Project Data Visualisation World forests and Deforestation

25.06.2021

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Context

Deforestation gained interests in the last decades with the environmental awareness that provoked the industrial revolution. One can visualize shocking pictures of the burning Amazonian forest. Detractors may argue that such images are overwhelming, focusing only on one part of the world and manipulating therefore the public opinion.

As of 2019, forests account for 38% of habitable land area, which represents 26% of the total land area. Shares of forest decreased by 4.2% over the last 30 years. 4.2% may seem small figures, but it still is 1,6 millions of km^2 (3 times the area of France). Moreover, it hides evolutions that are different depending on the continents. Indeed, Asia gained 9.2% while Africa and South America respectively lost 16.7% and 15.3%.

According to 'Our world in data', this marks '*a significant change from the past: global forest area has reduced significantly due to the expansion of agriculture. Today half of global habitable land is used for farming. The area used for livestock farming in particular is equal in area to the world's forests.*'

Within this project, we will bring some insights about the forest areas evolution in the world and over the last 30 years. There is always some subjectivity in the choice of the design, but still we hope these dashboards can bring some objective information in this debate away from the propaganda of climate negationists or environment political activists.

1. Data Used

1.1 Dataset

There is a huge quantity of datasets from which we were able to extract the data associated with the visualization of the worldwide deforestation, but we needed to choose the one that was "more ready" to use and also that was having enough and extensive information.

With this aim, we have chosen as our main data provider, the web site:

Our World in Data (https://ourworldindata.org/,)

As it can be read in their webpage content is nourished by researchers of the University of Oxford and its maintenance is done by the Global Change Data Lab (Global Change Data Lab (global-change-data-lab.org) a non-profit organization registered in England and Wales. This foundation is supported by donations from readers of the web publications of Our World in Data, and also grants coming from the Bill and Melinda Gates Foundation and the Quadrature Climate Foundation. Furthermore, it claims it received past support from the World Health Organization, the Department of Health and Social Care in the UK and from many other individuals.

We used the data from https://ourworldindata.org/deforestation, more explicitly the csv files associated to:

1. The annual Net change in forest area: it measures forest expansion (either through afforestation or natural expansion) minus deforestation, called "Annual-change-forest-area.csv'
2. Share of land area that is covered by forest, named "forest-area-as-share-of-land-area.csv"

In those datasets, it is possible to explore long-term changes in deforestation, and the deforestation rates across the world today.

Also data from https://ourworldindata.org/forest-area, and in more details, the files:

1. A breakdown of global forest area by world region, called "Share-global-forest.csv"

2. The total of forest area by country, with the name of “forest-area-km.csv”

These two files let you see the distribution of global forests globally.

All the original sources (as raw data) can be found as data published by “UN Food and Agriculture Organization (FAO). Forest Resources Assessment 2020” with the associated link: https://fra-data.fao.org/WO/assessment/fra2020

The UN FAO publish forest area and forest change data as the annual average on 10 or 5 year timescale, therefore these are the year allocations that apply:

- The annual average over the period from 1990 to 2000
- The annual average over the period from 2000 to 2010
- The annual average over the period from 2010 to 2015
- The annual average over the period from 2015 to 2020

Our dataset is thus mostly quantitative: forest areas and derived quantities, with 2 essential non quantitative dimensions:

- time (the year of the observation, ordinal property)
- location (the country of observation, nominal property)

Here location is not encoded as longitude/latitude but as a nominal property (the name or the Iso code of the country) and we will take advantage of that for our Choropleth maps, and for the labels of most of the charts.

We have 223 countries, and a varying number of recorded years depending on the variable or the country, for a maximum of 31 years, 1990-2020. As an example, the file “forest-area-km.csv” has 7846 entries, with 223 countries + other geographical entities (Europe, Least Developed Countries, etc.) and 31 recorded years:

	Entity	Code	Year	Forest area	Forest cover
0	Afghanistan	AFG	1990	12.0844	1.850994
1	Afghanistan	AFG	1991	12.0844	1.850994
2	Afghanistan	AFG	1992	12.0844	1.850994
3	Afghanistan	AFG	1993	12.0844	1.850994
4	Afghanistan	AFG	1994	12.0844	1.850994
...	...	...	...	...	...

7841	Zimbabwe	ZWE	2016	176.288	45.570273
7842	Zimbabwe	ZWE	2017	175.827	45.451183
7843	Zimbabwe	ZWE	2018	175.367	45.332093
7844	Zimbabwe	ZWE	2019	174.906	45.213002
7845	Zimbabwe	ZWE	2020	174.445	45.093912

1.2 Some Definitions

In order to gain some insights, we need to establish a basic conceptual framework, therefore, before applying any study on the data we are presenting, it is mandatory to clarify some definitions, so that the audience and the publication producers share the same wordings:

- **Forest:** Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. So a forest is determined both by the presence of trees and the absence of other predominant land uses.
- **Net Change in Forest**: it measures any gains in forest cover - either through natural forest expansion or afforestation through tree-planting minus deforestation.
- **Deforestation**: The removal / cutting of trees in a forest from. There are two types of deforestation: human-driven and the natural one.

1.3 Data pre-processing

Some data needed some pre-processing to show proper visualizations. For instance, the file forest-area-km.csv" provides raw data, describing the amount of forest area (numeric data) per country (nominal data) and per year (ordinal data). It contains 7 847 lines concerning 223 distinct countries and 31 years from 1990 to 2020.

As such, the data was pre-processed as follows:

- removing duplicate rows,
- filling empty years using back-fill propagation and then, if the latter was not possible, forward-fill propagation. This ensures a time continuity in our data, with reasonable interpolation assumptions,

- dividing the original area amount in ha by 100 000 to convert to thousands of km2 to get readable figures,
- adding a new metric by concatenating the forest density from the forest-cover.csv file,
- adding a new metric by computing the forest area yearly variation pourcentage,
- adding a new metric by computing a 1990 baseline index. The index equals 100 in 1990 for each country. Then the index evolves following the yearly variations of the forest areas.

Data Viz as an Exploratory Data Analysis tool: While building the dashboard, we got some insights about missing data and errors just by looking at the graphs.

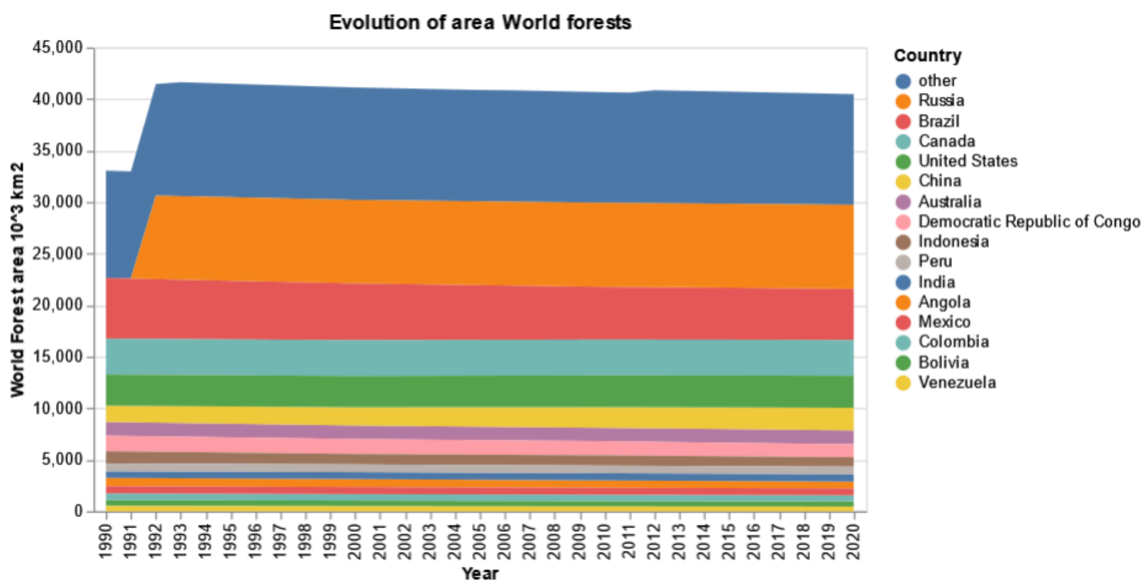


Figure 1: original area chart highlighting missing Data for Russia in 1990-1991

Thanks to that we looked back at the data and were able to correct and clean our dataset better. Thus the interest of Data Viz for this project was twofold:

- Presenting a clean final dashboard **for our targeted audience**
- Understanding better and cleaning our dataset in a feedback loop Data preprocessing <-> Data Viz (**Data analysis team**).

