Understanding Wildfires and Their Impact

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Data Management

GIS 5003-999
Rebecca Rosenstiel

ABSTRACT

Wildfires in the United States happen every year and multiple fires are fought all across the nation by local to federal personnel. These fires burn crucial acres of forest and nearby communities. There are prescribed burns, but compared to natural and human caused fires, the possibility of prescribed burn becoming a wildfire is less. And are used to help prevent the dreaded event of wildfires occurring. Each wildfire costs are enormous and creates new environmental issues, and displaces residents who live near the wildfire area. Since the year 2000, there have been many thousands of acres burned. The U.S. Forest Service has implemented plans and strategies for fighting fires, one element is setting prescribed burns to reduce the chance and also remove underbrush in areas where the fires could simply rip through. (North, Hilbruner) Wildfires can be caused by people and nature itself, for example a lightning storm. Using new technologies and updated strategies and coordinating with various government agencies, wildfires are now fought differently than in the past.

INTRODUCTION

Living in a western state in the U.S. one is aware of wildfires and the threat the fires create and the damage they do. How many fires have occurred since the year200? How many total acres of land has been burned by these fires? Which fires burned the most acres of land? What plans and strategies have been implemented to decrease the chance of wildfires? Which fires are prescribed, and which fires are caused by people and nature? What does the fire picture look like by state since the year 200? Does one state seem to have more fires occur than other states? Does the US government need to make updates or improvements to the federal approach.

The preference is to have no wildfires from occurring in any state. However, they are a fact of life around the globe. Each country has its own methods and strategies to fight fires.

Some states are more prone to fires and/or wildfires. Which has led to the idea of treating each individual forest as their own ecoregion and a zone unto itself. Which Canada has implemented, tailoring the plan to better fit and aid in fighting and preventing fires. Giving resources based on the probability of forest fires happening, based on history of fires, local climate, and recent weather events. (North)

RESEARCH CONTEXT/BACKGROUND

Three peer reviewed articles were read and are cited for this paper. Helping to explain the background and focus of the data. There are new techniques being used to decrease the chances of any wildfire occurring. From using climate condition models, remote sensing from satellite images, unmanned aerial vehicles (UAVs) and prescribe burns. Catching wildfires early on is critical to putting the fires out, which in turn minimizes the damage of the fire. (Yuan) The less time a fire has to burn is ideal when a fire is spreading and creating a path of destruction.

One main concern is the underbrush and other hazardous that is one favorite fuel of forest fires to spread across thousands acres of forests. And one factor that the federal government is struggling to measure, especially in forests. (North, Hilbruner). Coordinating with various government agencies, besides coordinating with the local communities in wildfire avoidance techniques, during a fire, and their needs after the fire are important as well. While

better understanding the behaviors of the fires themselves, better prediction of areas fires can burn with low impact on the surrounding ecosystem and communities. (Hilbruner)

Scientists can assist with using technology to predict regions more susceptible to wildfires, using weather and climate models, satellite imagery, and UAVs while coordinating with the nation agencies which are budgeting for suppression and techniques, like clearcutting trees around houses and buildings located in forested areas. (Yuan, Hilbruner) In Colorado, after many devastating fires, some local building departments now require new commercial buildings and some residential buildings to have a large tank or a retaining lake or pond, to reserve water should there be a wildfire.

MATERIALS AND METHODS

Articles were searched and downloaded from University of Oklahoma Library's website for peer reviewed. One report is from the U.S. Forest Service's website for their implemented plans of fighting wildfires. Read through the peer reviewed articles and was impressed by the thoughts and accuracy in the each one. While the national plan which fleshes out the strategy implemented over 10 years ago to fight fires, techniques used like better understanding the effects of smoke impacts, re-planting and cleaning up after a fire. While better understanding how a fire behaves and evaluate it more accurately. (Hilbruner)

Datasets were downloaded from USGS and U.S. Forest Service dataset sites. The spatial and csv files were added to pgAdmin, using SQL language generated graphs and charts with the data contained in the datasets. Data was filtered and sets were joined together to create a more complex SQL filtering of data. Two datasets were reformatted to csv files using ArcGIS Pro, as their original format did not allow pgAdmin to import them without converting to a csv format. Tables were joined together to achieve more details and produce graphs.

Using the program pgAdmin, the dataset main_fires was selected to show fires since year 2000 and their names. Selected columns fire_year, discovery_date, nwcg_cause, fire_size, state, fire_name from the main_fires dataset. As one of the first graphs, I selected more columns than necessary. And narrowed down the fire_year to greater than 2000 and fire_size over 4,000. Selected the graph visualizer, selected Line Chart option as an option, then chose fire_name as the X axis and fire_size as the y axis. I downloaded the graph to import into this paper.

Then to see the total amount of acres burned by fires using the geospatial dataset named main_fires, I selected the fire_size column and performed a total sum of the acres burned. And to see 2,097,150 acres burned is a significant result.

