Datagang Process Book

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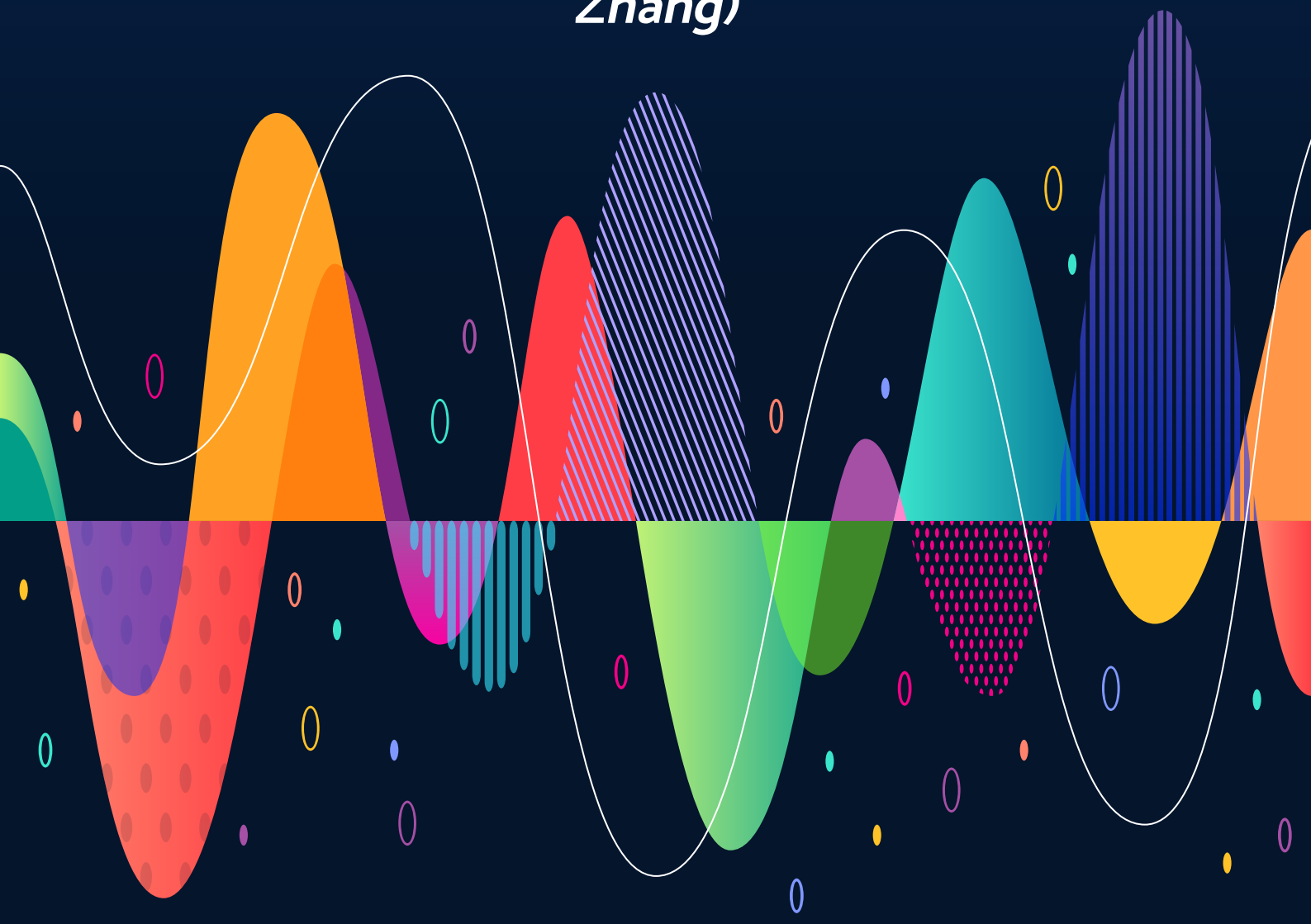


INTRODUCTION

Despite the many differences across the countries of the world, food holds economic and cultural importance in every single one. For this project, we wanted to create visualizations to illustrate the variations in the foods that countries consume and the way that food is distributed within those countries. World hunger continues to be a prevalent issue today, despite the enormous quantity of food produced worldwide. Our goal is to show how food supply and distribution have changed in the past 60 years and to visualize dietary differences among countries.

