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ALY 6060

Module 4

**Implementing Embedded
Analytics**

Introduction

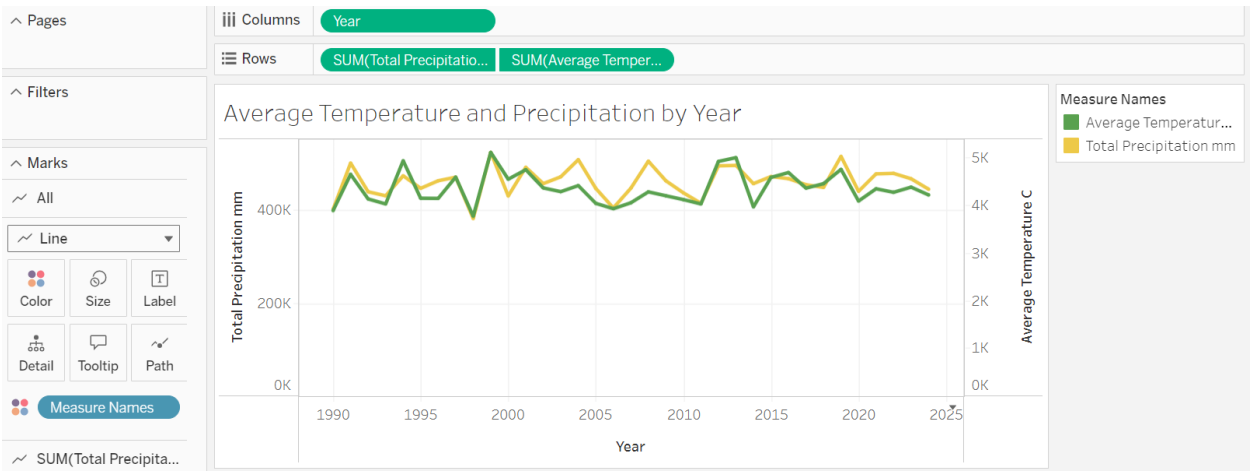
The focus of the model being studied is on climate change that has affected the agricultural industry and the steps taken to mitigate the changes over time. The graph begins in the year 1990 and shows how in the past 25 years each part of the world has soldiered on with the production of important crops for economic prosperity. The graph also provides agricultural metrics that can impact crop yields like irrigation, soil index, and fertilizer applications. Using different analytical methods, the numbers are evaluated to show what has transpired in the past and what can be done in the future when climate change can be detrimental to the industry.

Analysis

The line chart constructed below shows the average temperatures of all the countries and regions represented and the total precipitation per year. The lines show for the most part a parallel relationship between the global average temperatures and the amount of precipitation. The portions of the timeline that do not show this connection are over a five-year period in the early part of the 21st century where higher precipitation rates led to cooler temperatures. While this graph provides a window of time from 1990 to present, the overall values remain fairly constant overall with some ebbs and flows. In several cases, there is evidence of this from year to year where a higher level of precipitation and temperature will be followed by a steady drop the following year.