The third SQL query performed was using wildfire_1870_2015_great_basin and narrowed the results to show how many hectares were burned by year and displayed visually using a bar chart. Chose shape_area, fire_year and hectares_b from year 2001 onward and a shapearea of over 2100.

The fourth query searched for amount of acreage burned by state from the main_fires dataset. Included state, fire_size, nwcg_cause, fire_year columns to provide the results. Limiting the fire year from2001 and later, and 5,000 or more burned acres. While being ordered by the state column.

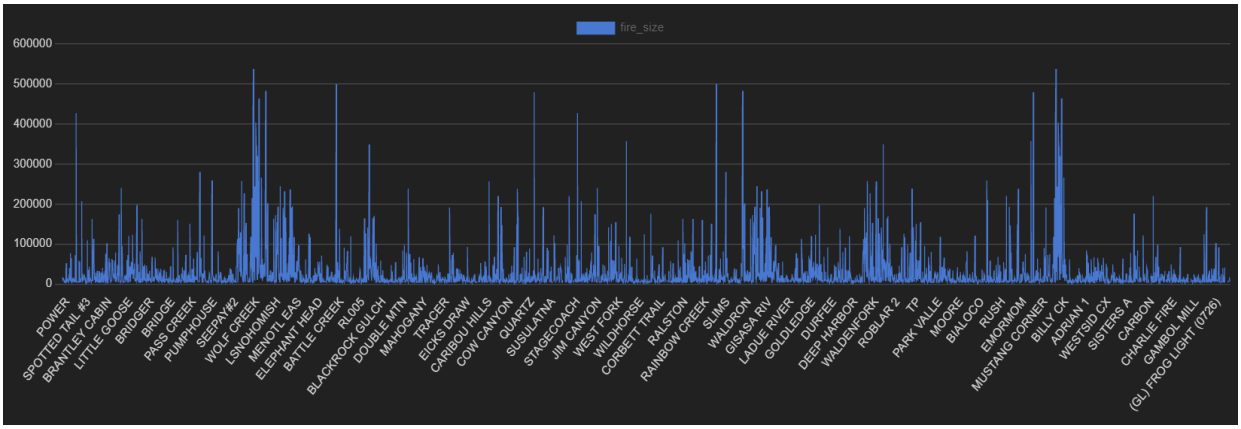
To compare the causes of reported wildfires, with the amount of acres damaged, a fifth query using main_fires, columns fire_year from 2001 forward, and fire_size of over 1,000 acres, while ordering by nwcg_cause. Which produced the chart showing natural, one missing data,

and natural creating the results that are amazing to see. It appears that there are more wildfires caused by natural causes than there are by people. The peaks of the fires seem to indicate that naturally caused fires burn more land than wildfires started by people.

Inquiring to see whether some months see more fire activity than others, the monitoring_trends_in_burn_severity geospatial dataset was selected. Using startmonth, year, acres, and shapearea columns a line chart was produced focusing on the startmonth and acres from the dataset, being ordered by startmonth. And appears the drier months of the year, wildfires are more likely to occur.

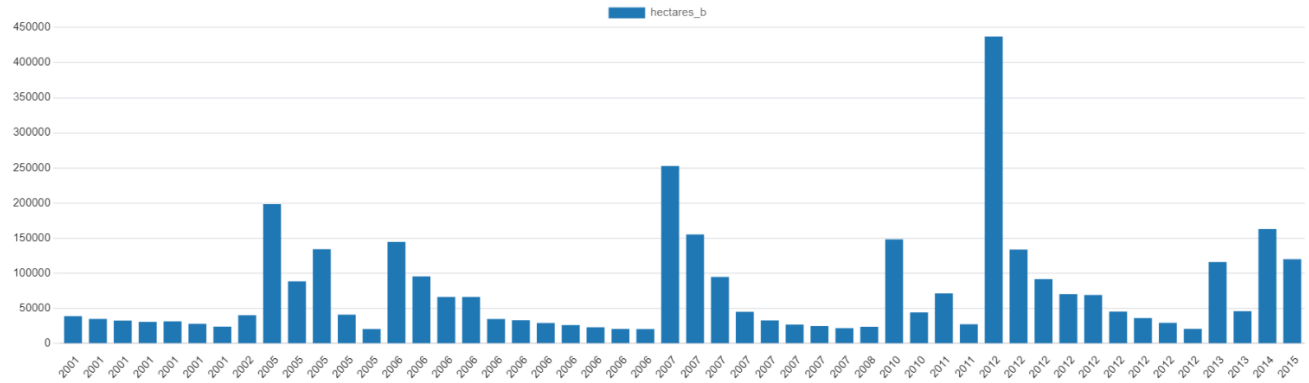
RESULTS

Viewing data to graph the results based on fires that burned over 4,000 acres across the nation starting from year 2001 to more recently. It is amazing to see the low peaks to the high, high peaks of the fires meeting this search criteria. There were more results than expected, and most burned over 100,000 acres. Causing concern of the environmental impact of smoke and soil erosion that happens with fires.