The last point is sometimes forgotten but it is perhaps as important or more as the final result in real-life context with raw, unclean and diverse data sets.

2. Aim of the project

2.1 Public targeted

Our data visualizations are aimed at the general public, so as to raise awareness of deforestation, which has a direct impact on climate change and animal welfare. The objective of our story is therefore to make our viewers aware of the forest destruction, by proposing powerful graphics and visualizations. Our visualization tools are intended to be used by novices related to data, and that understanding is possible for a person with no particular technical skills. We have therefore oriented our visualization tools towards a common design in computing (drop-down menus, checkboxes, sliders, multi-selection...)

2.2 What is the user looking for and how your design may or may not help them?

The user who looks for information in our visualization is already aware of the existing problems related to deforestation. Our visualization will not convince a person who is not interested in environmental and animal causes. On the other hand, a person who already has some knowledge about the dangers of deforestation will be able to increase his general culture and his factual knowledge on this subject thanks to our visualizations. He would be able to get basic figures per country over time: (forest area, density, variation (therefore reforestation and deforestation) and baseline).

However, users won't be able to dig into the data to search for the causes of the reforestation and deforestation, such as public policies or agricultural expansion. Moreover, users will not be able to measure the quality of the reforestation, for instance what types of trees grew and how they grew (naturally or man-managed). For instance, forest area in France grew in terms of area over the last 30 years. However, the net figures do not show that wild forest parts were destroyed while single-crop tree farming was encouraged. One should know that this type of industry deteriorates biodiversity.

2.3 How do the types of users influence the design of your visualization?

A regular user needs to get a global picture of the forest theme. Thus, the visualisation needs to guide him in his discovery and analysis. First, in the exploration part, the visualisation would need to show some general raw figures, such as forest areas and densities, so as the user to get an idea on how forests are spread around the world. Second, to continue the exploration, the visualisation should show the evolution through different computed metrics, such as variations and baselines. Third, so as to start the analysis, the user would want to filter countries and year and compare country trends.

A forest expert user has already in mind the global picture and the trend. He would want to focus on certain topics to analyse the forest evolutions, formulate causes hypotheses. As such, he would need more detailed information, for instance local forests figures and varieties of trees. Furthermore, to search the causes of reforestation and deforestation, he would need additional metrics such as agricultural, livestock, land use or meteorological metrics (ex: rainfall, temperatures) and biodiversity indicators. In our work, we did not have that type of data. Thus, we could not implement this type of data visualization.

3. Tasks

3.1 Questions

The questions we had in mind before designing the charts were:

- Does the user have an idea of the world forest area and density? Does he know which countries are the most significant? Does he want details at country level?
- Is the user aware of the reforestation / deforestation trends? Can he identify main contributors? Does he have an idea on how they position between each other?

3.2 Low-level analytic tasks

According to Schneiderman's mantra '*overview first, zoom and filter, details on demand*', a user would get a big picture of the forest area changes in the world, and then dig in selected countries to understand how they evolved. Finally, users would be able to analyze countries by retrieving data and comparing them along years and between countries.

To sum up, users will be able to:

- Retrieve value via tooltips
- Filter by selecting countries and/or years
- Visualize derived value, such as variations (reforestation / deforestation) and 1990-baseline, and determine trends
- Find extremum through plotted lines
- Determine the most significant countries by sorting values
- Determine range through color-encodings in the choropleth maps
- Characterize distribution of forest areas and densities across the world.

3.3 Interactions

The interactions we produced will be presented in the Design part. They were implemented in the different categories discussed in the course on tasks, which are the following:

- Select:
    - Selection of the countries on world maps (Dashboards fig. 14 & 15).
    - Selection of the bars from bar plot (Dashboard - fig 15)
- Explore:

    - Some of the graphics are designed to be explored with a drop down menu as interaction (Dashboard - fig 16)
- Reconfigure:
    - Reconfigure by changing the input data for a dashboard, through a dropdown list (Dashboard - fig 14). One can choose to see forest areas, densities, variations and a 1990-baseline
- Filter:
    - Countries can be filtered by multi-selection (Dashboards fig. 14 & 15)
    - The temporality is adjustable thanks to the slider (Dashboards fig. 14/15/16).

4. Design

4.1 Used Technology

We used Altair to develop our main views and interactions. Our choice was mainly driven by the fact that the development on Altair is done in Python, and that we preferred to focus on creating content on the data visualization itself, rather than wasting time learning Javascript on which we are not yet fluent.

In more details, we have used the version 3.7.6 of Python and that of the Altair 4.1.0.

For the publication in a dashboard, we have used vega-lite 4.8.1 and D3 7.0.0.

4.2 Technology dashboard pipeline

This is the workflow used to display the data in a dashboard using the technology already described:

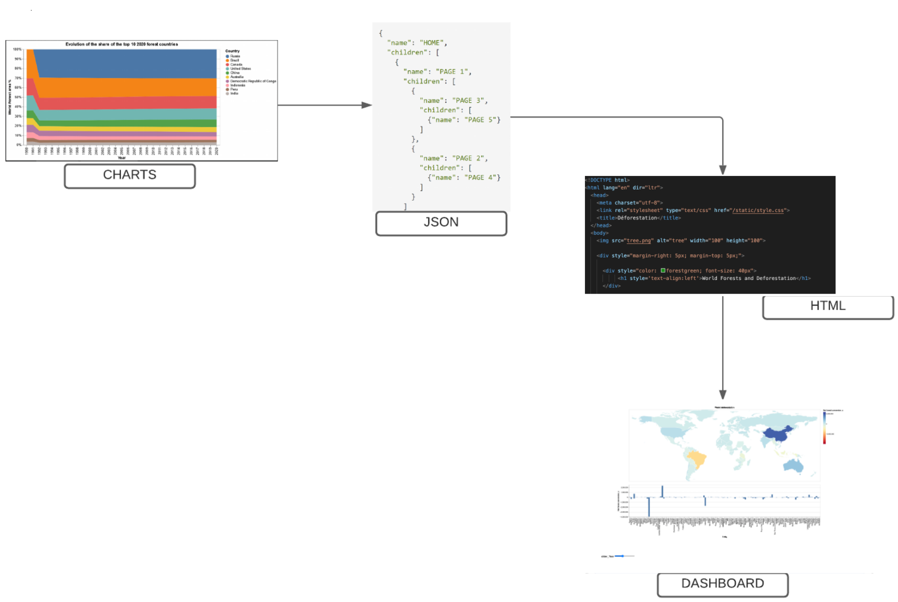
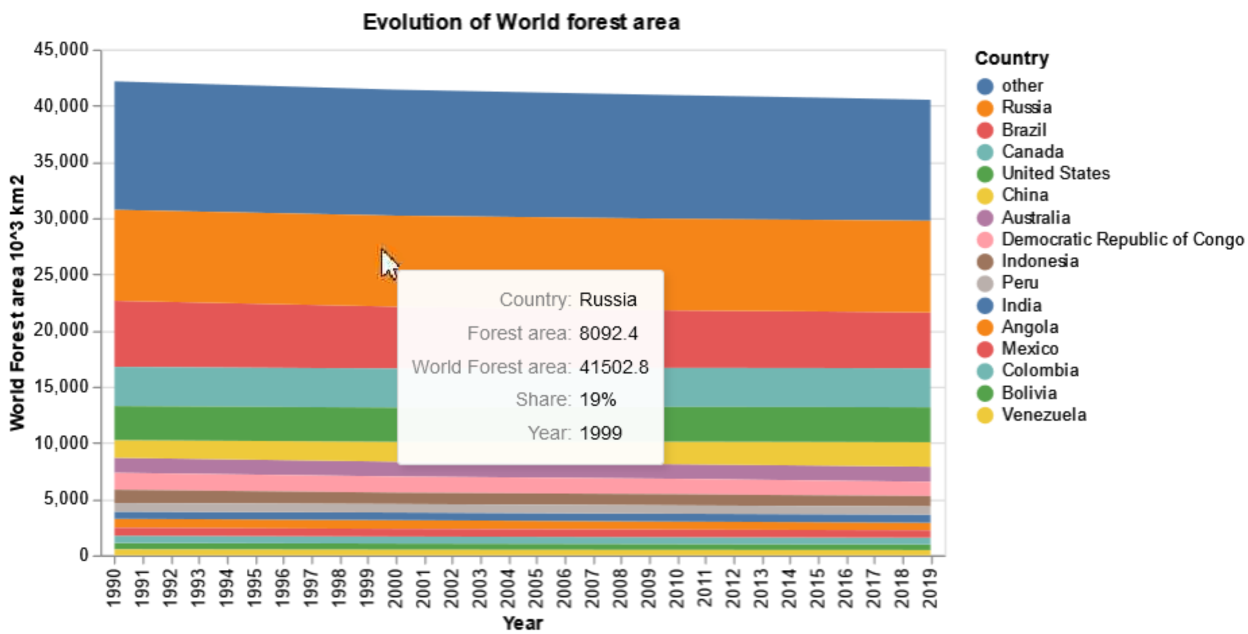