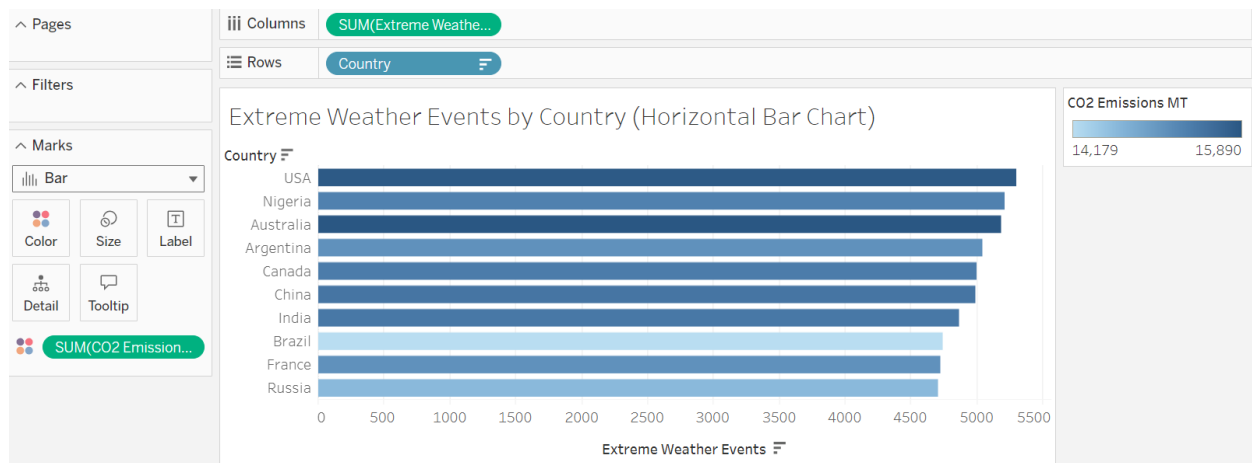
With a sample that spans 25 years, these trends and patterns should continue in the future with an increase in extreme temperatures across the planet and spontaneous levels of precipitation will be prevalent. These numbers can also serve as ways to prepare the agricultural sector for years whether droughts are anticipated from past data and when to expect higher than

normal precipitation levels. That will allow companies to adjust their model and where to place more emphasis on products and services.



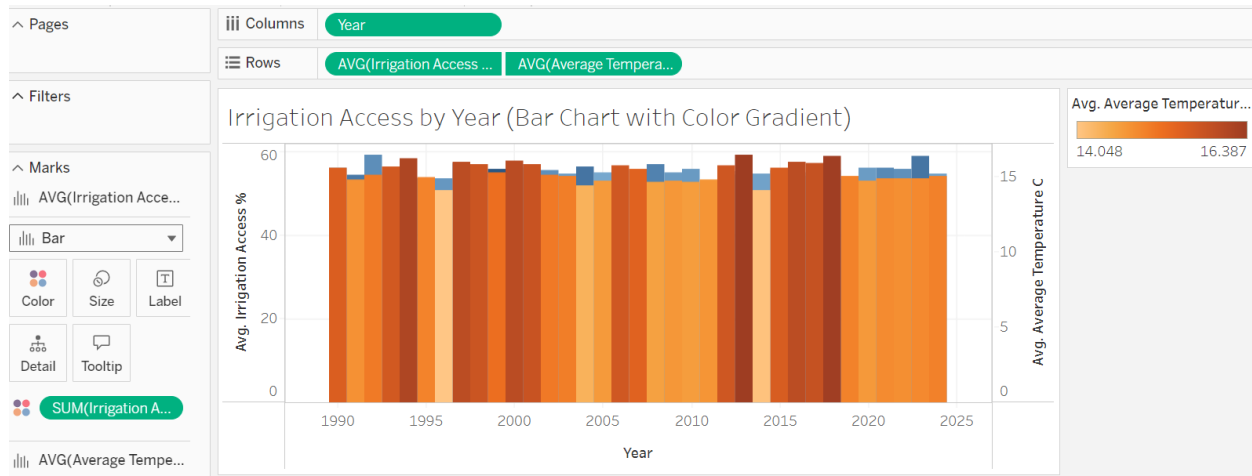
To highlight how many extreme weather events have occurred in all parts of the world in the last quarter century, a horizontal bar chart in descending order was made. How scientists define extreme weather events pertains to two main factors that is based off probabilities of an event happening in a place based off reference points and also the impact that the event has on a place after it occurs (ClimateHubs, 2024). The United States of America has the most extreme weather events followed by Nigeria and Australia. The shades of blue in each line show the amount of carbon emissions produced by each country over that time span.

Because the number of events is close between each of the 11 countries, this indicates that over time the rankings could change. What is noticeable is the disparity in emissions between each country, with countries like the United States and Australia emitting at much higher levels than countries like Brazil and Russia. While lowering emissions across the globe is critical, there should be more plans in place for countries that produce higher emissions than other countries to do more. This will impact not just their countries but also other countries where emissions are much lower but are having extreme weather events just as often.



