The Carbon Cost of Food Production

DS 4200

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Link:<https://a1n3k5e79.github.io/DS4200-Project/>

**Visualization Design Writeup**

Our project investigates the environmental impact of agricultural practices by analyzing CO₂e emissions across countries, practices, and time. We designed five key visualizations, both static and interactive, to communicate trends, spatial differences, and structural sources of emissions. Below is a breakdown of the design rationale and data choices for each visualization

**Overall Emission and Temperature Trends (Dual Line Charts)**

**Purpose:**

To show the long-term trend in total agricultural CO₂ emissions and its correlation with global temperature rise.

**Design Choices:**

* Line charts were chosen for both emissions and temperature due to their clear representation of time series trends.
* The visuals are presented side-by-side for visual comparison, showing parallel increases.
* Color was used minimally and consistently for clarity.
* Each Y-axis is labeled distinctly to avoid confusion.

**Data Handling:**

* Total annual CO₂ emissions were aggregated globally from 1990 to 2020.
* Average temperature data was aligned with emissions by year to allow accurate year-over-year comparison.

**Top Emission Producing Practices (Stacked Area Charts)**

**Purpose:**

To break down CO₂e emissions by agricultural activity and compare natural vs. manmade sources.

**Design Choices:**

* Two stacked area charts were used: one for natural emissions (e.g., fires, rice cultivation) and one for manmade emissions (e.g., industrial processes, food processing).
* Color was used to distinguish emission categories.
* The vertical space and area size communicate growth or stability of each practice over time.

**Data Handling:**

* Emissions from 1990 to 2020 were grouped by category.
* The top five contributors in each group were selected based on cumulative emissions over time.

**Emissions Choropleth Map (Geospatial Visualization)**

**Purpose:**

To show which countries contribute the most to global agricultural CO₂ emissions.

**Design Choices:**

* A choropleth map provides a clear geographic overview using color intensity to reflect emission levels.
* A year slider allows viewers to observe changes from 1990 to 2020.
* Color gradients reflect emission severity, and hover interaction shows exact values.

**Data Handling:**

* Total annual emissions were summed by country and joined with geographic coordinates.
* Countries with inconsistent data were excluded to maintain visual clarity.

**Emissions by Population Factors (Bubble Chart)**

**Purpose:**

To explore the relationship between population size, total emissions, and per capita emissions.

**Design Choices:**

* An interactive bubble chart was chosen for its ability to represent three variables at once: total emissions (Y), population (X), and per capita emissions (bubble size).
* A time slider was included to view change across years.
* To improve visual clarity, color was disabled and all bubbles were styled uniformly.
* Countries with incomplete time series data were excluded to ensure visual consistency.

**Data Handling:**

* Only countries with full data from 1990 to 2020 were included.
* Per capita emissions were computed by dividing total emissions by total population.
* Log scales were used for both axes to handle wide variations in values.

**Top Agricultural Emissions by Country and Category (Interactive Tableau Heatmap)**

**Purpose:**

To reveal the structure of emissions within high-emitting countries by specific agricultural sources.

**Design Choices:**

* A heatmap format was used to compare emission categories across 20 countries over time.
* A filter was added for year selection (1990–2020).
* Color intensity reflects emission magnitude in kilotonnes.
* The interactive Tableau embed allows for tooltips and exploration without overloading static visuals.

**Data Handling:**

* Focused on the top 20 emitting countries.
* Selected the top 10 most impactful emission categories.
* Missing values were cleaned, and category totals were computed per country per year.

**Conclusion**

Our design process focused on clarity, interactivity, and the ability to draw comparisons over time, geography, and emission type. Static charts were used for high-level trend analysis, while interactive elements allowed users to explore deeper patterns within the data. The final visualizations reveal that both natural and manmade agricultural processes contribute to emissions, and that geographic and population-driven factors are key to understanding the broader impact.