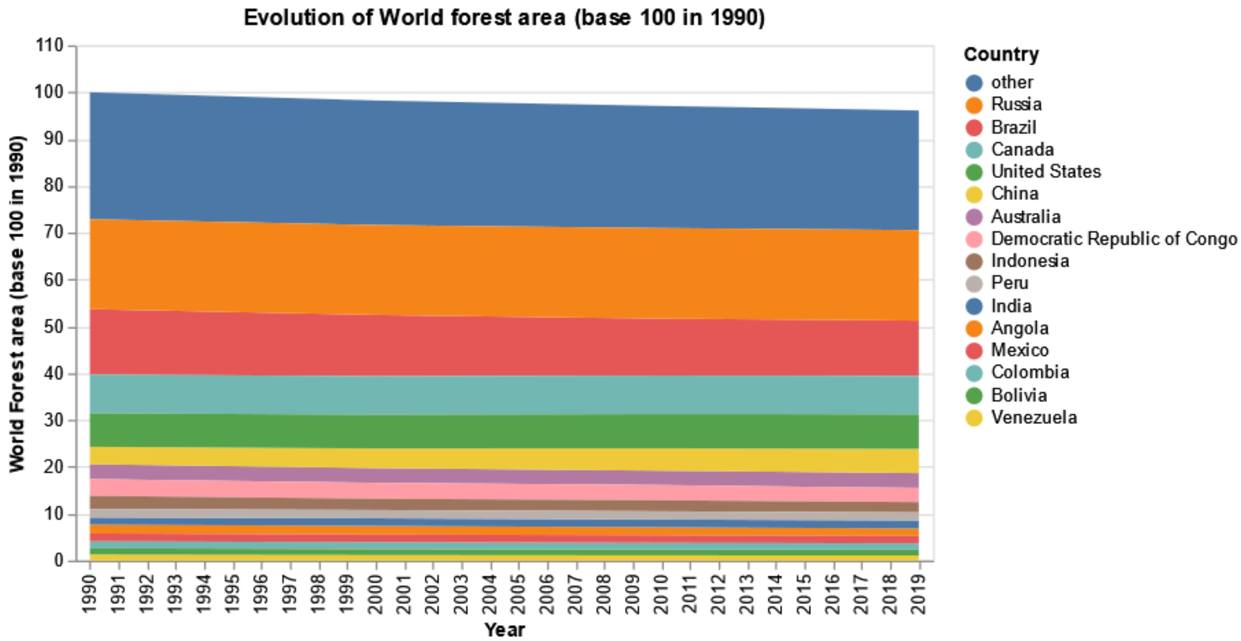
Figure 2: Workflow pipeline to display the data in dashboards

5. Views

5.1 Overview

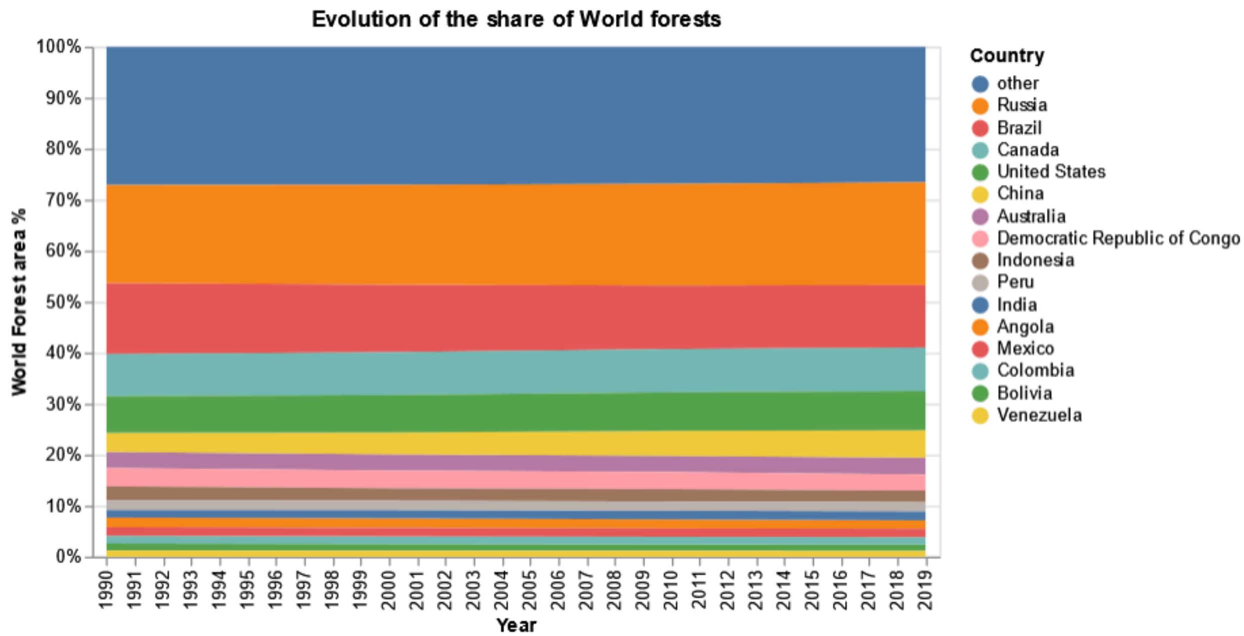
Stacked area charts of forest areas evolution





We display individual evolution for the 15 largest forest countries as of 2019, the 207 remaining countries were grouped in the 'other' bucket for readability. The legend follows the vertical order of 'layers'. Both graphs are (almost) identical. The bottom one has only different y units, for the same variable (forest area). We divided all forest areas by the Global Forest Area of 1990, so that we could better see the relative evolution of forest areas compared to 1990 as a baseline.

Graph's insights: We passed from 100 index Global Forest Area of 1990 to 96 in 2019, so a global decrease of 4% of the global forest cover over the past 30 years (1.6 millions km2). 4% might seem a small figure at first, but that would mean that all forests would have disappeared from Earth in less than 750 years, ending most of the terrestrial species as we know them today. Not a single extinction in all Earth history has been so fast ever. Yet we notice on the graphs that forest evolution seems a slow but steady process at human life scale, just like climate change. This graph is also a way to see the share of the most important forest countries in the Global forest area. We displayed the evolution of these shares as a chart area as well :



