Canadian Wildfire Analysis

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Introduction

There are now major obstacles to public safety, emergency response, and environmental sustainability as a result of Canada's increasing wildfire frequency and severity. Adopting data has become essential due to this rising threat. Driven strategies for managing wildfires. With an emphasis on Canadian wildfire data analysis, our study aims to apply analytics to comprehend the scope, contributing factors, and trends of more than 27,000 documented wildfire incidents. We developed a dynamic dashboard with Power BI that combines time-series, category, and geographic data to produce insights that can be put to use. The project's aim, goals, important KPIs, and strategic conclusions drawn from our analytical work are all covered in detail in this article.

Mission Statement

Our goal is to use data analytics to improve wildfire response tactics and assist in making well-informed decisions in Canada. We want to draw attention to patterns in fire causes, geographic distribution, fire size, and detection techniques by looking at historical wildfire data. The overall objective is to help forest and emergency services, educate public policy, and increase understanding of the ways that human activity and climate change fuel the spread of wildfires. We show how integrating environmental science with business intelligence technologies may effectively protect ecosystems and communities using a strong analytical framework.

Purpose

This analysis's main goal is to provide light on the dynamics of wildfires in Canada. Our study aims to assist local communities and governmental organizations in developing proactive and preventive actions by examining specific qualities including detection type, land origin, fire size, and ignition reason. Our strategy enables stakeholders to predict high-risk times and areas, analyze the effectiveness of the available detection techniques, and determine how land ownership affects the likelihood of fires. In the end, this project emphasizes how important it is to use historical data to increase preparedness and resilience against natural disasters.

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Objectives

To fulfill its purpose, the Calgary Fire Department has established many key objectives.

➢ **Recognize Fire Causes by Year:** Determine how the main causes of wildfires change over time to enable focused preventative measures.

➢ **Map High-Risk Areas:** To assist with resource planning and disaster preparedness in impacted regions, see the spatial density of wildfires.

➢ **Examine Land-Origin Impact:** To evaluate susceptibility, ascertain the distribution and frequency of wildfires on private, Indigenous, and provincial lands.

➢ **Examine Detection Techniques**: Determine the impact of fire detection technique and agent on average fire size and fire containment.

➢ **Create a Complete Model:** Create a scalable Power BI data model that permits KPI tracking, historical trend analysis, and real-time analysis.

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Dataset Overview

Our project's dataset, which includes historical records of wildfire incidents, comes from Canada's open government portal. A multidimensional analysis requires a variety of information and dimension tables, which are included. The dataset's essential components are:

➢ **Fire Events Fact Table:** Contains records of each wildfire incidents.

➢ **Location Dimension:** Consists of geographic coordinates (latitude/longitude), province, and area.

➢ **Cause Dimension:** Provides information on human activity, prescribed burning, and lightning as sources of ignition.

➢ **Weather Dimension:** Documents related environmental parameters including humidity, wind speed, and temperature.

➢ **Detection Dimension:** Describes the type of agent (LKT, AIR, GRP, CAM, UNP) and detection technique.

➢ **Date Table:** Facilitates seasonal trend analysis and time-series displays.

A layered analysis of wildfire patterns over several years and geographical areas is made possible by the dataset's richness.

Analytical Questions

Our investigation sought to address a number of fundamental queries about the behavior of wildfires and their consequences:

➢ Over time, what are the most frequent reasons for wildfires?

➢ Which areas or provinces in Canada are most impacted?

➢ What effect does land origin have on wildfire frequency?

➢ How much does the average fire size and management success depend on the detection method?

➢ Do any outlier years (like 2019) or temporal trends indicate anomalous activity?

➢ How can this analysis help improve public awareness, reaction, and preventative efforts?

