Submitted by: Neha Navarkar

Global Greenhouse Gas Footprint

Visualizing Greenhouse Gas Emission Patterns Across Geographies

Objective

The project focuses on analyzing global agricultural emissions data, particularly emissions from cropland fires, to identify patterns and trends in greenhouse gas emissions. The goal is to provide visual insights into the emissions landscape and assess relationships between emissions and climate vulnerability.

Visualizations

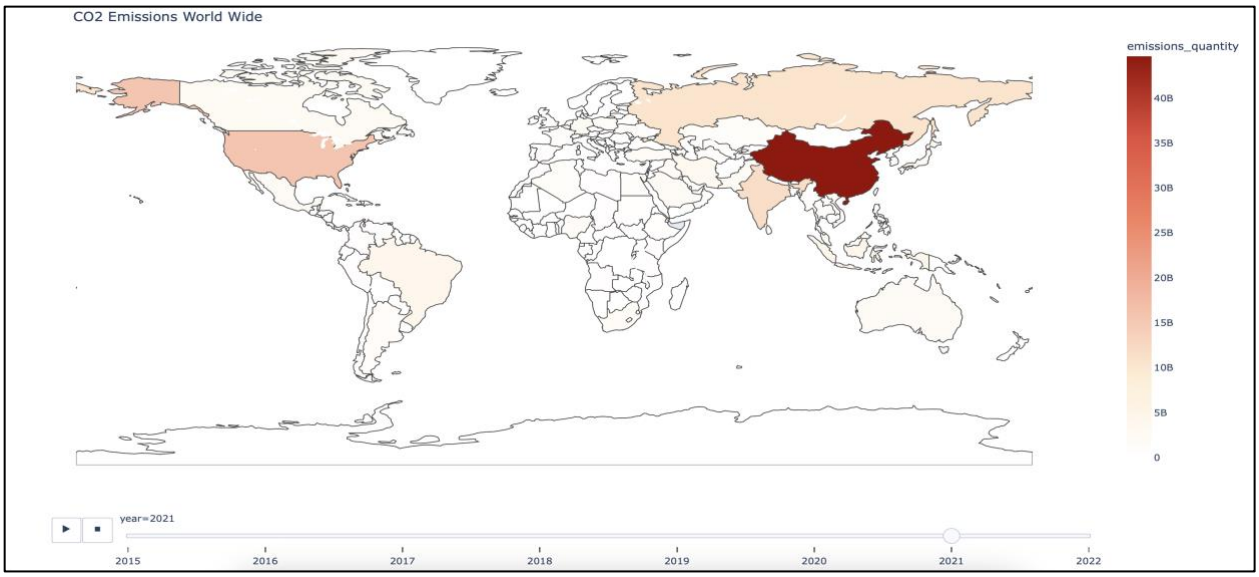

Fig 1. Exploring Global CO2 Emissions Across Countries since 2015

Fig 1 shows the map illustrates global CO2 emissions by country. The intensity of the color represents the total emissions quantity, with darker shades indicating higher emissions.

High Emissions Regions: Countries like India, China, and parts of South America demonstrate significantly high emissions, as indicated by the dark red areas. **Low Emissions Regions**: Many countries in Africa and smaller island nations exhibit lighter shades, indicating lower emissions quantities.