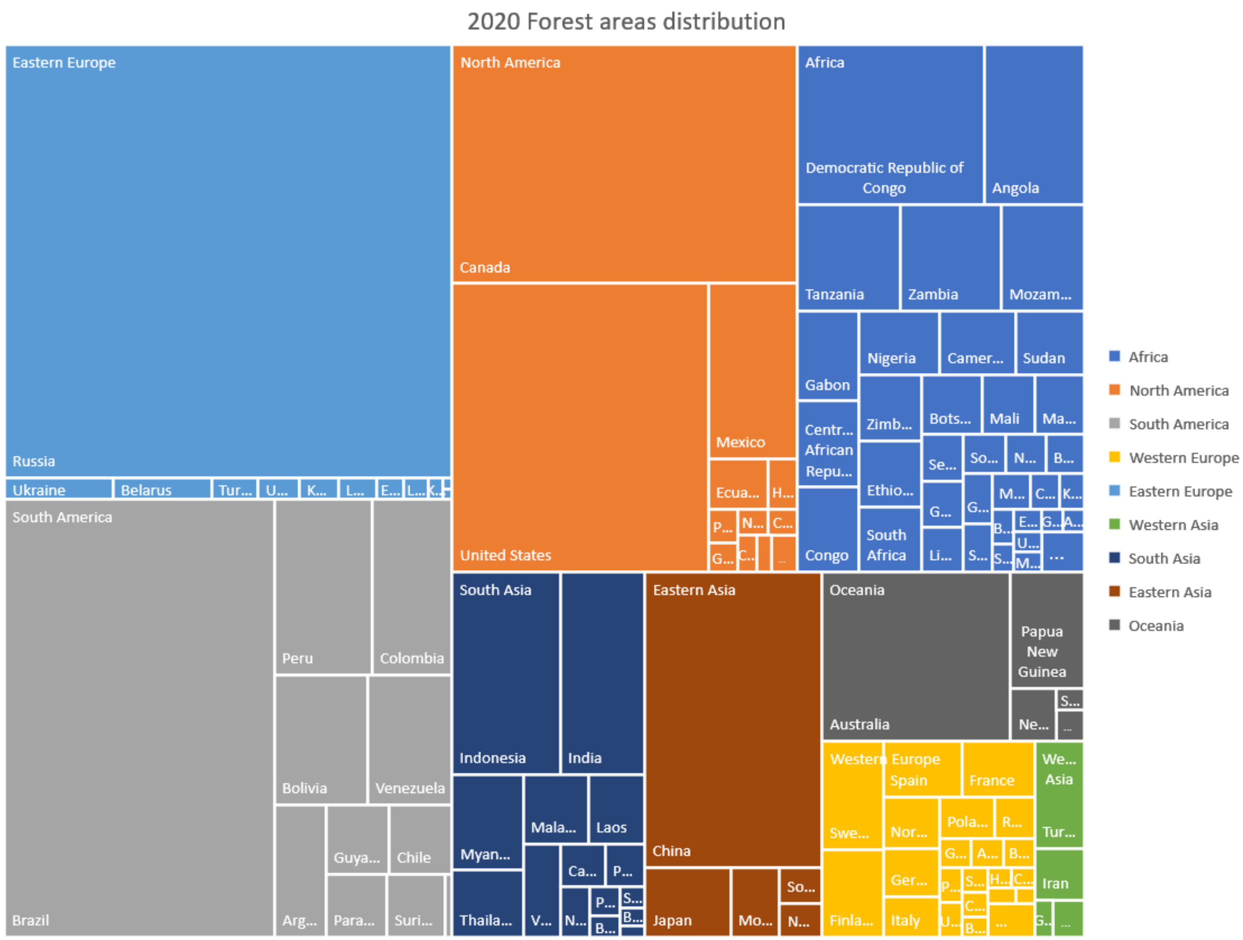
Actually forest evolution is so slow that it is hard to notice a change, but we can clearly see Brasil decreasing its share while China on the contrary is increasing its forest share. We also notice that most of the countries seem to have small forest areas except for the top ten.

Graph's limits: these three graphs tell actually pretty much the same story with just slightly different perspectives. Instead of small multiples we could have used for example just one chart linked to a dropdown menu to change interactively the variable displayed. The graphs disclose the slow nature of the forest evolution, but at the same time that means less information to gain from them. Finally, It is hard to display more than 15 countries, so we are losing some details from the 207 small forest countries grouped in the 'other' bucket.

Graph's alternative: To show Global Forest shares, our first intent was a Pie Chart, or better a Tree Map with the different World regions as containers. It was only technical constraints that pushed us to give up the idea. Vega-lite, not talking of Altair, is currently not able to display Tree maps[1]. Thus, if the dataset, the targeted audience, the representative tasks and interactions are all essential constraints for a Data Viz project, one should not underestimate the technical limits of the tool, and the skill limits of the team to achieve the desired result within a fixed time frame!

Pie charts would have been difficult to manage without some grouping of the 223 countries beforehand. We show a treemap built with Power BI from our data giving some interesting insight about the world forest area breakdown:

[1] https://github.com/altair-viz/altair/issues/204



Russia, Brasil, Canada and the United states are dominating forest countries. Asia with giant countries like India or China has comparatively small forest areas compared to the other world regions. Relative importance of each country is pretty well rendered. We will not comment on this treemap further since it is not available in our dashboard, but it's too bad.

SunBurst chart has the same issue as pie chart, a lot of countries make it hard to read and some grouping will be necessary at the lowest level. Anyway, Sunburst charts are not available either in Altair. We could also have used a stacked bar chart to display forest shares, but this one is similar to the area stacked chart we've used. Another option to display forest areas distribution was Bar Charts, per country, per year or both (grouped bar charts). It has potentially more information to display, but we think it is somewhat for an advanced analysis as it is less striking and readable.

Waterfall graph of Countries contributions to deforestation

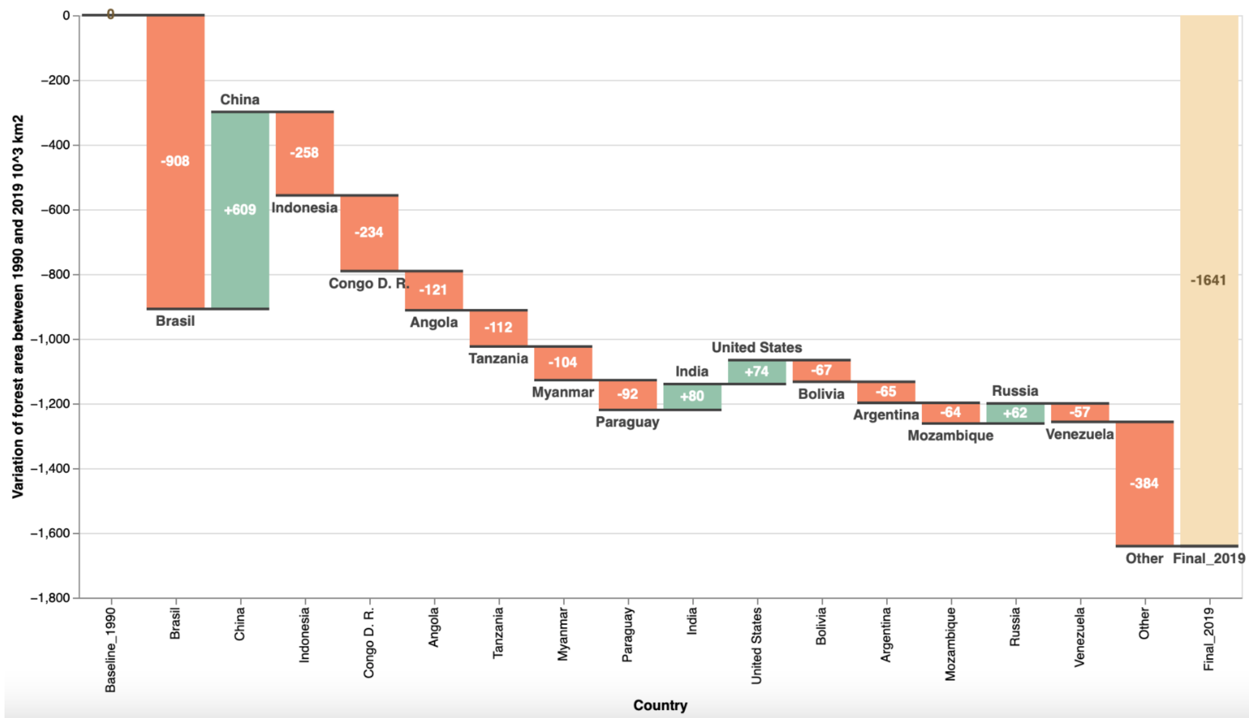


Figure 10: Contribution of the 15 most important contributors to global Forest area variation over the past 30 years.

This graph ("Waterfall graph") shows the action of the 15 most important contributing countries on deforestation or forestation over the last 30 years. We can see the starting point 1990 (baseline 0) and the end point 2019, and measure the impact of each country - positive or negative - on global deforestation. This graph allows us to draw up a general balance sheet while weighting the responsibility of the most important contributors to forest variation during this period.

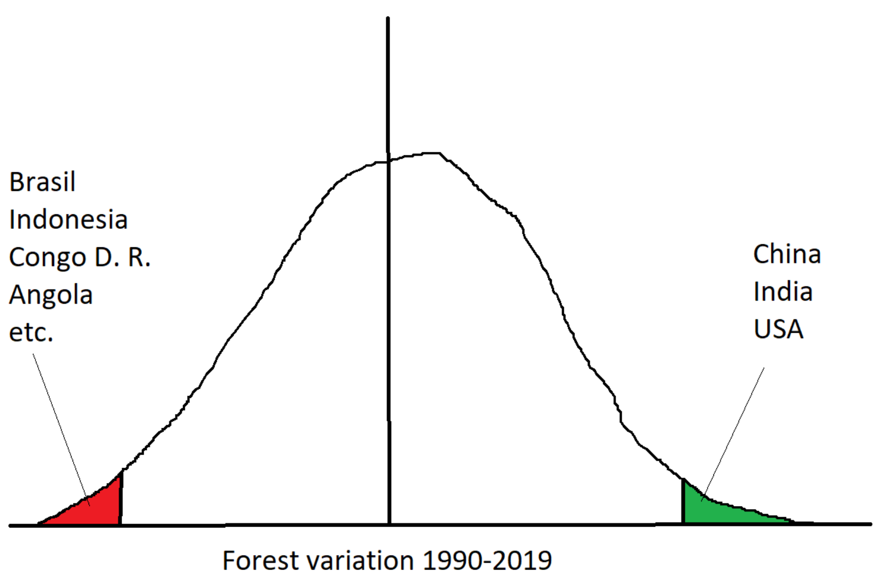
Graph's insights: Here we get the bad guys of deforestation, and the champions of forestation. We can see that Brazil contributes **more than 55%** to the Global deforestation over 30 years, and China reforested an incredible amount of 610 000 km2, helping limit the world deforestation by 37%[2] (this is something that we discovered thanks to this project, our *'aha'* moment). We also noticed that most of the countries have negative forest variation, only a few of them are actually reforesting, yet with limited efforts (except for China). There are unfortunately much more bad guys than champions, for a net general balance of 1.6 millions km2 of forest having disappeared over 30 years...

