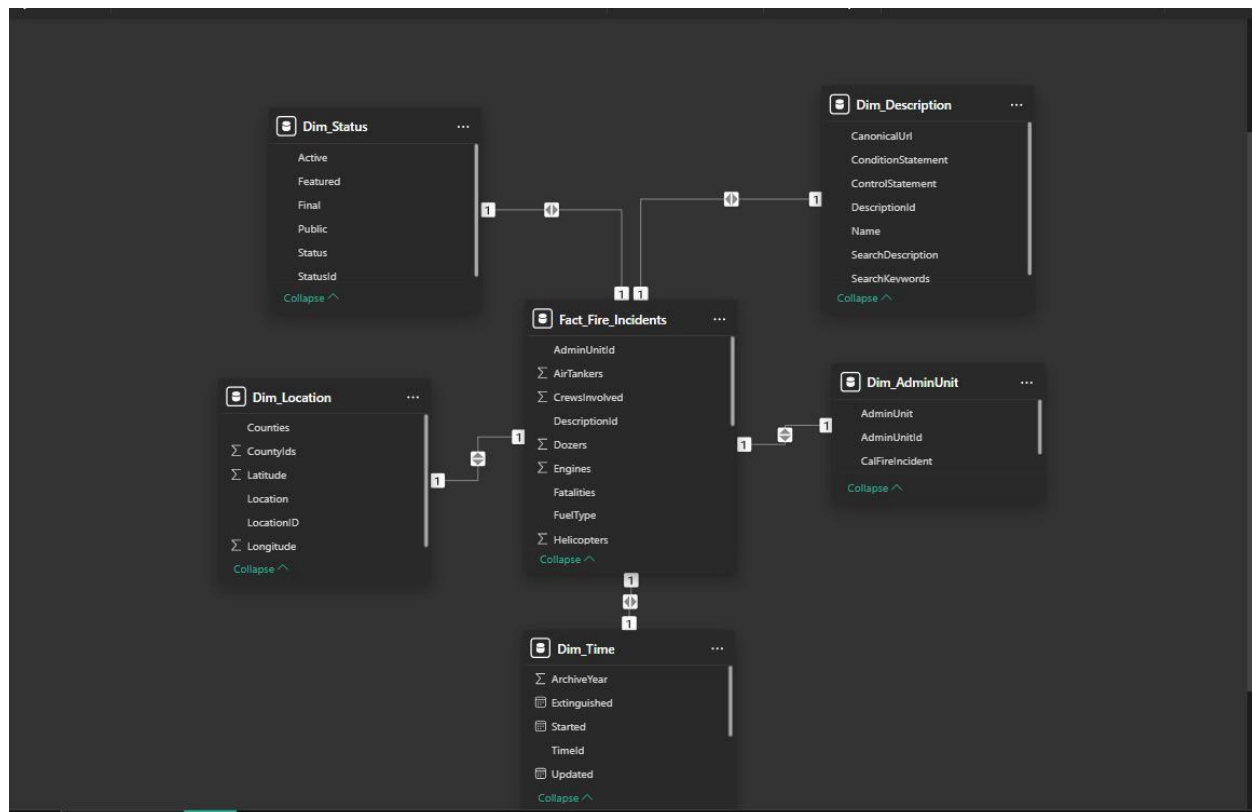
5. Results

Here's a brief explanation of the Each and Every Card And Graph:

1. Average Fire Duration Card:
The Average Fire Duration card gives information about the average length of a wildfire by displaying the number of days it lasts each year. This statistic aids in assessing long-term patterns, such as if fire durations are lengthening owing to climate change. A longer average length indicates longer fire seasons, which leads to more environmental damage, higher suppression expenditures, and increased hazards to human life and property. By recording this data, policymakers and emergency responders may evaluate the success of firefighting activities and devise methods to reduce wildfire impacts and enhance response time.

2. Total Property Damage Card:
The Total Property Damage card provides a detailed perspective of the number of structures damaged by wildfires, allowing you to analyze the financial and structural effect of these disasters. Wildfires can inflict considerable damage to homes, businesses, and infrastructure, resulting in significant economic losses and long-term displacement of inhabitants. By examining this data, authorities can discover patterns in fire-prone locations and impose tougher building codes and fire-resistant construction materials to reduce destruction. This statistic also assists politicians and urban planners in developing more effective land management methods, ensuring that communities are better protected from future wildfires.

3. Total Human Impact Card:
The Total Human Impact indicator measures the total number of injuries and deaths caused by wildfires. This essential factor contributes to determining the severity of wildfire incidents in terms of human safety and well-being. Tracking this amount over time allows emergency response teams, policymakers, and disaster management agencies to assess the efficacy of evacuation plans, firefighting techniques, and public safety measures. A growing trend may indicate gaps in preparedness and response efforts, whereas a fall indicates advances in early warning systems, resource allocation, and community resilience.