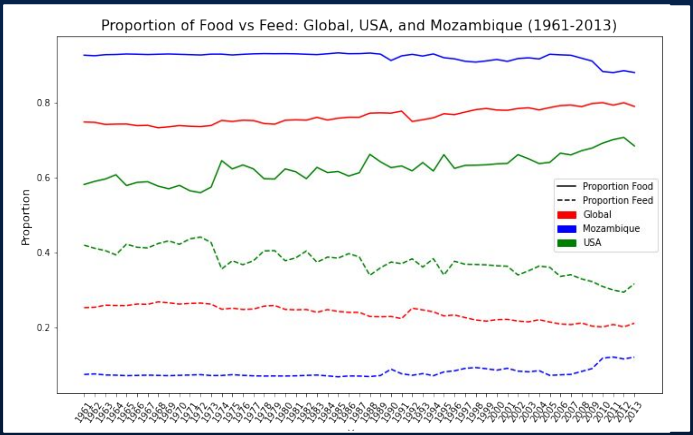
DATA

The dataset that we used for this project comes from the Food and Agriculture Organization of the United Nations (FAO) [1]. It includes data over almost 60 years, from 1961 to 2019. For each year and each country, the dataset provides food supply information such as import quantities, export quantities, quantities of food allocated to livestock, food allocated to humans, protein and fat supply, as well as food supply per capita. All of these measurements are provided for specific food categories, giving us a significant amount data to work with. The measurements that we were initially most interested in exploring were the “Feed”, “Food”, and “Food Supply (kcal)” categories, that are defined as the following :

- **Food**: the total amount of the commodity available as human food during the reference period
- **Feed**: the quantity of the commodity in question available for feeding to the livestock and poultry during the reference period
- **Food Supply (kcal)**: the total amount of food available for human consumption expressed in kilocalories

EXPLORATORY ANALYSIS

As part of the first milestone, we did some initial exploration of the data. We were interested in exploring differences among countries, especially in the allocation of food to humans and animals.



For a preliminary investigation, we compared Mozambique and the United States and used a global average for reference. In the line graph, there is a much larger gap in the proportion of food allocated to humans vs animals in a poorer country such as Mozambique. On the other hand, the United States, a richer country, diverts an almost equal proportion to food and feed.