Graph's limits: we first considered showing the forestation contribution of each country with one Bar Chart, but it was hard to easily display positive and negative contributions with the precise identity of contributors on the same graph. Two bar charts, one for

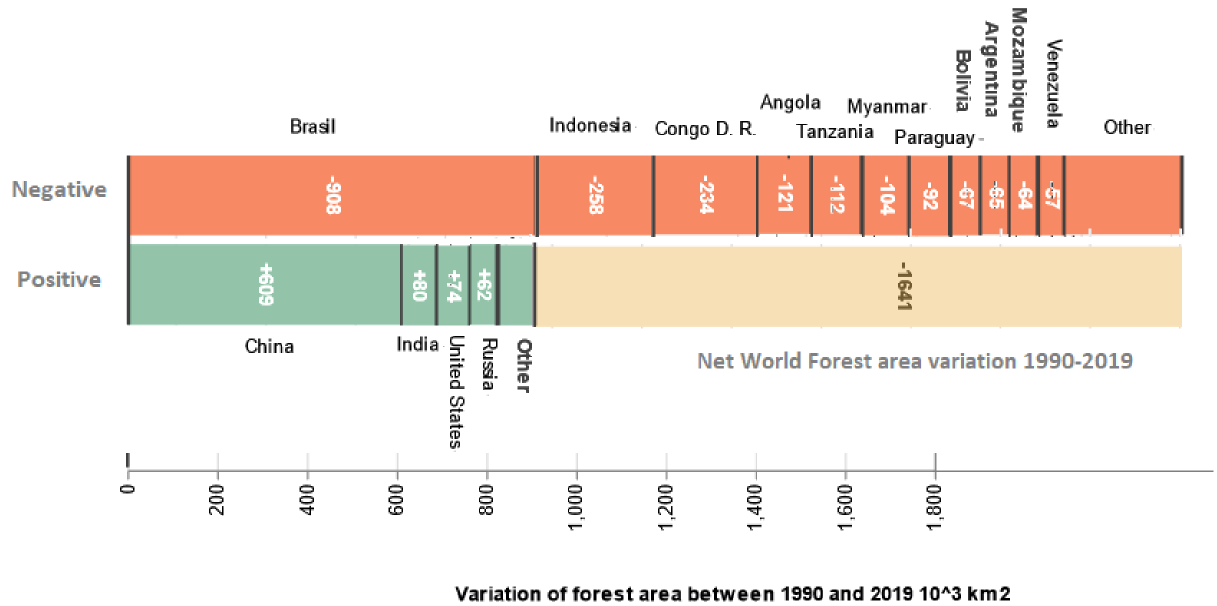
[2] https://forestdeclaration.org/the-latest/case-study-china

deforesting countries and one for foresting countries was our next move and it was OK, except for the numbers of countries (223). We would have to group some of them in order to improve readability. Eventually we prefered the waterfall graph, as telling a story of some kind of competition between foresting countries and deforesting countries. The relative contribution of each country was also easier to compare, as well as their impact on the final balance. However part of the story telling is arbitrary, with the order of the countries displayed. Here we chose an “objective” order: the absolute value of the individual forest variation for each country. Currently there is also some redundancy in the chart with the country names displayed as x axis labels, and displayed as well on each of the bars. Labels on the bars is our first option, but we kept the labels on the x-axis as the best option if we wanted a greater number of countries displayed. One limit of this graph is indeed the difficulty of showing many countries and still being readable. Thus we had to group the remaining 210 countries under the same bucket ‘other’. The graph is not able to give more details about these small contributors, we only know that the absolute value of their individual contribution is less than Venezuela’s one (57 000 km2 forest variation), but their sum still accounts for 23% of the global deforestation over the past 30 years.

***Graph’s alternative**:* A) a **histogram** of forest area variations, highlighting right (positive) and left (negative) tails. Still the identification of individual countries on each tail might be difficult for this kind of graph (maybe displaying the country names while hovering the histogram bars), and comparing magnitudes between positive and negative variations that are far apart on the x axis is not straightforward. We have not investigated this kind of graph further.



B) two parallel stacked bar charts (positive and negative forest area variations over the past 30 years).



This graph is very similar to the waterfall graph. It is more compact and has an improved "data ink ratio", and will maybe allow displaying more forest countries. On the other hand it might be slightly less readable, and may demand a little bit more effort to get fully understood by a large audience. It was hard to choose between the two, and this graph might be our best option if we targeted a more specialized audience.

The waterfall graph was adapted from https://vega.github.io/vega-lite/examples/waterfall_chart.html and was directly written in Vega-Lite JSON Specification. It seems Altair's current version makes it hard to draw such advanced graphs in Altair dialect.

5.2 Countries views

In order to observe the variation of the forest/tree population in the world, we display a world map offering several visualizations. A choropleth map of the world map is very explicit and offers a clear visualization of the situation.

Below, we display the world map showing the distribution of forests and forest density per country.

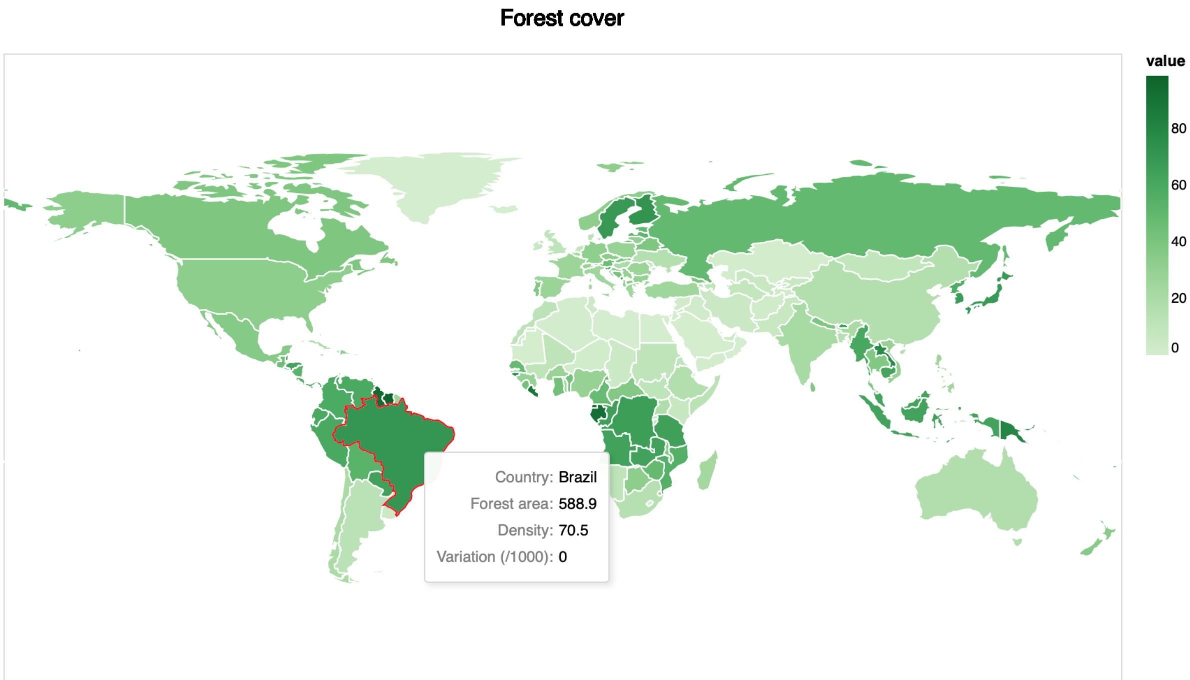


Figure 3: World map's heat map showing the forest distribution for each country.

Our choice to represent this contrast of population between countries is a choropleth map where darker the color higher the density of trees is on the territory.

A **choropleth** map displays divided geographical areas or regions that are coloured in relation to a numeric variable. It allows us to study how a variable evolves (in time) along a territory.