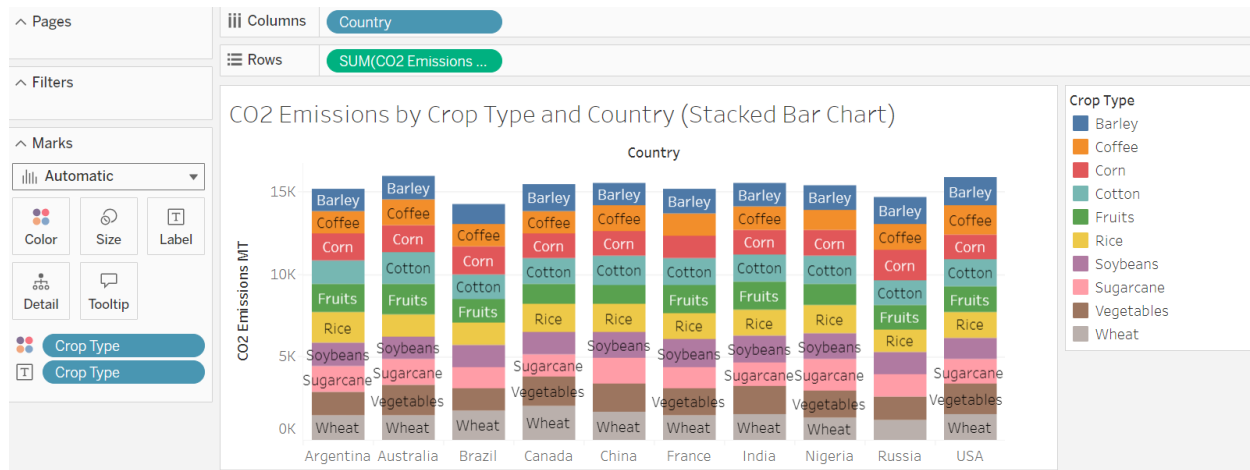
A look at the world by year and how climate change has affected its agricultural production, a bar chart was built to examine its irrigation access by percentages. The global average temperatures are shown on the bar chart in range of orange colors by Celsius, with the lowest temperature at 14.05 and the highest at 16.39. The irrigation levels by percentages are shown on the same bars with the shades of blue on top showing when the levels were higher than the average temperatures. The years with the highest temperatures are all above the levels of irrigation access with the lower temperatures showing higher levels of irrigation.

Overall, the temperatures from the last 25 years have been relatively consistent so this trend of irrigation access being impacted by the weather will continue after the year 2024. There are some recent trends that show that irrigation levels have been more consistent over the few previous years where temperatures were higher than normal, so these cycles can help make sure that irrigation will be able to handle extreme weather. Other potential factors to look at here are how precipitation numbers can impact irrigation percentages and if there are parts of the world that could better equipped for these patterns.



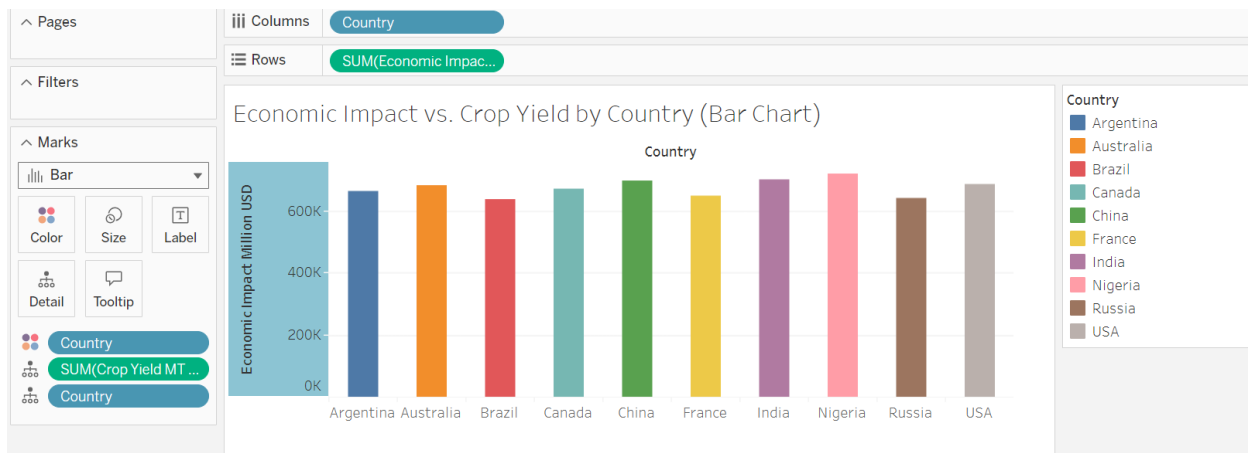
An evaluation of the crops of each country and how they are impacted on the amount of carbon emissions is demonstrated in the bar chart below. The bars overall show the total emissions per country in the dataset and the percentage of each crop makes up the sum of the carbon emissions. The total number of emissions produced per crop in each country over this studied period is similar, with some variation in crops like vegetables, corn, rice, and fruits. This can be attributed to what part of the world the crop is produced in since they will be more suitable for growing in some regions than others.