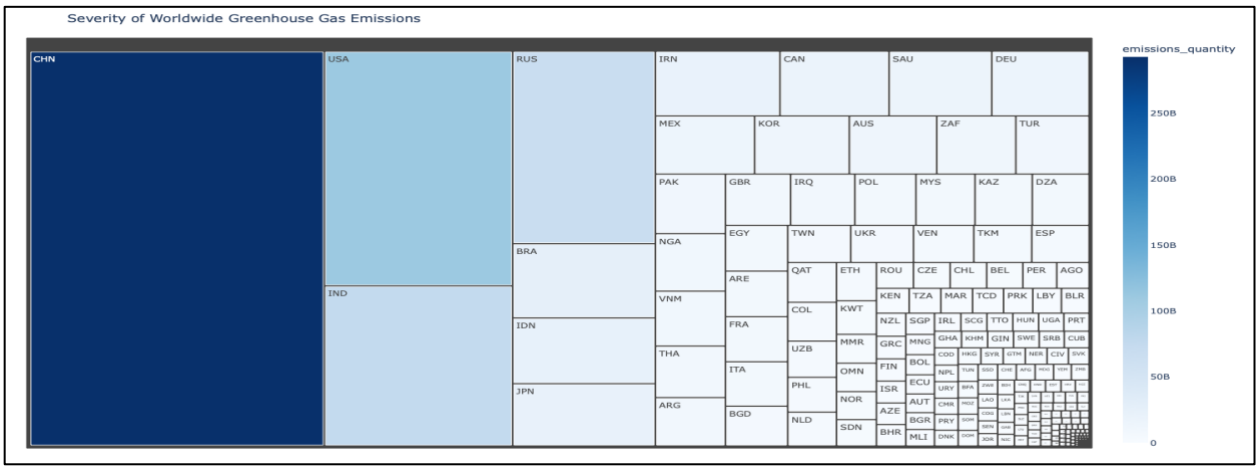

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Fig 2. Greenhouse Gas Treemap

Fig 2 The treemap illustrates global greenhouse gas emissions by country. Each rectangle size represents emission quantity, while color intensity reflects emission levels, with darker shades indicating higher emissions. India (IND) and China (CHN) are the largest contributors, followed by Brazil (BRA) and Russia (RUS). The visualization highlights stark disparities, where a few high-emission nations dominate, while smaller, low-emission countries are less prominent.

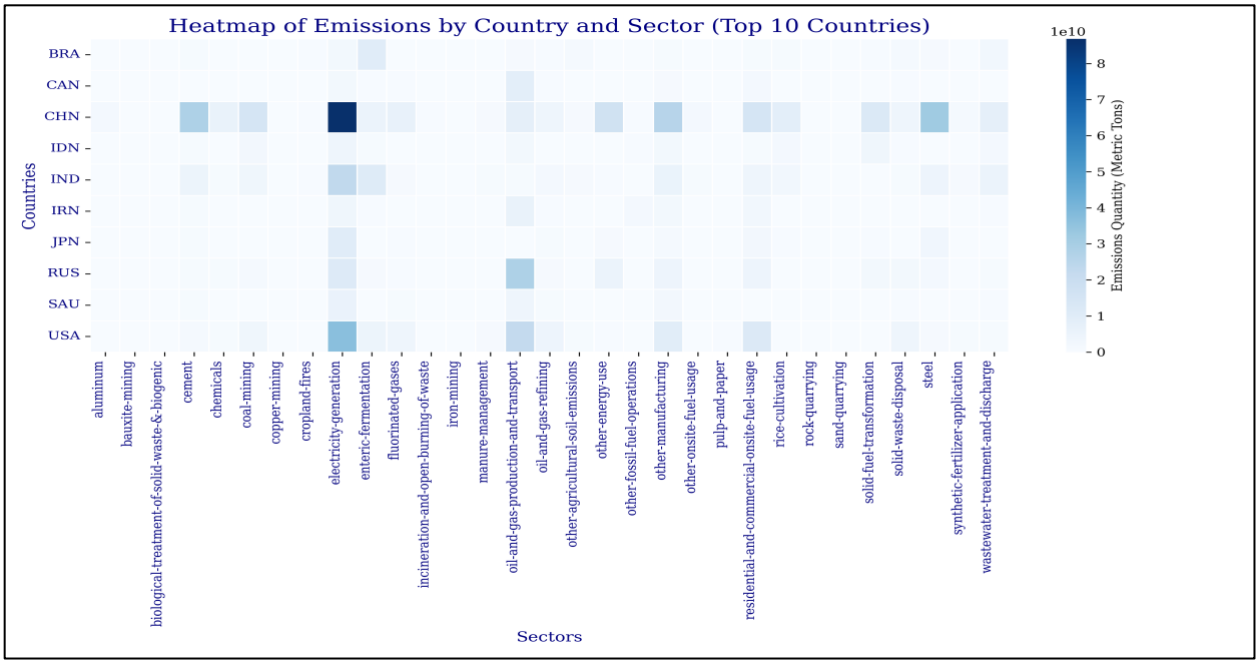
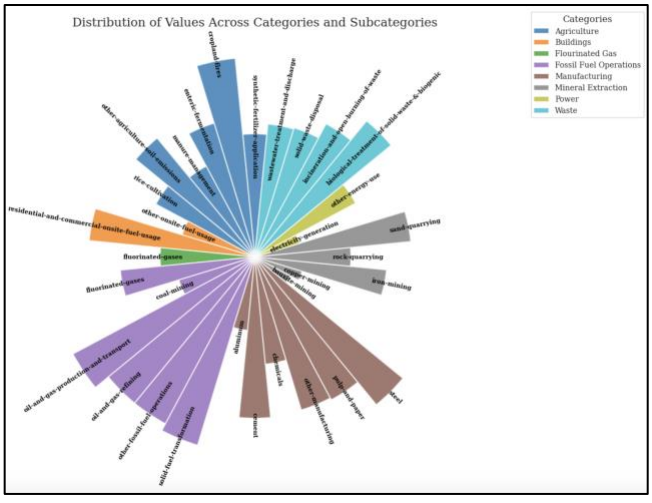