It is a powerful and widely used data visualization technique. However, its downside is that regions with bigger sizes tend to have a bigger weight in the map interpretation, which includes a bias. It could also be misleading in the presence of outliers.

5.3 Forest area variation maps

In the next series of maps, we show the evolution starting in 2000 and every 5 years (with a gap of 9 years between 2010 and 2019) of the change in forest cover across the world, in hot colors those countries where the change is negative and in green those with a positive change, meaning that these countries are gaining more than what they are losing.

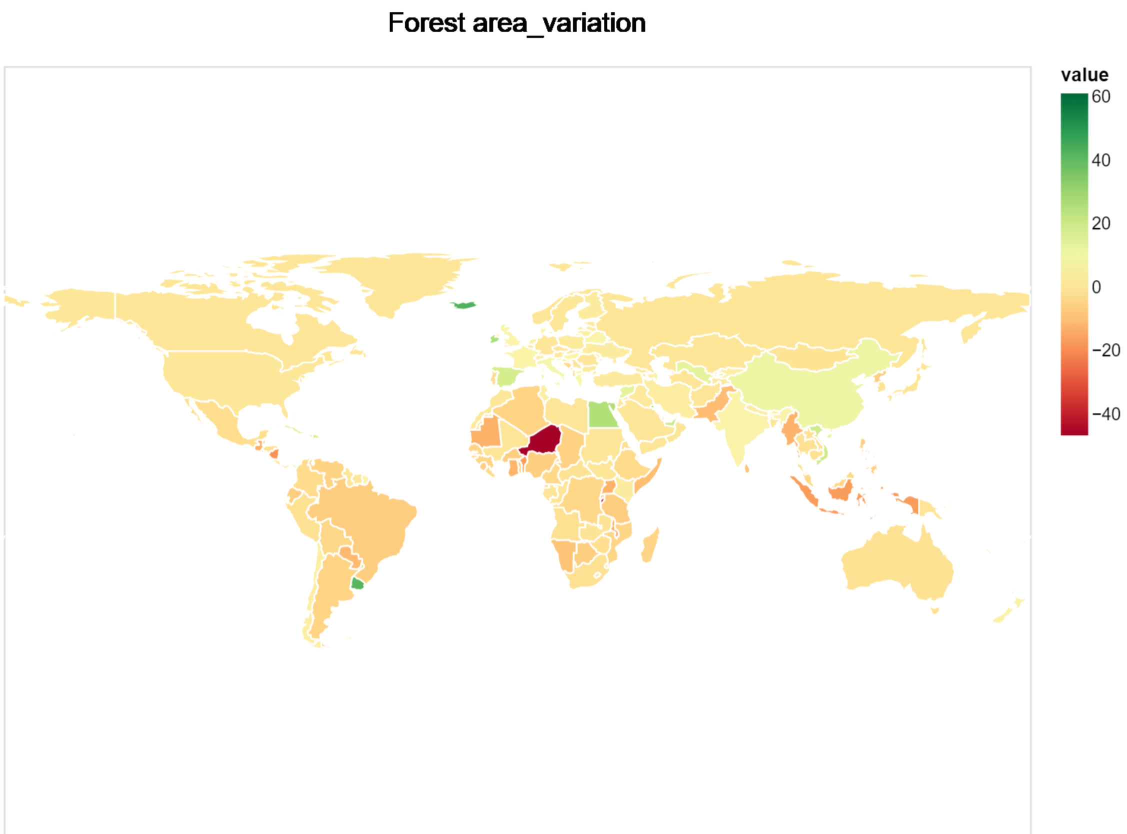


Figure 4: World heat map showing the change in forest for each country in 2000.

The losing countries for this year are Niger, Indonesia, Ghana and Nicaragua among others. Meanwhile, Iceland, Ireland, Spain, China, Uruguay and Egypt are good pupils.

It looks like in 2005, the mentality and the public politics have not reached their goals, because there had been a worldwide decrease in the change in forest as we can observe in this map:

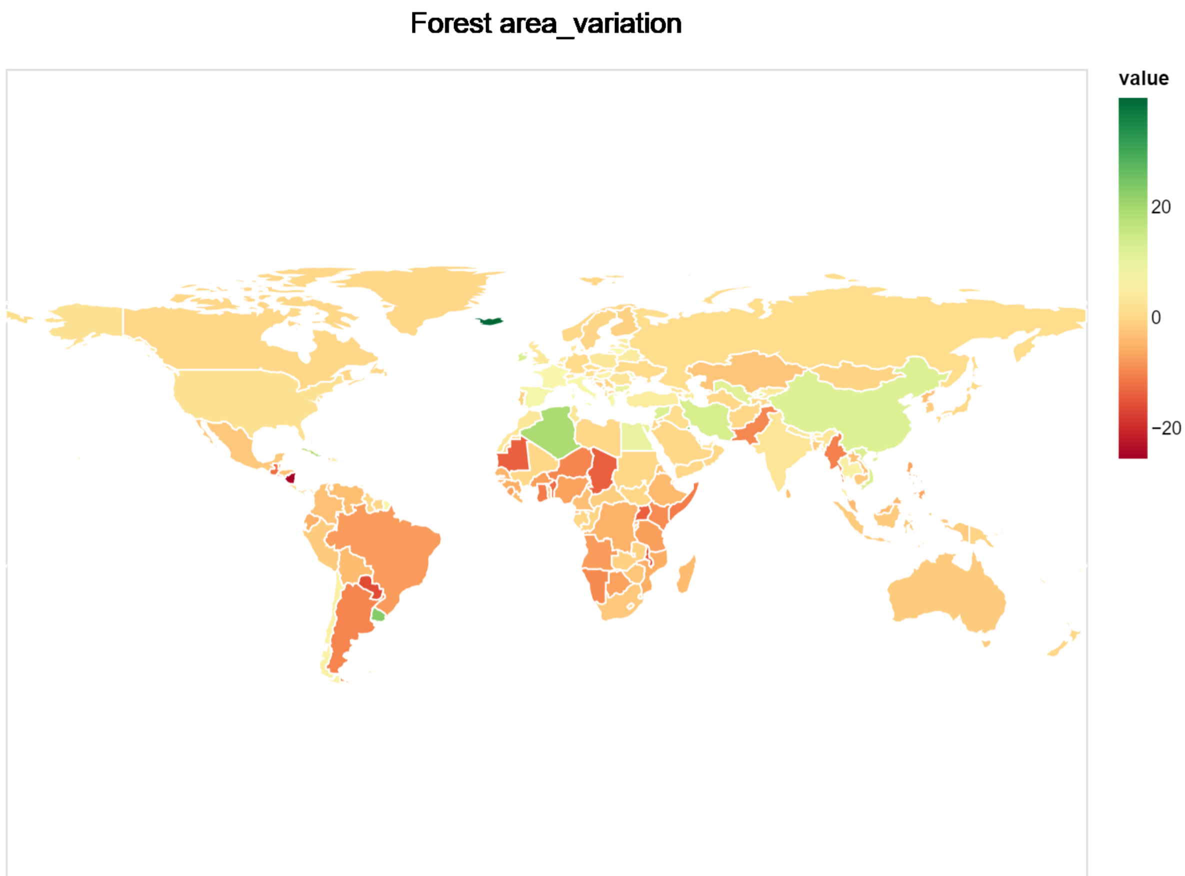


Figure 5: World heat map showing the change in forest for each country in 2005.

But looking much more in detail, we can see a change in the scale in both directions, so now the maximum change is of +40 and the minimum is of -20. We can observe some countries that increased their forest area in relation to 2000 like Niger, changing from -46 to -10.

In 2010, the scale remains the same, but there are new countries that still increased their change in forest positively, like Iran, Uzbekistan, China and Algeria and there are some other countries that have improved their situation, but are still in the yellow zone like USA, Peru, Colombia, Russia, Australia and others. In general we observe an improvement, a positive change in forest.

