

Wildfire Analysis and Impact Assessment -Report

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Open-Source Data Information

The analysis is based on an open-source dataset obtained from [Kaggle](#). This dataset was selected for its comprehensive coverage of wildfire incidents, offering details such as:

- **Incident Duration:** Capturing the start and extinguished times.
- **Human Impact:** Data on injuries and fatalities.
- **Property Damage:** Records of affected structures.

The dataset provides historical trends that facilitate a robust understanding of wildfire behaviour, making it ideal for detailed impact analysis.

Purpose and goals

The primary purpose of this study is to leverage data analytics to:

- **Analyse Wildfire Incidents:** Determine trends in wildfire duration, frequency, and intensity.
- **Assess Impacts:** Quantify the effects on human lives, property, and the environment.
- **Inform Policy and Preparedness:** Generate actionable insights to enhance emergency response, implement stricter building codes, and improve evacuation strategies.

These goals aim to support stakeholders in making informed decisions to mitigate future wildfire risks.

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Key Questions on the Data

The analysis addresses several critical questions, including but not limited to:

1. **What is the average duration of wildfires?**
(Understanding how long fires typically burn can help in resource allocation and response planning.)
2. **How much property has been affected by wildfires?**
(Quantifying property damage assists in economic impact assessments and insurance planning.)
3. **How many human lives have been impacted by wildfires?**
(Evaluating casualty figures is essential for assessing public safety and emergency readiness.)

Additional questions explored include:

- **How have wildfire incidents evolved over the years?**
- **Which year recorded the highest number of human casualties?**
- **Which counties experience the most frequent and severe wildfire incidents?**

Metrics and KPIs

To track both operational and strategic objectives, the following key metrics and KPIs have been defined:

- **Average Fire Duration:**
 - Reported value: Approximately 85–90 days.
 - **Insight:** Indicates prolonged fire incidents that require sustained firefighting efforts.
- **Year-over-Year (YoY) Change in Fire Duration:**
 - Measured change: Approximately -0.60 days.
 - **Insight:** Suggests slight improvements in response times or seasonal variations in wildfire behaviour.
- **Total Property Damage:**
 - Impact: 68K structures affected.
 - **Insight:** Highlights significant economic losses and the need for improved infrastructure resilience.

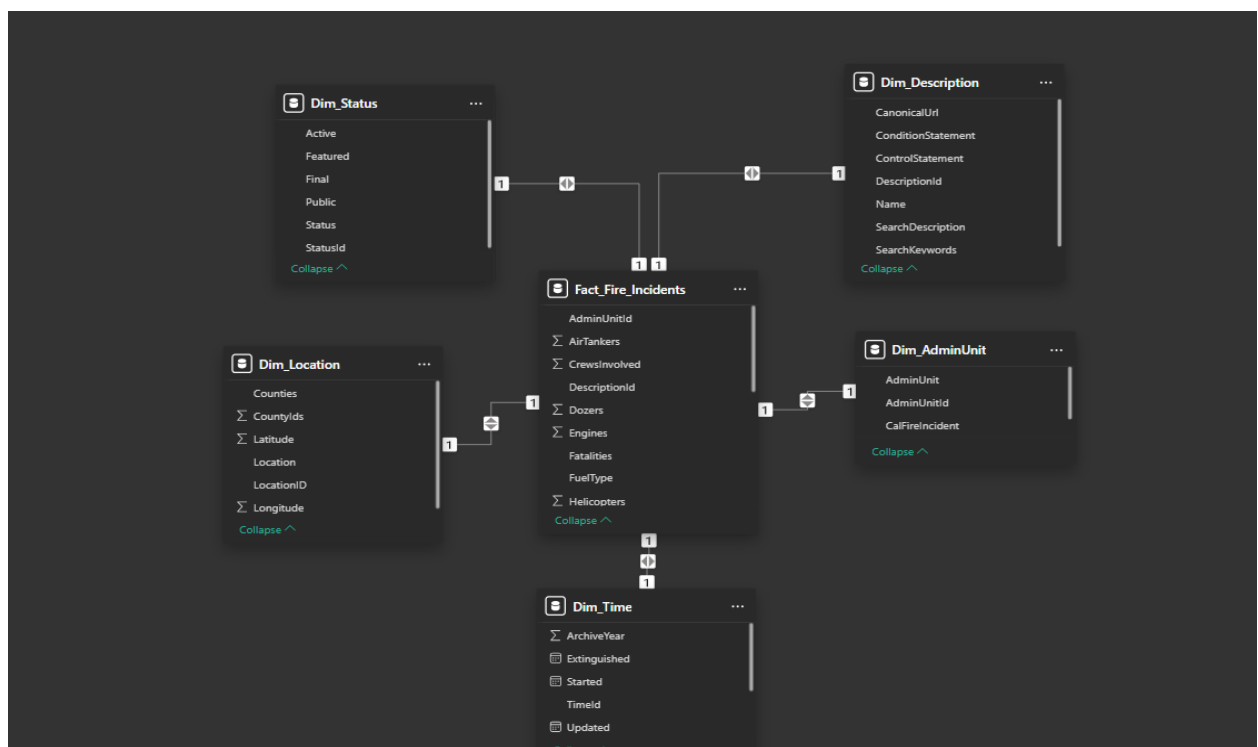
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- **Total Human Impact:**