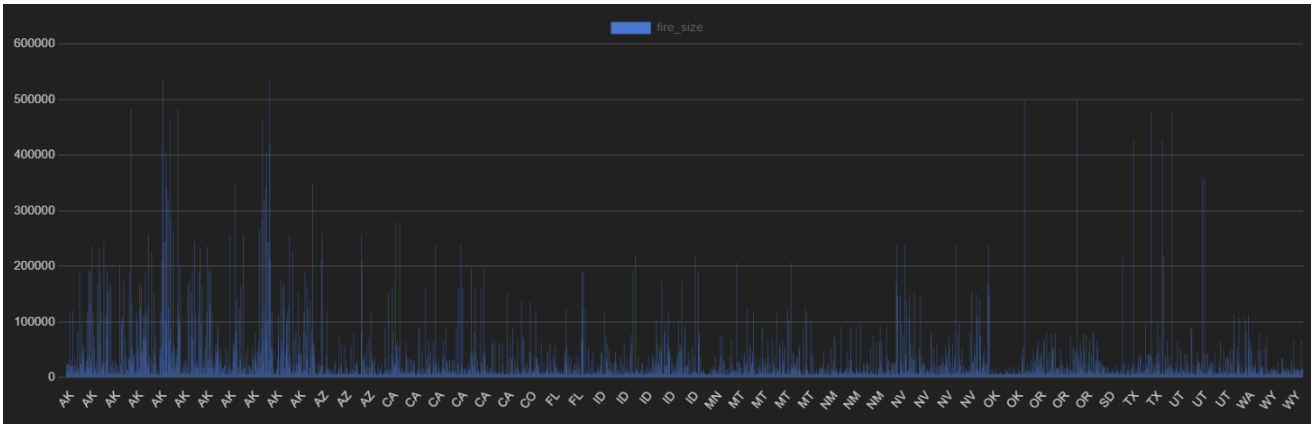


After receiving the above results, I was curious to see the amount of impact of fires on burned land was, I surprised to see over 2 millions acres have been burned since 1992. And am glad that the federal government has wildfires as a concern to be forward thinking and doing the best to prevent the wildfires from starting in the first place.

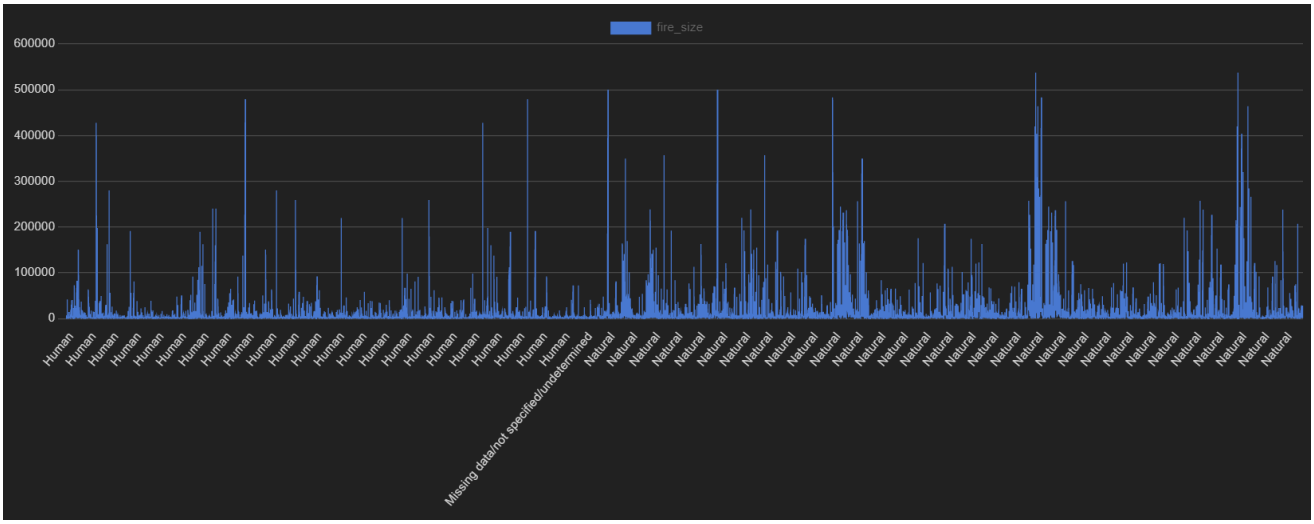
Seeing this number, discovery of which years had more burned areas occurring in them than other years. It turns out 2012 was a very active year for fighting wildfires, while 2001 seemed to be the opposite and more calm based on the results below from the wildfire_1870_2015_great_basin data.