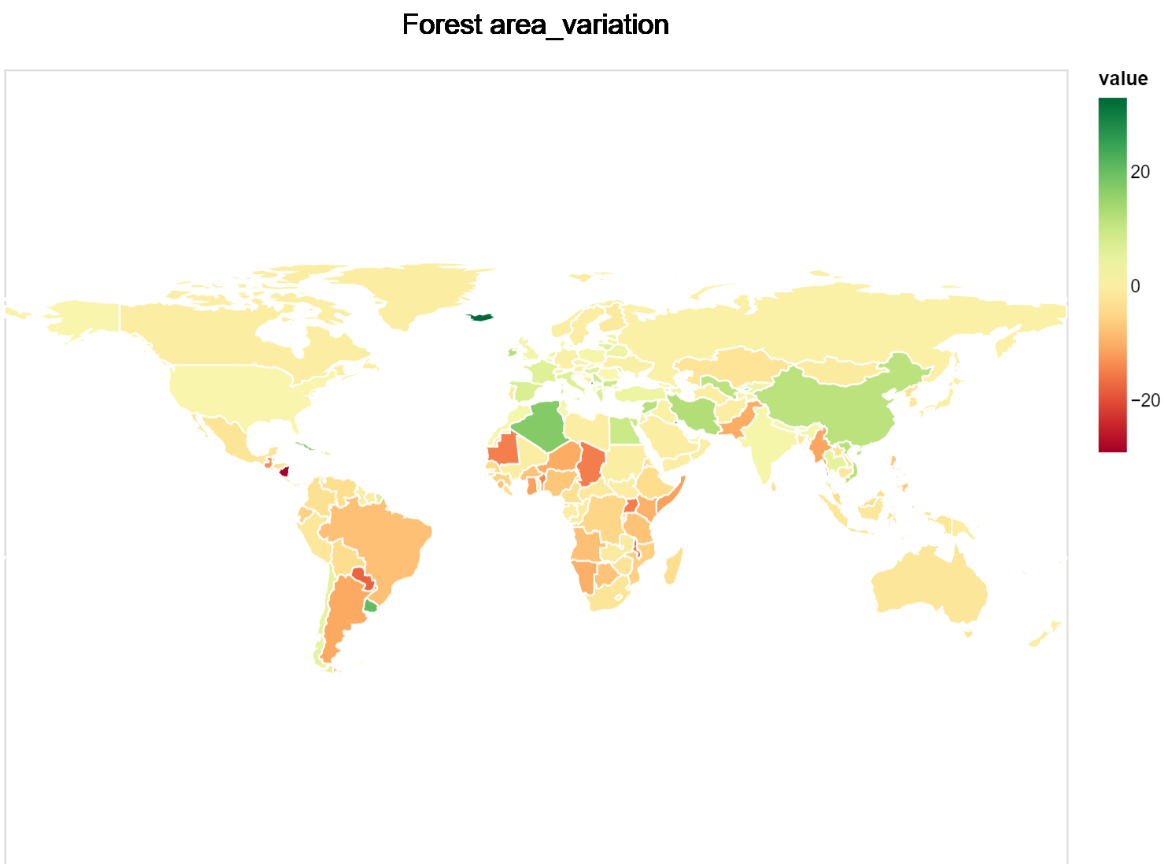


Figure 6: World heat map showing the change in forest for each country in 2010.

Checking the situation in 2019, we observe an improvement in the Brazil situation and also that of China, Russia and Kazakhstan and Paraguay, Nicaragua, Niger, Nigeria, Chad, Mauritania and Oman representing bad examples.

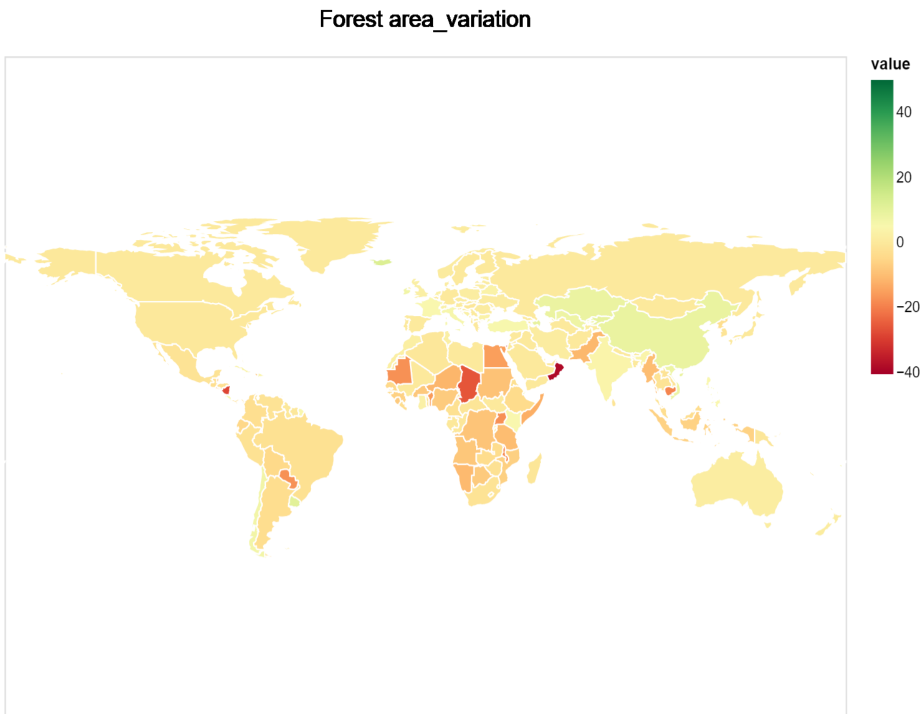


Figure 7: World heat map showing the change in forest for each country in 2019.

On these maps, we are able to select several countries and compare them in a chart, like in this example:

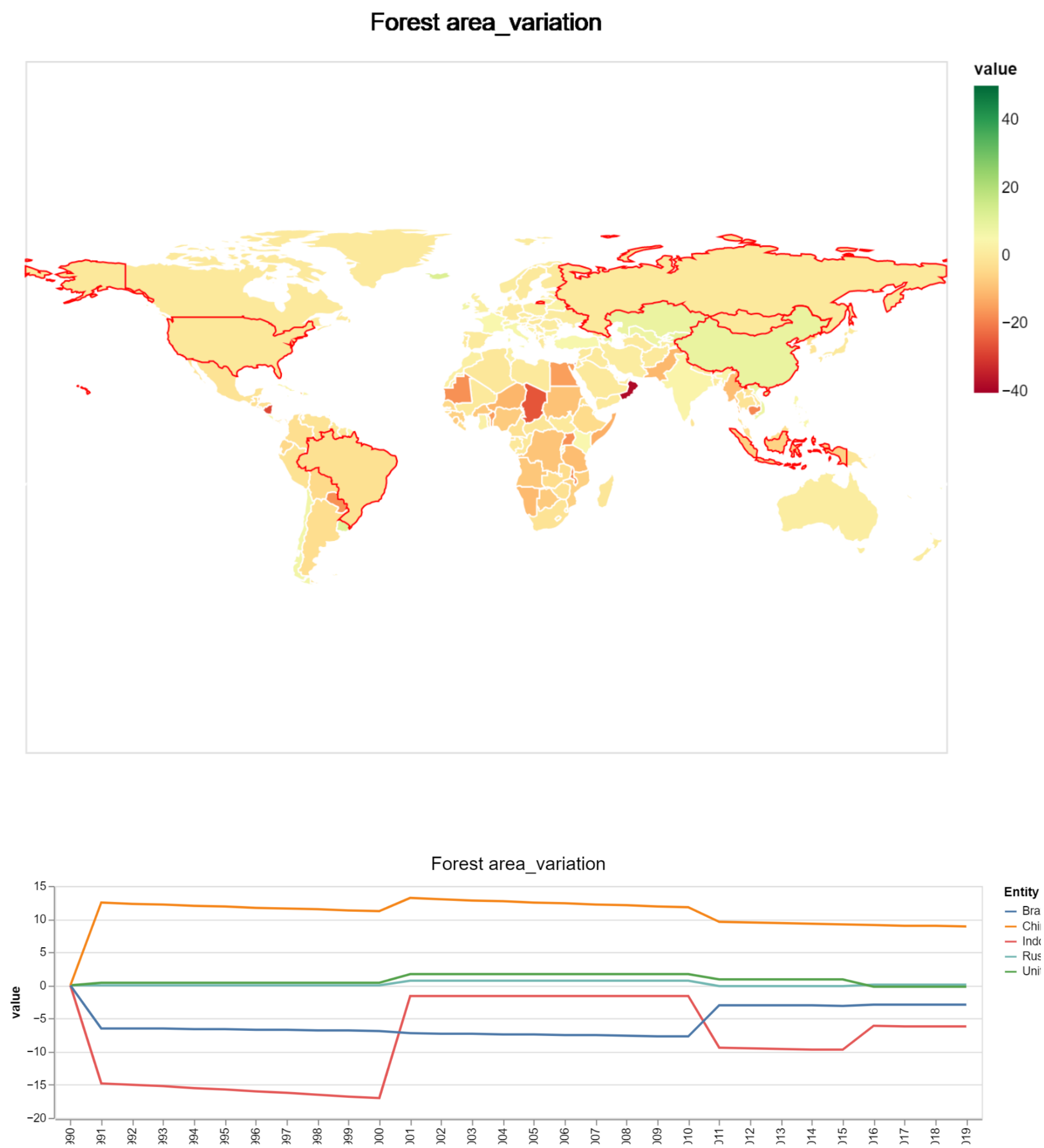


Figure 8: World heat map showing the change in forest for each country in 2019, with selected countries and the same information for those countries and their evolution in time.