The reliance of each crop in the future will depend on what region of the world has a higher demand for the crop but could be affected by rising global temperatures, indicating that crop percentages by emissions will evolve. Innovative technologies should be implemented in the future so that production of crops that people depend on can remain at attainable levels but will reduce carbon emissions to produce them. This can be done across the board for agriculture with growing crops and the transport of crops to other regions of the world.



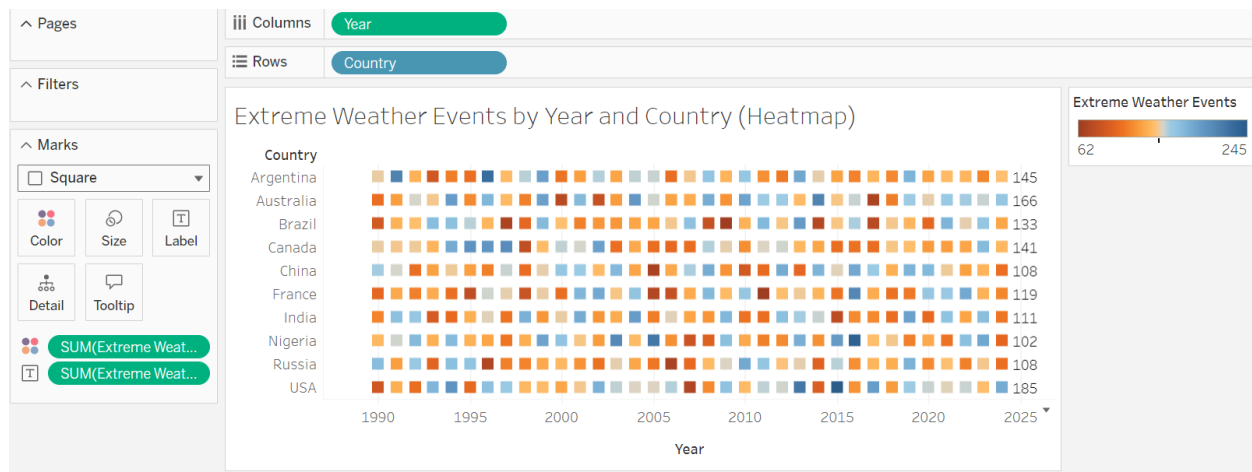
The economic impact is measured based off the crop yield per country as provided in a bar chart. Since the beginning of the time period researched, each country has seen fairly equal levels of economic impact with Nigeria having the highest crop yield economic returns overall. There are no noticeable differences between parts of the world where the countries are located, indicating that over time global warming has not hurt some areas over others. The countries have all managed to adjust to changing global climate patterns that have allowed them to not fall behind economically.

How the following years will change economic conditions will depend on the changing global warming patterns and how it can impact individual crops. A more detailed evaluation can entail looking at how economic times have changed since 1990 and if past recessions or strong economies have affected the agricultural sector. This can also help determine if certain crops are hampered by these patterns and if there is a correlation between the economy and climate in certain years and time range. An assessment of other countries in the region could also be useful to areas where crop yields are subpar.



