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LIVES AND GLOBAL WARMING
By Junze Li, Yusi Zou, Zhantao Deng

Process book

Project for Data visualization COM-480, EPFL

Lives and Global Warming

Team Zalda: Zhantao Deng, Junze Li, Yusi Zou

Overview

Motivation

Choice of topic

While the world is overwhelmed with the COVID-19 pandemic, the earth is still warming and many lives are suffering from the heating planet. A recent news reports that Antarctica has hit the highest temperature on record of 18.3C in February 2020. The climate zone for lives now is shrinking.

To keep within the climate zone for survival, most species on this planet, including plants, will have to migrate. However, many species will not be able to redistribute themselves fast enough, i.e. these species may well become extinct.

Human beings are no exception. Global warming could lead to extreme climates and the weather, such as ozone depletion, El Niño, increased danger of wildland fires, the global spread of infectious diseases, drought and flood, which would seriously affect the food-producing system and humanitarianism.

In this project, we visualize the factors related to global warming and its effects on species and human beings so that to appeal more concern from the general public to this global challenge.

Target Audience

Global warming is a problem that each human being and life on earth is facing. We think that everyone should be aware of the seriousness of this problem and be alert, and ideally, they could take more consideration of changing his or her lifestyle to make the planet better.

Process

Finding Dataset

Firstly, we want to find a dataset including the world average temperature over the years in order to have an overall grasp of the global temperature variation. The Berkeley Earth Lab, which is affiliated with Lawrence Berkeley National Laboratory releases one dataset containing global land and ocean temperature of each month from 1760 to 1840, which is very detailed but not up to date. So we choose the dataset released on Kaggle which containing the world average temperature from 1760 to 2013. To visualize global better, we focus on temperature in 20 and 21 century.

Then we find a dataset containing carbon emission amount per capita of each country from 1990 to 2014 released on Kaggle and a dataset containing forest coverage rate of each country from 1990 to 2015 released by Worldbank. Both these two datasets are suitable for our visualization purpose and have similar time ranges. We can implement these two datasets to reveal the relationship between carbon emission and forest coverage rate.

For the urbanization part, we find a proper dataset on 'Our world in data' website. The dataset containing the share of population living in the urban areas of each country from 1900 to 2010 is provided. This dataset together with the temperature information can help us to find the relationship between urbanization and climate change.

Finally, on the 'Petpedia' blog, we find the dataset containing the number of endangered animals over the world from 2000 to 2020. These animals are separated into critically endangered, endangered, and vulnerable classes. There is also another similar dataset containing the number of endangered animals over different species. These two datasets can be used to visualize the impact of climate change on animals.

Based on these information for different factors, we create several visualizations to explore the impact of climate change.

Define sections & visualization

As global warming is a complex problem, we group the datasets by different aspects and form 4 main sections. In each of these sections, we will bring information to our audience through visualizations, and ask questions related to the subtopics. We will also answer the questions with some domain knowledge and facts to show how severe the problem is.

Before the start of the sections, we introduce the topic with some background story and show some facts to bring the audience into the story. We also show some different opinions on this topic and ask questions to the reader: is global warming real? What are its causes and consequences? Especially, what are the impacts on lives?

The first section is the **World Average Temperature**.

As said in its term, global warming is a global issue. We choose to show the geological view of the annual regional average temperature year by year on the world map. We try to find the global temperature variation trend so we implement an animation on it. The button above is used to control the 'play' and 'stop' of the animation. At the same time, to show the values of average temperature and give a more intuitive view of global warming, we draw a line chart on the right side, and the temperature of particular year is shown when moving the mouse on the plot.
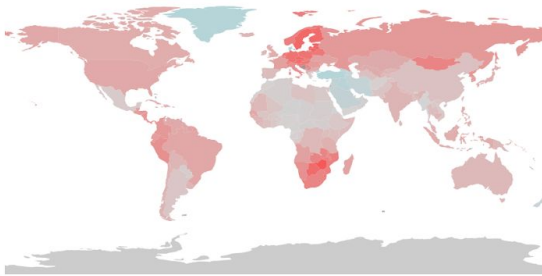
World Average Temperature

Click on the play button to show the evaluation of the temperature
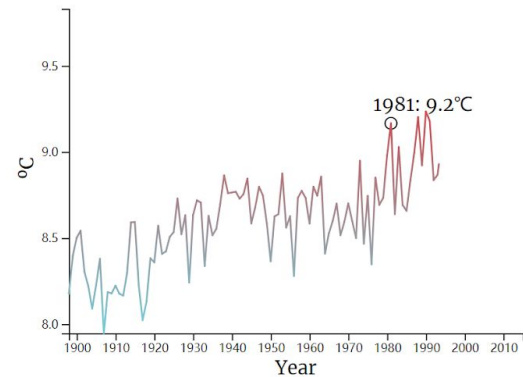
▶II

1994   Country-wise warming

World average temperature

1981: 9.2℃

Overall, we can find that the color of the global map tends to be red and the line ascends significantly. In this way, we contradict the words of some politicians who said that global warming is "bullshit". We also added some fact below the visualization to help our audiences to better understand why global warming is indeed a challenge to lives.