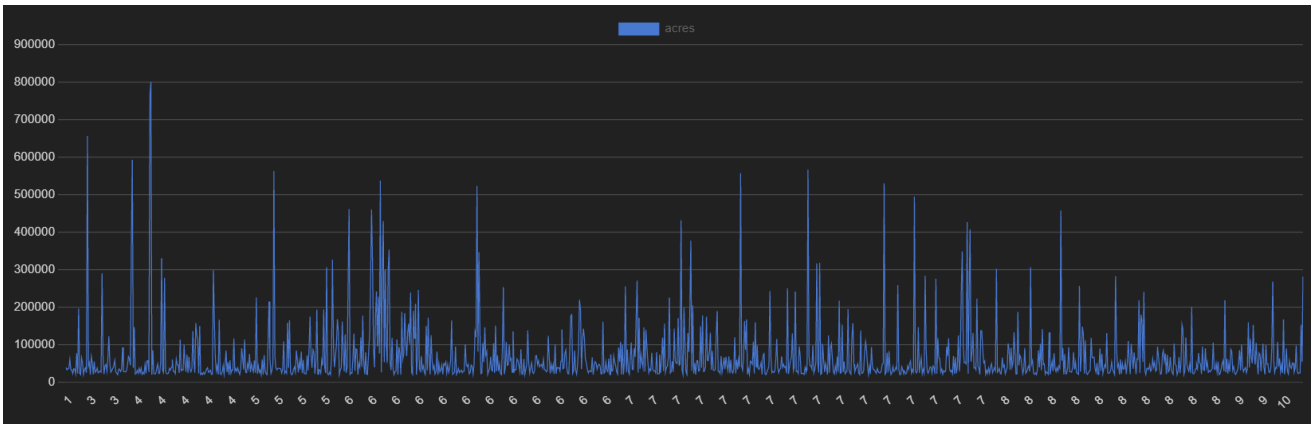
Some states show more data for wildfires than other states since year 2001.For example Connecticut, Maine, Virginia either had wildfires before 2001 or the fires were less than 5,000 acres burned. So there must be a components like heat and dryness that contribute to more western states of the United States have that eastern states do not have. Fires are a great fear during droughts, meaning the lack of moisture and too much heat can cause conditions to be ripe for a wildfire to start. Whether by nature or by people starting the fires.



Looking at wildfire causes with recorded fires from 2001 and later with fires larger than 1,000 burn areas to get a more overall view of which fires are started by people and those started by nature. Both seem to be just as damaging to land in the amount burned, almost equal to how dangerous wildfires can be.



After reading the conditions and that some areas are more prone when the weather is warmer and dryer than winter months. In viewing fire data by month there are more results in the months of June and July, which are summer months and known for having hot temperatures than other months, like February and December.



DISCUSSION

Wildfires make crucial impact on local environments of the area one burns. Hot temperatures, underbrush, lack of moisture are all factors of fires being started. Fires can be started by people intentionally or unintentionally, and by nature, like lighting storms. Western states of the US have more occurrences of wildfires burning through acres. Setting standards of coordination between the various local to federal agencies involved with fighting fires is particularly important. Slightly less than the importance of preventing fires and putting the fires out before one becomes out of control. And ends up burning hundreds of thousands of acres before being put out fully. (Davis, Hilbruner, North)

Also updating the plan on preventing and fighting forest fires is important, especially as technology is ever evolving. And is now able to use UAVs to check specific regions which are most likely to have a wildfire occur. Using UAVs might also capture the underbrush conditions more accurately than a satellite can capture. As the UAVs obviously fly at a lower altitude than any satellite is capable of. (Yuan)

Obtaining more information from peer reviewed articles, datasets regarding wildfires and techniques used to fight them, along with interviewing personnel who fight fires, lived through wildfires, and listening to elders of Native Americans of how their people would set control burns and dealt with underbrush. Reaching back to what has worked in the past and melding it with new technology might have more of a positive effect on fighting fires. Running more queries and spending time with all the collected data to be more informed about wildfires.

CONCLUSION

What is known now is wildfires can start anywhere, in any month, and still produce a devastating impact on the surrounding areas. However by implementing plans and strategies which incorporate newer technologies that assist in predicting potential fires and their locations, to accurate weather and climate models, UAVs, satellite imagery are great tools for predicting a wildfire breaking out. Control burns are used, however not always effective when compared to more accurate data of the region and the local weather pattern. As wildfires typically are during the warmer and dryer months, but not limited to them. (Davis, Hilbruner, North) And also not limited to the dryer states like Arizona, Colorado, and Nevada. There are wildfires that do happen in more humid states like Indiana and Florida.

Training local communities about wildfires and creating a clearance around all buildings, commercial and residential, assists decrease the amount of damage a wildfire can do to a community. Which assists with the wildfire from spreading or at least jumping over buildings that have this clearance.