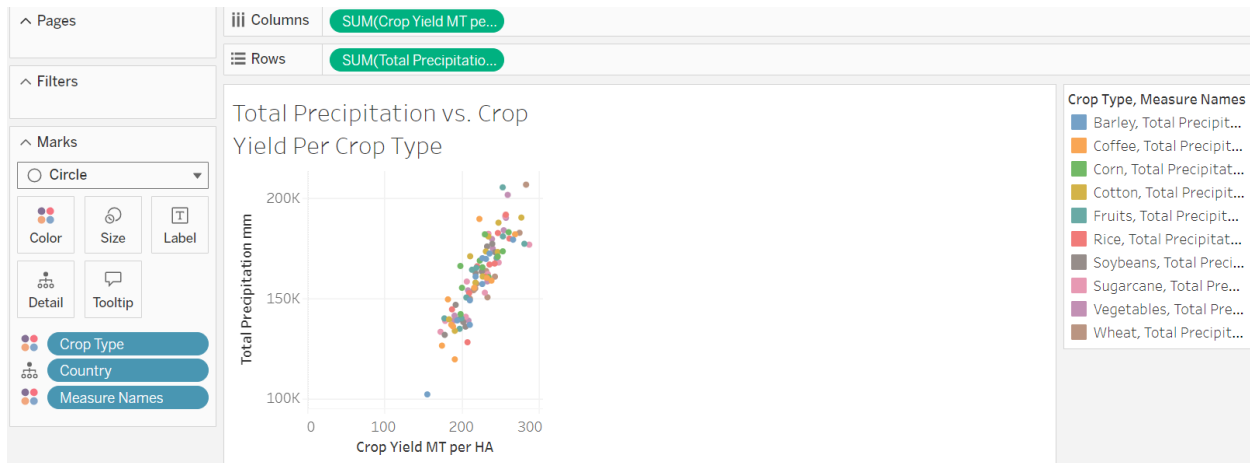
A heatmap was created to display the number of extreme weather events that each country experienced since 1990. When looking at each country, they share similarities in the cycle of many extreme weather events and less than average numbers. An assessment of each year shows that some years there were a share of countries that faced higher or lower amounts of extreme weather events, providing evidence of the effects of global warming. The last five years across the board show higher levels of events which are not seen in other time periods in the graph.

This recent trend in elevated extreme weather events indicates that this could continue in the future and if emissions continue to rise. Each country will need to continue to adapt to these changes even when there are some years higher than others. There will also need to be economic priorities when crop yields could affect costs and revenue. And continuing to find ways to lower emissions during production will be essential to slowing down the effects of climate change.



To understand the relationship between precipitation and crop yields, a scatterplot is built to show each crop and from what country. There is a linear relationship between the two variables that indicates that the crop yield is higher when there are higher levels of precipitation. The colors which each represent a crop are all spread out which suggests that there are not certain crops that perform better with more precipitation or will have higher crop yields than others. There are a few outliers that are not with the main clump with the most obvious crop being barley that is produced in Brazil, and if this crop has been grown there for 25 years, then this could indicate that not much precipitation is required in this part of the world.

The linear pattern demonstrated in the scatterplot over a quarter century is evidence that it will most likely continue in this direction moving forward. As shown in the past there will be variability in the crop yields and other factors have contributed and will in the future to how it performs. These factors include more technological advances in agricultural production that will improve crop yields and using continual research in irrigation of crops for future enhancements (Kukal & Irmak, 2018).



Conclusion

The visualizations provided show a pattern that global warming has been a recurring theme in the last 25 years and has affected all parts of the world. These cycles have affected agricultural practices like irrigation and crop yields and will continue unless emissions can be reduced. And more technologies need to be developed for better preparation of extreme weather events and precipitation levels that are inconsistent. This will ensure that the agricultural sector's economic concerns will be addressed properly, and supply will continue to match demand.

References

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