Fig 3. Gas emission for top ten countries

This heatmap shows greenhouse gas emissions by sector for the top 10 countries. Darker blue shades indicate higher emissions, with China (CHN) dominating electricity generation. The chart highlights significant sectoral and regional disparities.



This circular bar plot illustrates the distribution of values across various categories and their subcategories. The length of each bar represents the value, while the colors distinguish categories like Agriculture, Buildings, and Waste. It highlights the relative contributions of subcategories within each sector.

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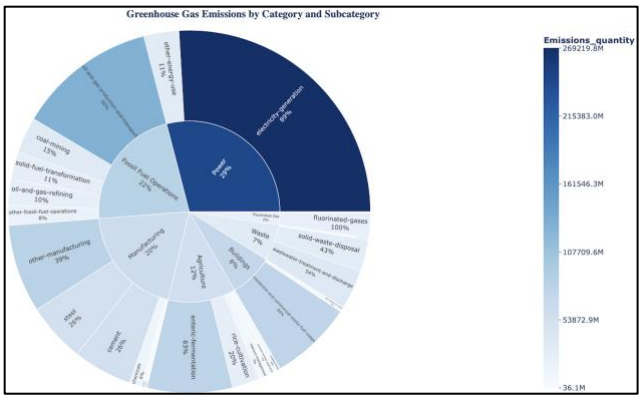

This pie chart represents greenhouse gas emissions by category and subcategory, with segment sizes and color intensities corresponding to emission quantities. The darker shades highlight higher emissions, with electricity generation being the most significant contributor. It provides a clear breakdown of emission sources across sectors.

Importance

In this project, I have generated multiple visualizations. The selection was made to evaluate whether all the graphs effectively convey the same message and if the information illustrated in each aligns with the overall analysis. Exploring the data through different visual formats allows for a comprehensive understanding of the emissions landscape.

Each visualization format brings unique strengths and limitations:

- **Geographical Maps**: These maps vividly depict the physical location of emissions, making them ideal for identifying emission hotspots. However, they are less effective in showcasing the magnitude of emissions quantitatively.
- **Heatmap Plots**: These visualizations provide insights into the intensity of emissions across countries and sectors, combining comparative analysis and magnitude representation.
- **Treemaps and Sunburst Charts**: These hierarchical charts excel in showing proportions and distributions across sectors and sub-sectors, making it easy to identify dominant contributors. They are, however, limited in representing temporal or spatial dynamics.
- **Interactive Plots**: Interactive visualizations, like heatmaps and HTML-based maps, allow users to zoom in, explore details, and interact with data for a deeper understanding. Yet, they may lack the clarity of static graphs for quantitative analysis.

By combining these diverse visualization formats, the project provides a holistic perspective on greenhouse gas emissions globally. Each graph complements the others, ensuring a cohesive narrative that bridges geographical, hierarchical, and relational insights. This approach highlights the complexity of emissions data while enabling a clearer understanding of its distribution and impacts.

Data and Method

Data:

- The project utilizes a comprehensive greenhouse gas emissions dataset from Kaggle, focusing on emissions across sectors, sub-sectors, and gas types.
- Key variables include country identifiers, emission quantities, and vulnerability scores, providing both geographic and relational insights.

Method:

- **Data Processing**: The dataset was aggregated using Python libraries like Pandas and NumPy.
- **Visualization**: Tools like Matplotlib, Plotly were used to create static and interactive visualizations. Hierarchical charts (e.g., treemaps and sunburst charts) were generated to represent sectoral contributions.

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Github Link:
https://github.com/NehaSN23/greenhouse_gas_data_visualization

Data Source:
https://www.kaggle.com/datasets/michaelbryantds/greenhouse-gas-emissions-dataset?select=agriculture

Source Code:
https://github.com/NehaSN23/greenhouse_gas_data_visualization/blob/main/SourceCode_v1.ipynb