Dealing with underbrush is quite tricky, miles and miles of forests have underbrush, but no accurate way to account for it nor deal with it. And in a way that does not interfere with national forests, but is also not introducing a new technique that is found to be harmful to the animals in these forests. Looking at other ways of treating regions as their own ecoregion, split into various zones to better address each varying ecosystem. There are national forests with waterfalls and meadows, where others have camping and fishing locations.

And keeping lines of communication between agencies, local to federal, that fight these wildfires open and clear. (Hilbruner, North) Working with local communities, implementing clearance zones, and water storage tanks or ponds into building codes are two ways in preventing and fighting the fires before one starts. And the earlier a wildfire is discovered, the chances are better of the fire being put out earlier.

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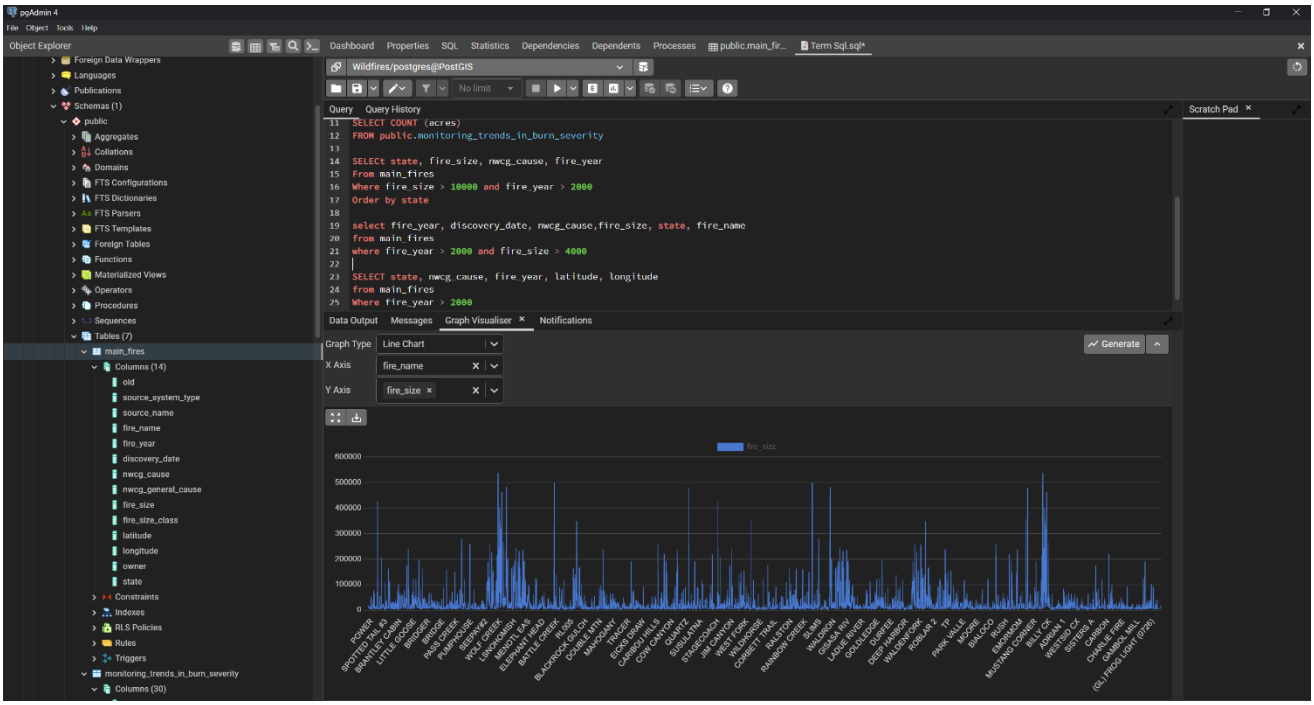
APPENDICES