The second section is **CO2 and Deforestation**.
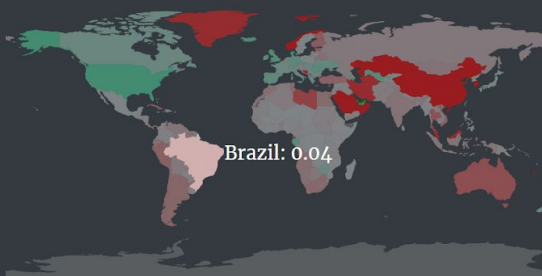
CO2 and Deforestation

Click on the play button to show the evaluation of the CO2 emission
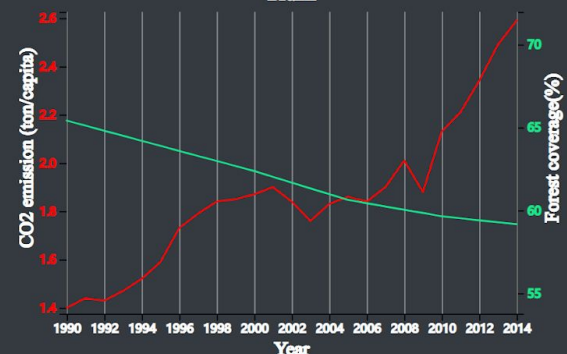Click on the country to show the forest coverage v.s. CO2 emission

▶II

2010   Country-wise CO2 Emission

Forest Coverage v.s. CO2 emission of Brazil

Brazil: 0.04

Same as for the previous section, we choose to show the CO2 emission of each country on the world map. The greenhouse gas such as CO2 is the key factor related to the global temperature, so we visualize the CO2 emission amount of each country on the world map year by year. When we click on the country we interested in, the line chart containing two lines indicating CO2 emission amount and forest coverage rate respectively is shown on the right. In this way, we can not only grasp the global perspective of the CO2 emission amount but also the relationship between CO2 emission and forest coverage rate of each country.

The third section is **Urbanization**.
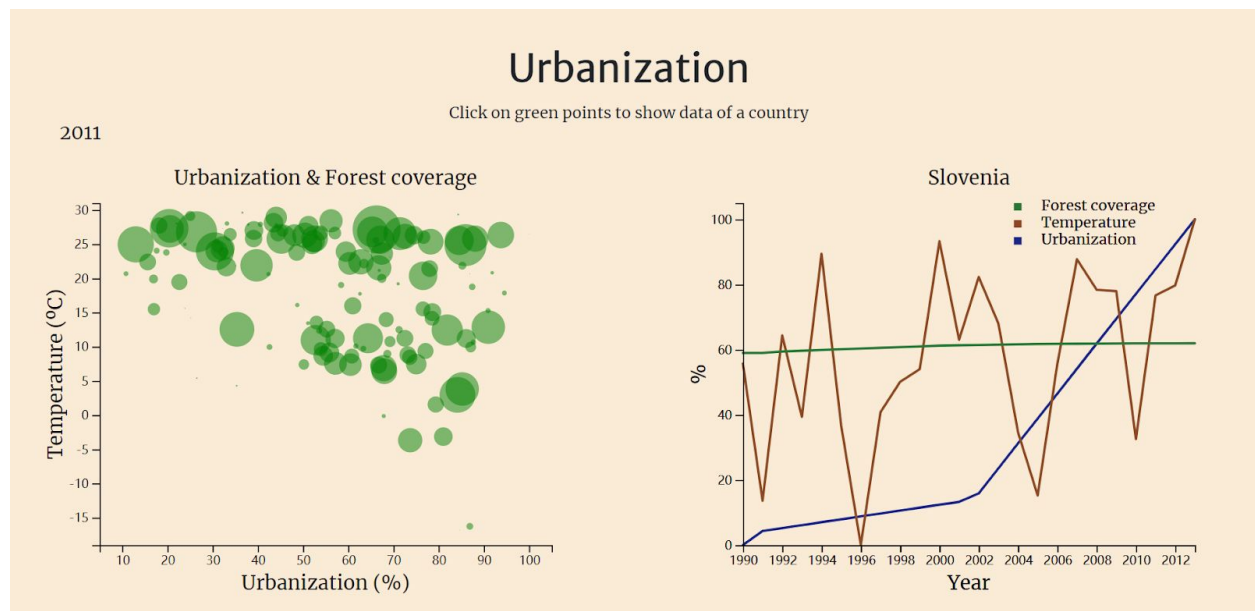
We want to show how the urbanization level is related to the temperature, as well as the forest coverage, so we use a scatter plot. It shows each point with 4 dimensions: the evolution of urbanization level and the annual temperature on the x and y-axis respectively, the forest coverage rate of each country with the size of the dots, versus time, i.e. the dots would move dynamically in the figure year by year. When the move is moving to a dot, the dot will be highlighted and show the country name. By click on it, we visualize the value of each dimension more clearly for the corresponding country with a line chart containing three lines indicating the other three dimensions versus time.