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Key Performance Indicators (KPIs)

We developed the following KPIs to monitor the extent of the problem and the efficacy of wildfire management:

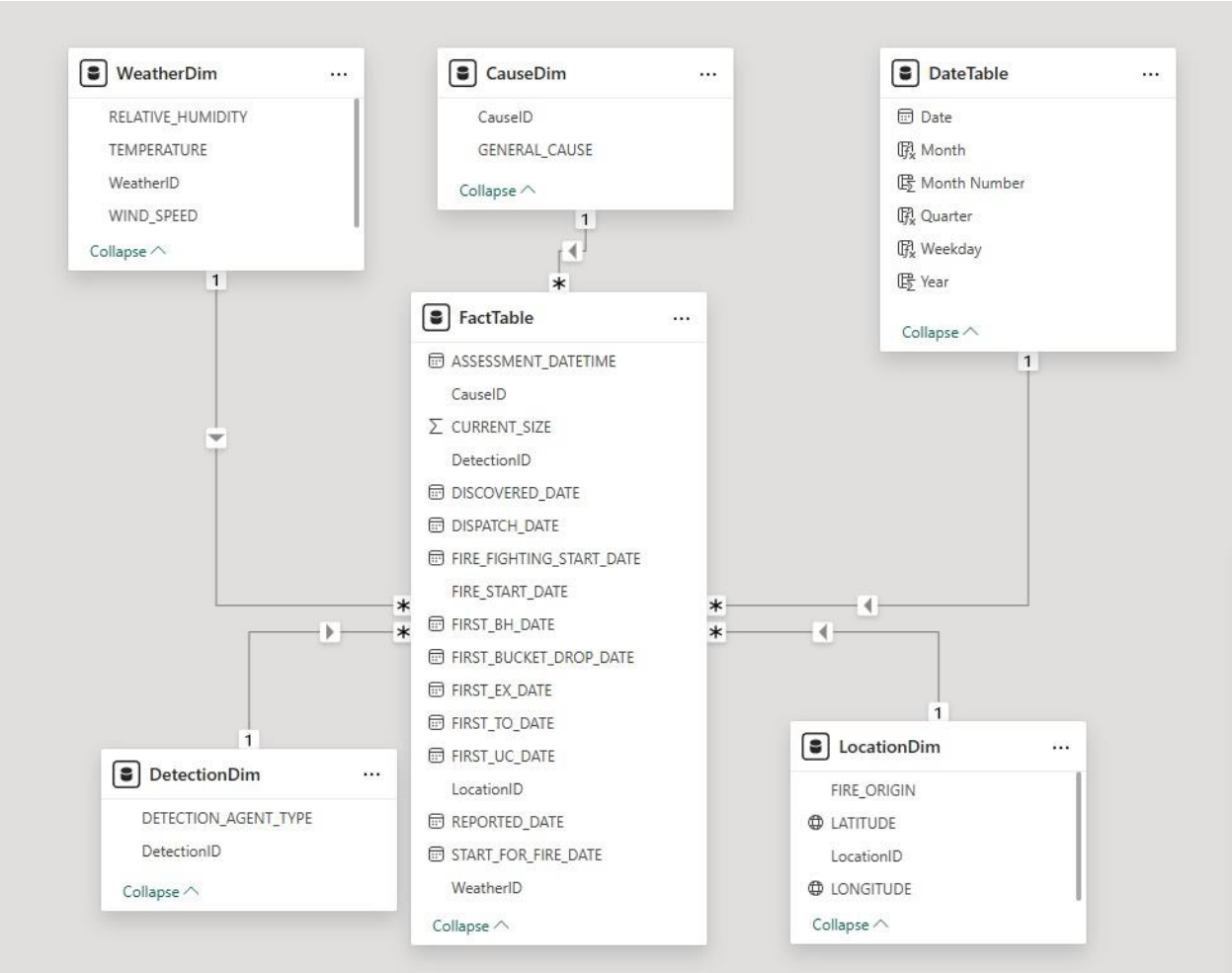
➢ **Total Fires:** The dataset contains over 27,000 reported occurrences.

➢ **Total Area burnt:** Over 6.6 million hectares of land have been burnt overall from all instances combined.

➢ **The average size:** Fire is estimated to be around 249 hectares per event.

Using interactive cards in Power BI, these KPIs were displayed and provided decision-makers with immediate summaries.