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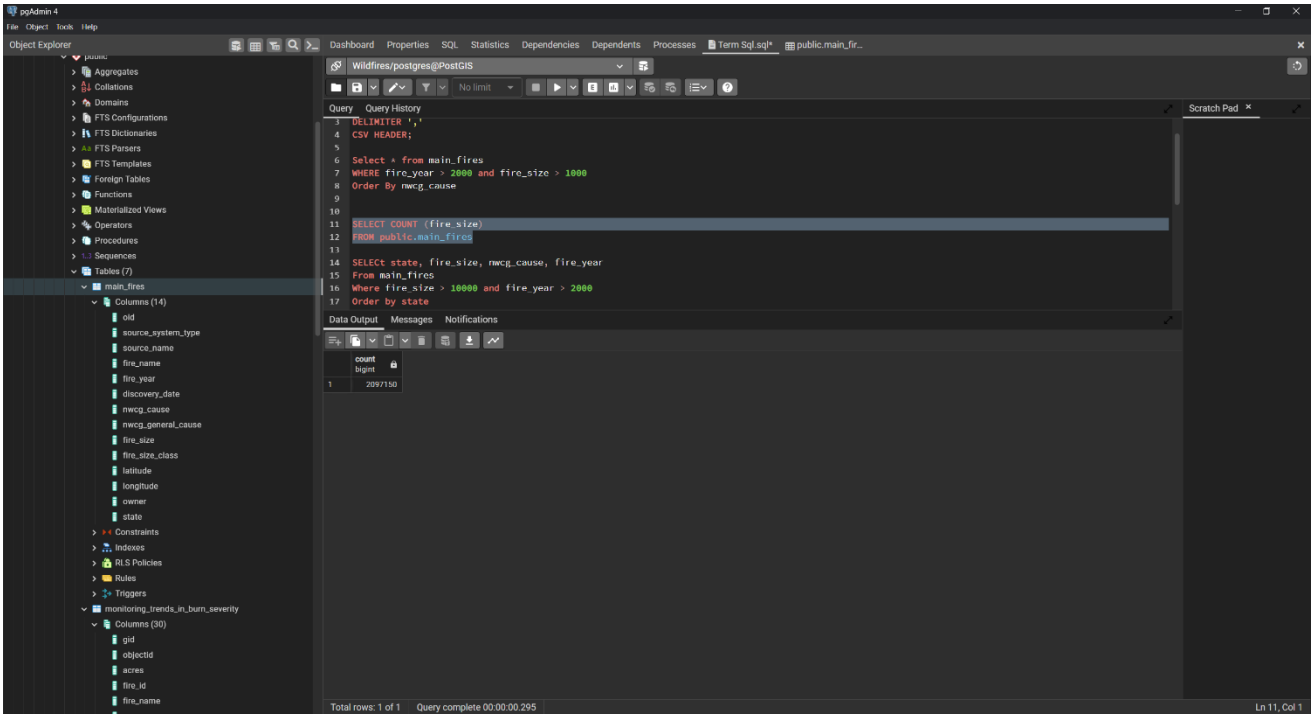