INITIAL PROPOSALS

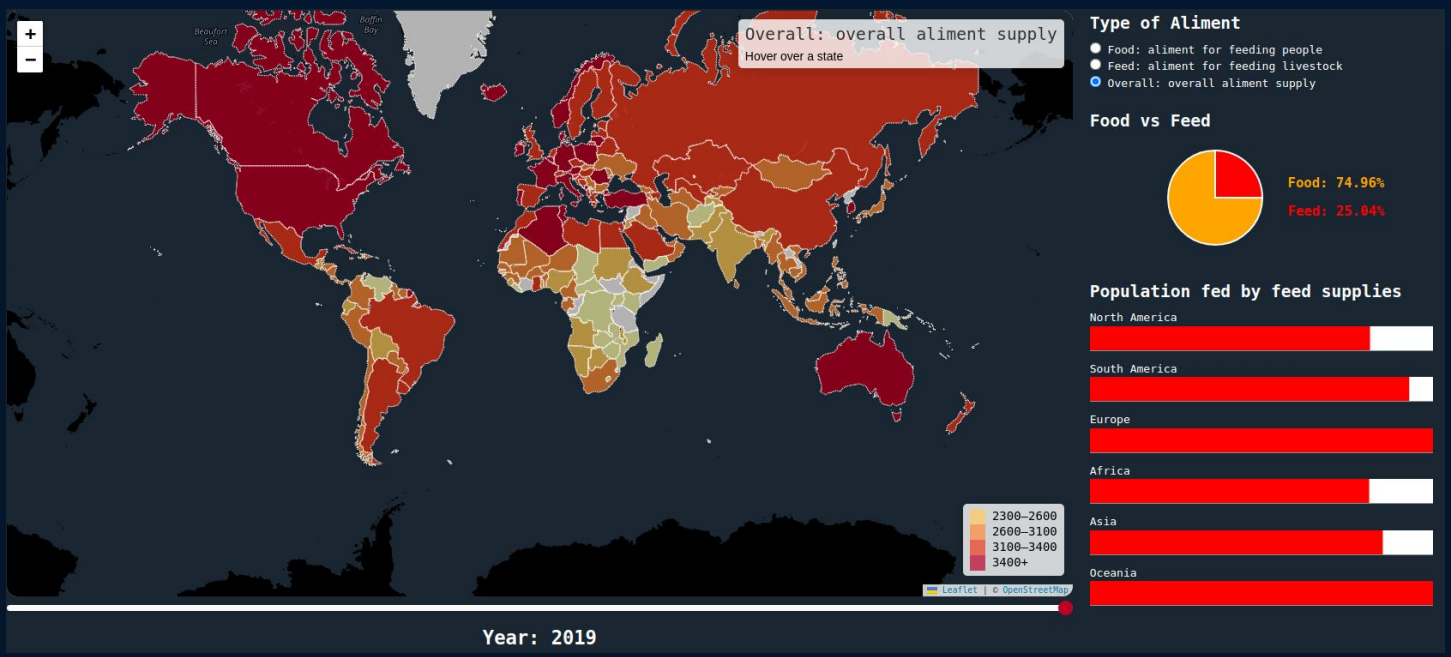
In the second milestone, our main visualization goal was to create an interactive map with the countries colored according to their food quantity, feed quantity, and food supply per capita. The map would be accompanied by a timeline. We also hoped to add additional information for each country when clicked on, such as importations, exportations, and economic state. On the side of the map, we aimed to add some additional visualizations that were also dependent on the map timeline. The second visualization that we proposed was a treemap that would show the types of aliments with the highest quantities available for food and feed. Another area we thought we could explore if time allowed was the environmental impact related to food production.

FINAL WEBSITE AND VISUALIZATIONS
INTERACTIVE MAP

Our first main visualization is an interactive map displaying different information about the food/feed repartition in the world. When clicking on any country, a dialog appears with more information.

This map was created using Leaflet.js in combination with the GeoJSON data format. To generate the GeoJSON file, we had to extract the interesting data from our dataset in a Python notebook, and add it as properties in the world map GeoJSON file. Users can choose between three different options: the amount of food for people in tons per capita, the amount of food for livestock in tons per capita, or the overall aliment supply in kcal/capita/day.

The entire map component, as well as the associated charts on the side are bound to a year slider allowing to visualize the data year by year from 1961 to 2019. For every section of the website we decided to add a “What does it show?” section to explain the interest of our representations and provide some more insight. This was not planned in the first draft.



On the side of the map we added some charts showing aggregate data.

The first one is a pie chart displaying the proportion of aliments allocated for food or for feed. This chart shows that the proportion of food used for livestock is decreasing over the years, but is still big (1/5th!).

The second one displays a bar for each continent. The red section of the bar displays the food supply per capita per day on average in that continent. The full length of the bar represents the calories needed by one person in a single day. The interesting thing about this visualization is that by the year 2019, all of the bars are completely full. This means that every continent has enough food supply to sufficiently feed its population in theory. Of course, we know that this doesn't happen due to a myriad of factors, such as poverty, lack of access, and food waste.