- Impact: 1,755 casualties (including both injuries and fatalities).
- **Insight:** Emphasizes the critical human toll and the importance of effective evacuation and emergency strategies.

These metrics form the backbone of the analysis, allowing for a detailed evaluation of wildfire trends and their impacts.

Data Model



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Diagram Explanation (brief):

- **Fact_Fire_Incidents:** Contains core wildfire event data (start/end times, severity).
- **Dim_Location:** Geographic details (county, state).
- **Dim_Time:** Calendar attributes (date, year).
- **Dim_Status:** Fire status (active, extinguished).
- **Dim_Description:** Categorical descriptors of each fire.
- **Dim_AdminUnit:** Administrative data (responsible agencies, units).

The data model for this analysis incorporates several layers:

- **Data Ingestion and Cleaning:**
 - Raw data from Kaggle is cleaned and transformed.
 - Outliers and inconsistencies (e.g., missing timestamps) are addressed.
- **Computation of Derived Metrics:**
 - Fire durations are calculated as the difference between start and extinguished times.
 - Year-over-Year (YoY) comparisons are made to assess trends.
- **Relational Structure:**
 - The dataset is organized to relate wildfire incidents with corresponding human and property impact metrics.
 - Time-series elements allow tracking of trends over multiple years.
- **Visualization Integration:**
 - Power BI is used to create dashboards that illustrate key insights such as average durations, regional impact variances, and trends over time.

This model supports both operational monitoring and strategic planning through detailed and actionable insights.

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The analysis has yielded several important findings:

Wildfire Duration:

- On average, fires last between 85 and 90 days, underscoring the prolonged nature of these events.

Regional Impact:

- High-impact areas are predominantly located on the West Coast (e.g., California, Nevada, Oregon), with counties like Riverside, San Diego, and San Luis Obispo experiencing the highest frequencies of incidents.

Temporal Trends:

- There is a notable peak in wildfire incidents around 2017, with that year also recording the highest human casualties.
- Although some metrics indicate slight improvements (e.g., a YoY reduction in fire duration), the overall risk remains high.

Effectiveness of Firefighting Efforts:

- Visual comparisons between fires started and fires extinguished suggest that while response efforts are effective, the sheer scale of incidents poses ongoing challenges.
- These results collectively emphasize the necessity for continuous improvement in wildfire management and emergency response systems.

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Conclusions

The wildfire analysis highlights several critical insights:

- **Significant Impacts:**

Wildfires caused extensive damage not only to the environment but also to human lives and infrastructure. The average incident duration and peak casualty periods underscore the urgent need for improved preparedness.

- **Actionable Recommendations:**

Based on the metrics, there is a clear need to:

- Enhance evacuation strategies and emergency response capabilities.
- Revisit and reinforce building codes to mitigate property losses.
- Invest in preventative measures to reduce the frequency and severity of wildfires.

- **Data-Driven Decision Making:**

The comprehensive data model and robust KPIs provide a strong foundation for developing policies that can better manage and mitigate wildfire risks.

This study demonstrates the power of open-source data and data analytics in addressing complex environmental challenges, providing a clear pathway for future improvements in wildfire management and public safety.