Finally, the last section is **Living things**.

There are a lot of species facing danger, and we want to show how fast is the number of threatened animals increasing, so we chose to use a stacked line chart. The left figure shows the evolution of the number of different degrees of danger for threatened species

through time with an animation of plotting from left to right. When clicking on different animal buttons, it generates a new right figure that shows the data for this particular class of species.
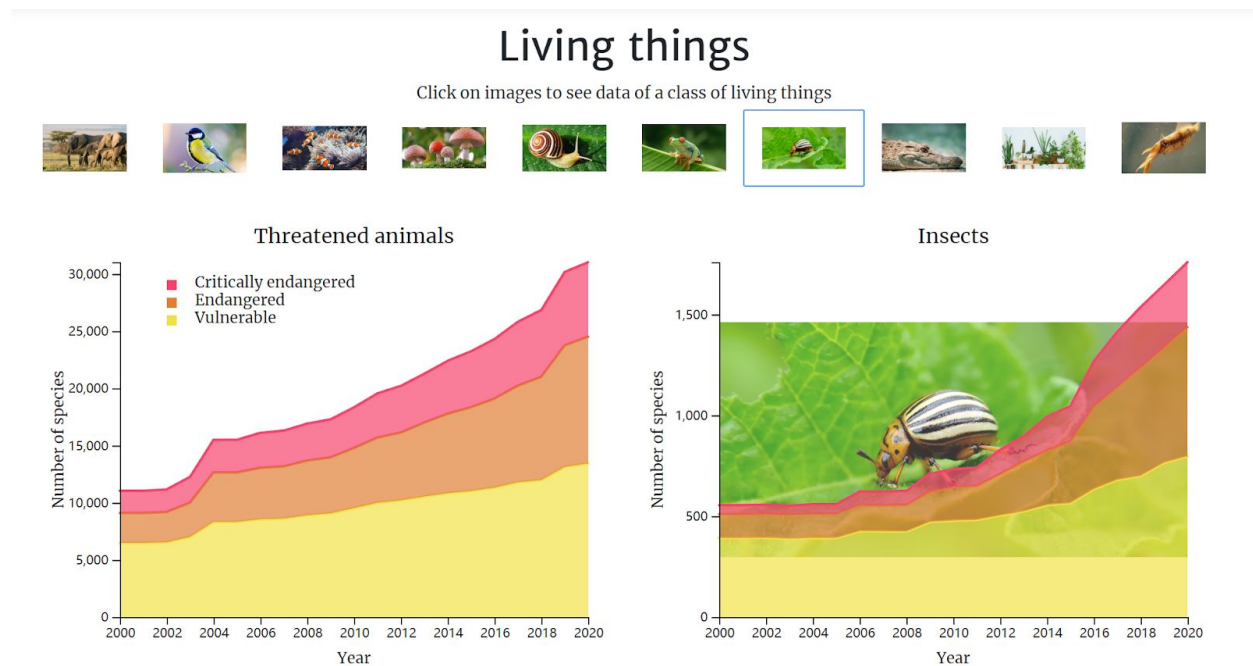
Challenges

There are some problems that we encountered during the making of this project. Some of them have been solved, the less important ones are abandoned.

For the world average temperature and CO_2 emission amount, we visualize these values on the world map. There exist inconsistencies in country names and we try to use country code to match these two values with each country. For some missing values of each country, we use the values of the nearest year to fill them. In this way, the jump of color on the map could be avoided.

The overall style and layout of the website is important for the user's first intuitive experience. Based on the course lectures, we learn some useful methods to design the website. Moreover, we also reference the templates on the 'Start Bootstrap' website. Then, we determine the current version of website style containing consequent colorful blocks for each section.

We plan to implement the fisheye distortion to the scatter plot but we decide to give up this function because this is not an essential point and we don't have enough time.

Peer assessment

The project has been worked in an enjoyable atmosphere. The team members actively bring new ideas for topics, resources, and visualization, and communicate often for sharing codes, features, and help each other with their implementation.

The tasks are equally distributed among team members:

- Zhantao implements the map features and the interactivities on map
- Junze implements line plot features and the interactivities with line plots
- Yusi implements the scatter plot features and interactivities with button
- The interactivities among multiple plots and the textual description are discussed and have been worked together, same for the process book and the website construction

Most of the time, the team works and chat together online and can thus discuss at any time for adding or removing features or for asking help for any technical questions. Each team member has expertise in certain things that the team can rely on, which makes the teamwork efficient.