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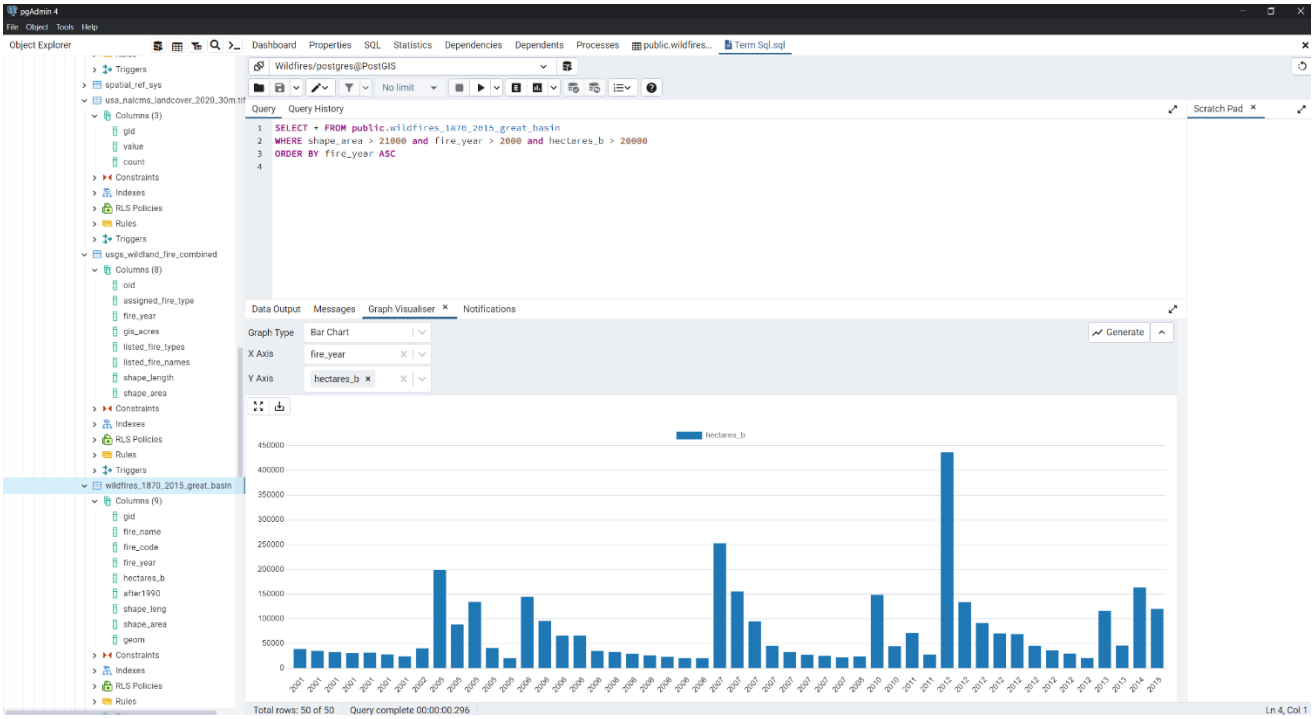
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ORDER BY fire_year ASC
Data Output
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Graph Visualiser
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Bar Chart
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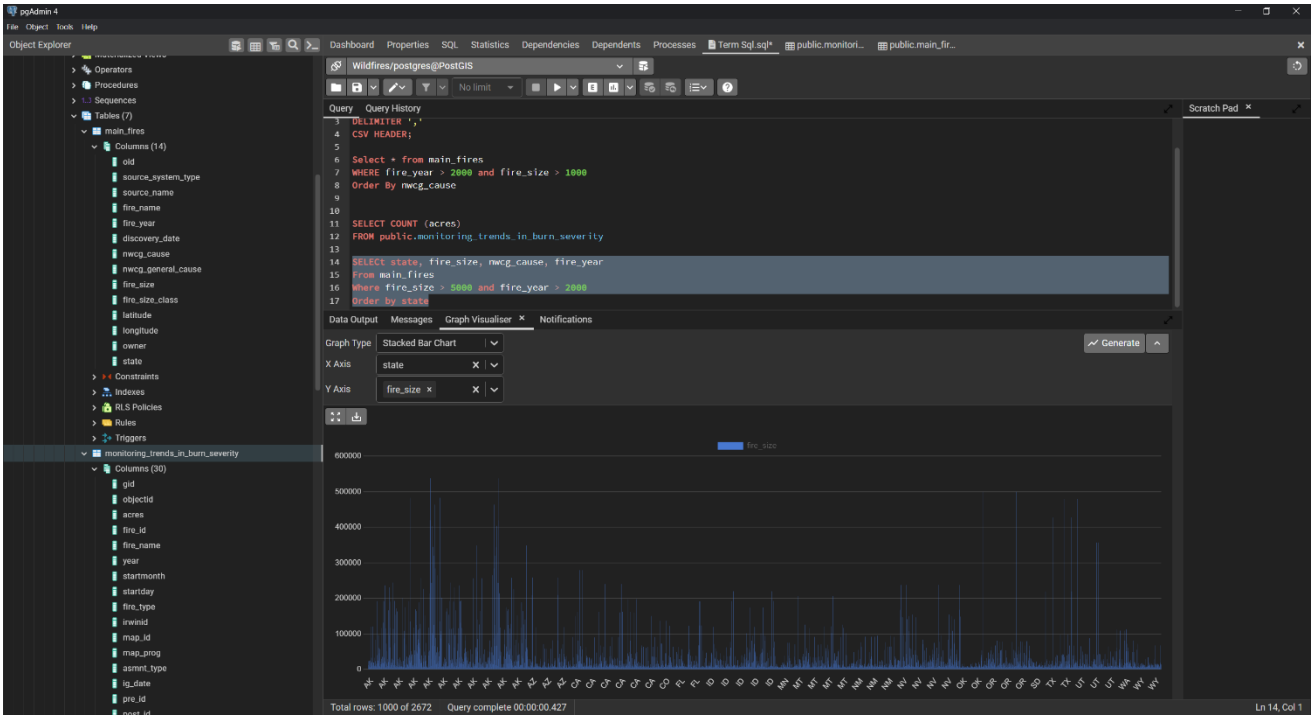
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From main_fires
Where fire_size > 5000 and fire_year > 2000
Order by state
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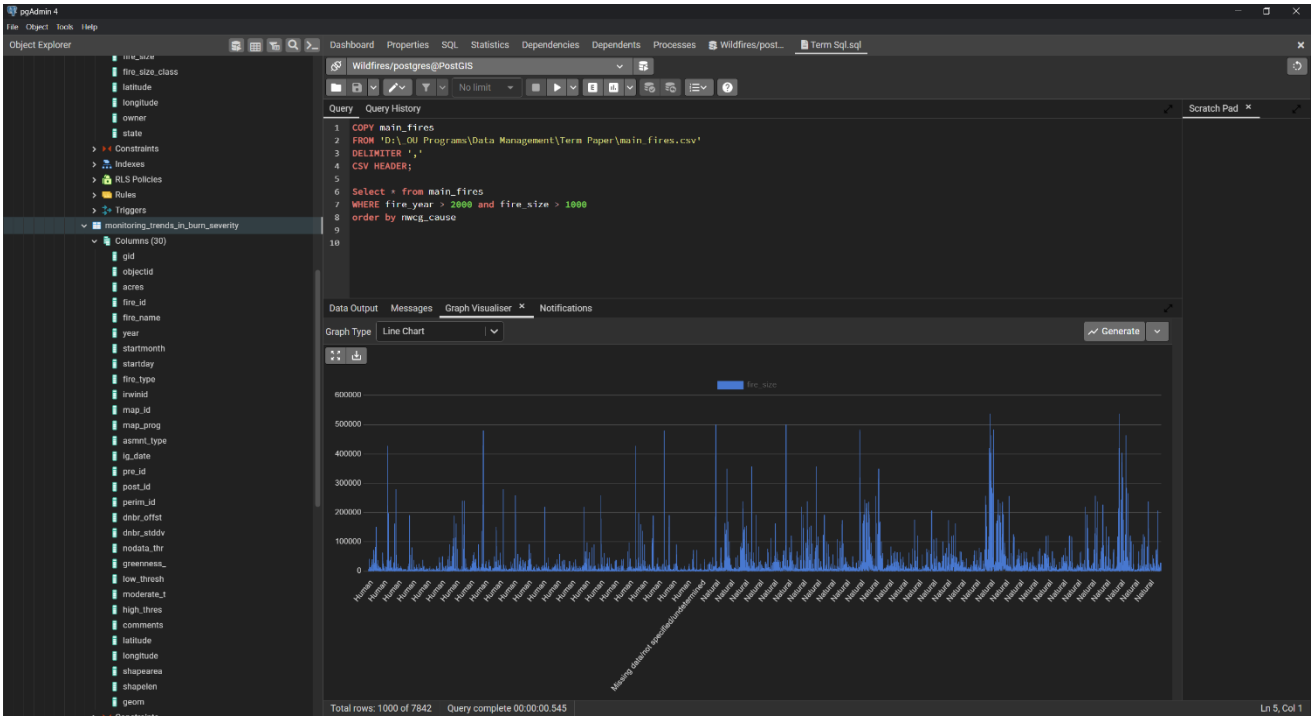