4. Yearly Fire Incidents Bar Graph:

The Yearly Fire Incidents bar graph shows the overall number of wildfires reported each year. This graphic assists in identifying trends across time, highlighting peak wildfire years such as 2017, which witnessed a large increase in fire incidence. Researchers and policymakers can assess relevant elements, such as climate change, drought conditions, and human activities, by examining these trends. Furthermore, this data aids in the evaluation of firefighting activities, resource allocation, and policy success in reducing

wildfire risks. Understanding these changes allows for better preparedness and response efforts to reduce future wildfire impacts.

5. Wildfire Hotspots Map Visualization:

The Wildfire Hotspots map visualization offers a regional overview of wildfire activity, highlighting counties with the highest number of events. Using color gradients and spatial mapping techniques, this tool quickly detects high-risk locations like Riverside, San Diego, Butte, and San Luis Obispo, where wildfires are common. This visual technique not only displays the severity and concentration of wildfires but also helps decision-makers assess risk. With a clear picture of where wildfires occur most frequently, emergency response teams and policymakers may better allocate resources, implement focused prevention measures, and improve community preparation to lessen future wildfire impacts.

6. Human Casualties by Year Bar Graph:

The Human Casualties by Year bar graph depicts the annual total of injuries and fatalities caused by wildfires. This visualization allows analysts to easily compare yearly patterns and identify periods with considerable human impact. Researchers can find trends in casualty fluctuations over time, which may be related to changes in emergency response techniques or improvements in public safety measures. The findings from this data not only highlight the immediate human cost of wildfires, but they also assist guide future safety standards and policy decisions targeted at lessening the negative consequences on communities.

7. Fire Incidents vs. Fire Extinguished Line Graph:

The Fire Incidents vs. Fire doused line graph compares the number of wildfires that have begun and those that have been successfully doused throughout time. By charting these two trends on the same chart, the visualization provides information about the success of firefighting efforts and emergency response techniques. A close alignment of the two lines often implies efficient wildfire management, implying that reaction teams are promptly and successfully controlling incidents. In contrast, a big gap more fires beginning than being extinguished—may indicate problems with resource allocation or reaction times, emphasizing areas for improvement. This information is critical for improving firefighting techniques and ensuring that communities are better protected from wildfires.

8. Property Damage Trends Bar Graph:

The Property Damage Trends bar graph visualizes the annual financial losses caused by wildfires by depicting the amount of property damage incurred each year. This graphic enables stakeholders to see how property damage has changed over time, highlighting

times with considerable financial effect. By monitoring these trends, scientists and policymakers can analyze the rising economic cost of wildfires, emphasizing the need for improved fire control measures and tougher building rules. The graph is a valuable tool for assessing both immediate economic losses and the larger implications for community resilience and resource allocation in wildfire-prone areas.

9. Most Affected Counties Clustered Bar Graph:

The Most Affected Counties clustered bar graph compares wildfire incidences across counties, allowing stakeholders to quickly see which areas have the highest frequency of wildfires. The chart illustrates regional variations in wildfire activity by grouping data for each county side by side, making it simpler to identify hotspots like Riverside, San Diego, Butte, and San Luis Obispo. This precise analysis facilitates targeted interventions by allowing local governments and emergency services to prioritize resources and implement region-specific fire prevention methods. Finally, this representation helps to refine wildfire management strategies, allowing populations most at risk to be better protected from repeating wildfire outbreaks.

6. Conclusion:

Finally, our data demonstrates that wildfires have a broad and devastating impact on communities and the ecosystem. Key findings from the study include:

• Wildfires endure an average of 85 days, demonstrating that these events are both intense and lengthy. This extended duration causes severe property damage and a large number of casualties.

• The terrible impact of wildfires may be seen in the abrupt peaks of events, particularly in years like 2017 and 2018, which witnessed a significant increase in both injuries and deaths. This highlights the vulnerability of affected areas and the crucial need for better evacuation procedures and public safety measures.

• Despite the high number of wildfires, firefighting efforts have largely been successful. The data demonstrate that the number of flames extinguished roughly matches the number of fires started, indicating that emergency response personnel are effectively controlling events.

• However, the overall findings indicate that there is still considerable work to be done. The substantial property and human losses necessitate stronger fire prevention measures, improved fire-resistant infrastructure, and more resources allocated to high-risk areas.

Overall, while successful firefighting has helped to alleviate some of the damage, wildfires' long duration and catastrophic consequences highlight the critical need for enhanced preparedness and robust intervention tactics to safeguard both people and property.

7.Appendix:

7.1 Power BI Dashboard