Data Model



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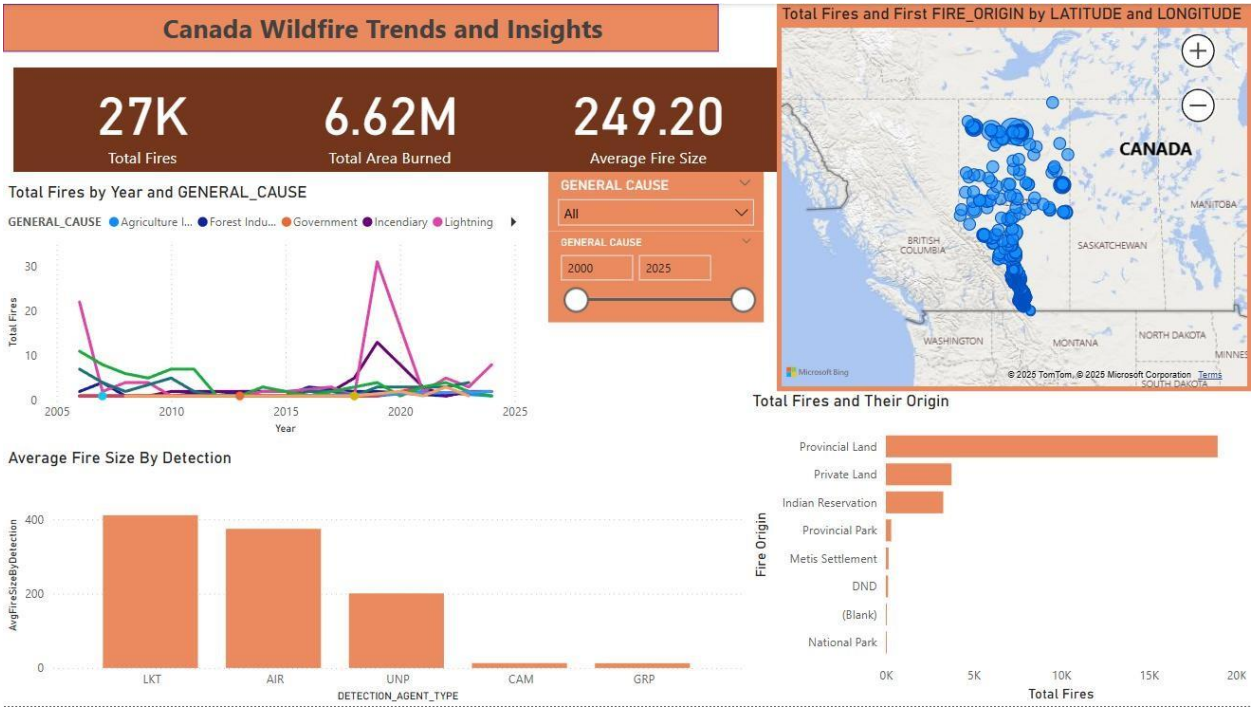
Dashboard Insights

• **Fires by Year and Cause:** A line graph illustrates annual patterns, highlighting 2019's highs and several years where lightning and incendiary causes predominated.

• **Fires by Location:** Clusters of wildfire activity, particularly in Northern and Southern Alberta, are shown on a geographic map.

• **Fires by Origin:** Bar charts indicate that the bulk of fires occur on provincial territory, with private and indigenous land coming in second and third.

• **Impact of Fire Detection:** Visualizations show that flames identified by lookout towers or aircraft patrols typically have smaller average diameters, suggesting the efficacy of early detection.



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Results

Description of the Chart:

➢ **Increases in Particular Years:** In 2019, there was a significant increase in the number of wildfires, indicating the necessity for more research on the climate or human factors that year.

➢ **Main Causes:** The two main causes of ignition are lightning and incendiary sources, indicating the need for both natural and man-made preventative measures.

➢ **Geographic Trends:** The high frequency of wildfires in provinces like Alberta necessitates focused response.

➢ **Land Use Patterns:** The highest frequency is observed on provincial properties, indicating the importance of forest management and land policy.

➢ **Detection Influence:** The importance of early detection systems is reinforced by the correlation between lower fire sizes and detecting agents like Lookout (LKT) and Aerial Patrol (AIR).

Conclusion

The Canadian Wildfire Analysis serves as an example of how data might revolutionize the way that national catastrophes are understood and handled. This initiative gives stakeholders the information they need to distribute resources, educate the public, and create climate resilience by illustrating historical trends and pinpointing underlying causes. Data analytics will be essential in determining how disaster preparedness and environmental policy are developed in Canada going forward, as wildfires become a more serious hazard as a result of environmental change. Our research demonstrates that we can better safeguard ecosystems, communities, and human lives if we have the appropriate information and tools.