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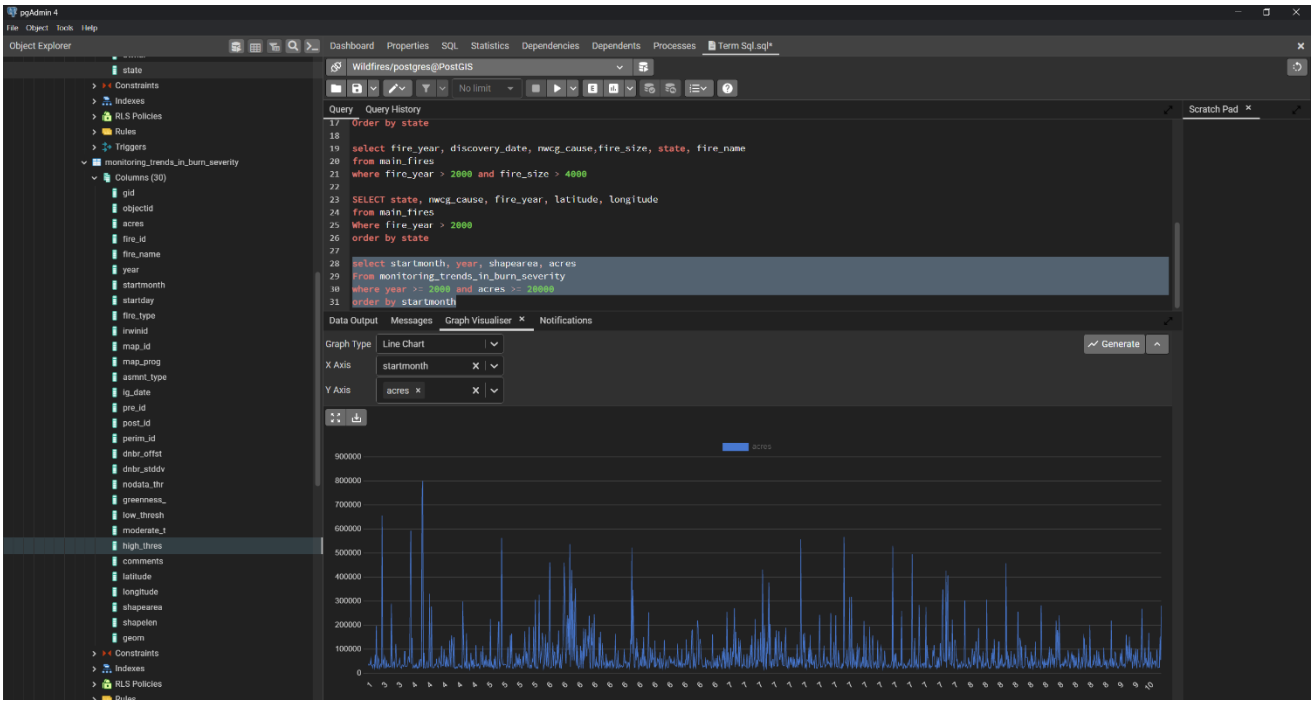

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