TREE MAP

Our second main visualization is a zoomable treemap. This map was created using the d3.js treemap function. The custom layout, accumulate, and transition functions are built on top of a template on Observable [2]. We chose to use the data for the most recent year in the dataset, so 2019. From the original dataset, we add a continent column and output a JSON file that represents the hierarchical relationship of continent, country, food/feed, and aliment type. The values correspond to the amount in 1000 tonnes of each item. The sizes of the boxes in the treemap correspond to these values. As can be seen on the first screen, among the continents, Asia's food and feed quantities are the highest. The second screen displays all of the countries in the chosen continent.

Initially, we planned to possibly average the values by continent, or to only display certain countries. However, when looking at the data, it was really interesting to see the differences between each and every country. Certain countries that we might have omitted, such as small island nations, have a less typical variety of aliments.

For the countries whose boxes are too small to fit their name, hovering over them will display the name in the top bar. The third screen shows the proportion of food allocated to feed and the proportion allocated to food. These proportions are also visible on the second screen, as the opacity of the country rectangles are slightly less than one. On the final screen, depending on the selection, either the top 25 food items are shown or the top 15 feed items. All items not explicitly shown are grouped into an "Others" category. Once again, for food items with smaller proportions, the name and percentage are shown when hovered over. Clicking on the top bar will return the user to the previous screen.

The treemap confirmed what we had a glimpse of in our original exploration of the data. The richer countries tend to have much closer to even proportions of food and feed, while poorer countries have very small proportions of feed and very large proportions of food.

CHALLENGES

Data: The data was in a usable format originally, so there weren't too many difficulties. The two original datasets were from 1961-2013 and 2010-2019, so they did have to be merged and the overlap dealt with. We also had to do a few tricky aggregations and some filtering of the data for certain visualizations.

Map: The main challenge for the map was to create the GeoJSON data file. It needed quite a lot of parsing of the dataset and tinkering to get it to work. Apart from that, Leaflet provided a great API making the implementation quite straightforward.

Another challenge was getting all the side visualizations to update in real time with the year slider. It caused some optimisation problems as it induced a lot of redraws of heavy components (map, pie chart, bars, ...).

Treemap: The first main challenge with the tree map was adding the images. Since everything is layered on top of each other, it was difficult to correctly redraw the images when transitioning back and forth between screens. Another major challenge was the styling. A lot of the boxes in the bottom right-hand corner are very small, so the text doesn't fit correctly and neither does the image. For the food screen, we initially had a movable tooltip implemented over each food item to display the information, but it was very difficult to debug. In the end, we opted for a static version. It was also surprisingly difficult to display the percentages, since the underlying values of the JSON file were the raw numbers, not the proportions. When using the proportions as the values, the food and feed boxes ended up being equal, which took away an important part of the visualization.

Team: We worked great as a team, the project was challenging because we didn't have much prior knowledge on JavaScript and D3 but it was fun to work on our idea and build it from scratch. We split our work in 3 parts: one working on the map and merging things together, one working on the side visualizations and treemap and one working on the detailed charts per country.

Our third team member - supposed to handle the last part - stopped answering messages one week before the deadline and didn't show any work. We had to take over his part in a rush and only managed to do a simple visualization as a proof of concept. It added quite a overhead for the final sprint.

CONCLUSION

In the end, we managed to achieve some effective visualizations that explored both the differences in the types of food consumed by humans and livestock and also the differences across countries. The map visualization allowed us to see the changes across countries and over time. These visualizations give us some insight into the ways in which food availability and distribution vary not just across geographical boundaries, but also economic boundaries.

PEER ASSESSMENT

Meghan

Worked on the implementation of all the graphs at the side of the map: the pie chart, the calories bars.

Also implemented the entire zoomable treemap and performed most of the data analysis

Lucas

Worked on the interactive map, the pop-up and the chart appearing when clicking on a country.

Also the year slider and the binding of the other components, as well as overall design of the website.

Terry

Disappeared when we started implementing Milestone 3.

Should have implemented detailed information appearing in a pop-up when clicking on a country.

Didn't implement anything.

REFERENCES

[1] https://www.fao.org/faostat/en/#data/FBS

[2] http://bl.ocks.org/ganeshv/6a8e9ada3ab7f2d88022