In this way, it is possible to observe at the same time several countries and their evolution, while checking their situation at a specific point in time. From this graph we could say that the change in forest in Indonesia is drastic, which could lead to a possible variable way of measuring or not realistic values, while the same curve for other countries is more stable and their changes more subtle.

Another way of visualizing the same date is with the use of Bar Plot for categorical data, like this:

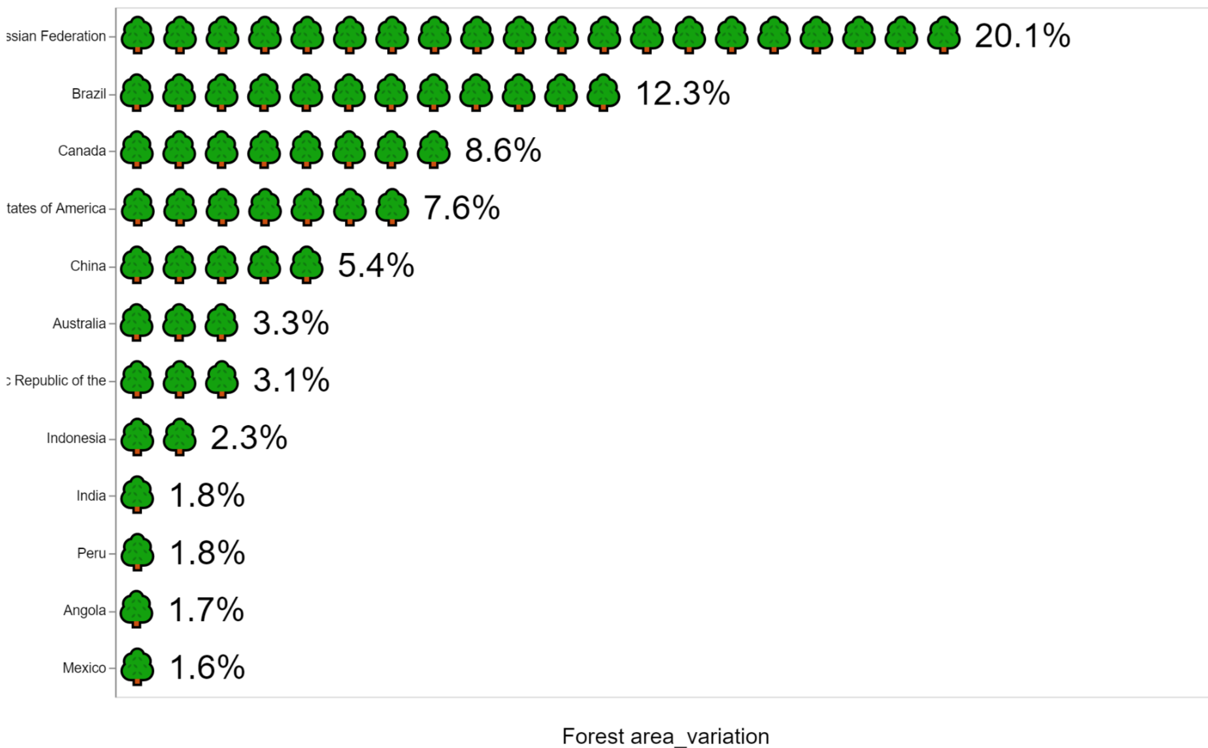


Figure 9: Top countries with biggest change in forest in 2019.

A barplot is one of the most common types of graphics. It shows the relationship between a numeric and a categorical variable. Each entity of the categorical variable is represented as a bar. The size of the bar represents its numeric value.

An ordered barplot is a very good choice since it displays both the ranking of countries and their specific value.

5.4 Interactions

Figure 11: Multi selection on the world map.

The multi selection of countries allows us to compare countries on a graph displaying the value of deforestation if negative value or forestation if positive value. This interaction aims to compare a limited number of countries from the display of all countries in the world.

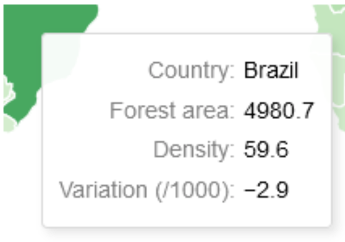


Figure 12: Mouseover tooltip for a country.

The mouseover interaction allows the user to quickly retrieve key information about a specific country from the global data display. It allows the user to explore the data by fetching specific information instantly.

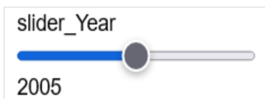


Figure 13: Slider for year variation

The slider allows the user to have an overview of the variations of the different countries over the years. The variation of the slider from right to left and then from left to right several times in a row gives an overview of the evolution of the world and the trajectory that certain countries are taking, especially those that are adopting forestation policies or those that are moving towards deforestation policies.

Figure 14: Drop-down menu for continent selection

This drop-down menu allows the user to select the continent on which to keep the data, in order to have an overview of the selected continent in relation to the world data. This can be useful, for example, to observe the political orientation of certain groups of countries within a continent, such as South America which has been massively deforesting in recent decades.

6. Dashboards

The Dashboards are designed to dynamically display our graphs on a web browser page, in order to have an overview and to be able to quickly modify the inputs of our graphs. We made our main dashboard with Altair, exporting the graphs and visualizations in HTML, for a direct display on a browser. To realize our dashboard with Altair charts, we had to export charts and the data in json. Moreover, we use D3, vega, vega-lite and vega-embed scripts to parse the data and display it on the browser. Below we show some screenshots of our html site (Figure 14, 15 and 16).

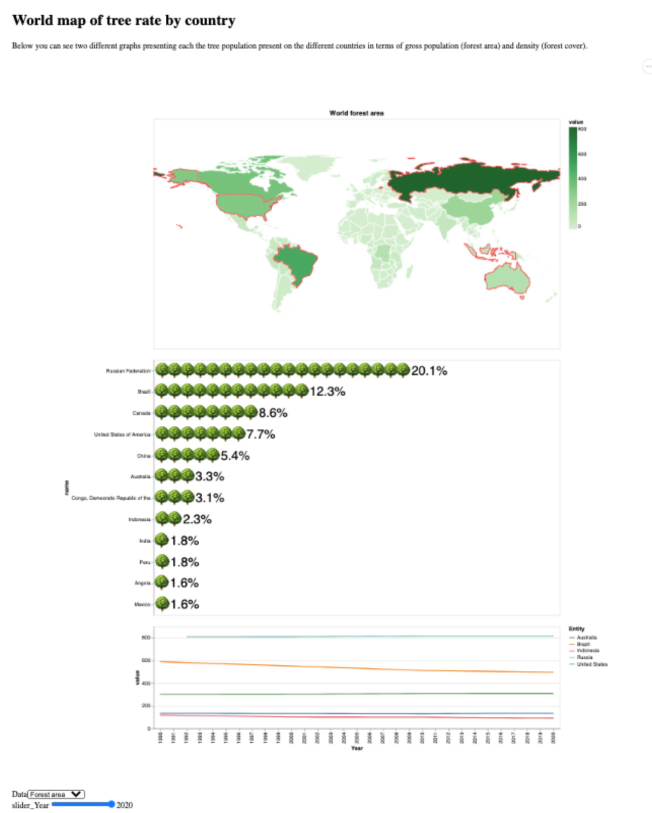


Figure 14: Dashboard showing the World forest Area with 5 countries selected for the plot.

This graph allows the user to see the forest areas each country has in the world. Thanks to our interactions, it allows our user to select one or more countries to see the history of the forest areas in the last 30 years. This is to confirm or deny the ideas that we can develop by following the press from afar. If we take the example of China, which is a country that is among the most polluting in the world (even if most of the CO_2 produced is used for the production of Western goods), we can imagine that it will be in a policy of deforestation since China sacrifices its environment for the benefit of its economy. Using this graph, we can see that this is not the case. This is the kind of objective that our design has as well as the interactions that compose this Dashboard.

Design's benefits : Our design allows the user to compare two or more countries on different metrics, some of them normalized by the total area of the country, making the comparison less biased.

Design's limits : The slider uses a single entry point as a year. We could set up a new slider that takes the start year and end year of the desired observed period. This would allow, for example, to observe the evolution of deforestation following economic crises and establish correlations.

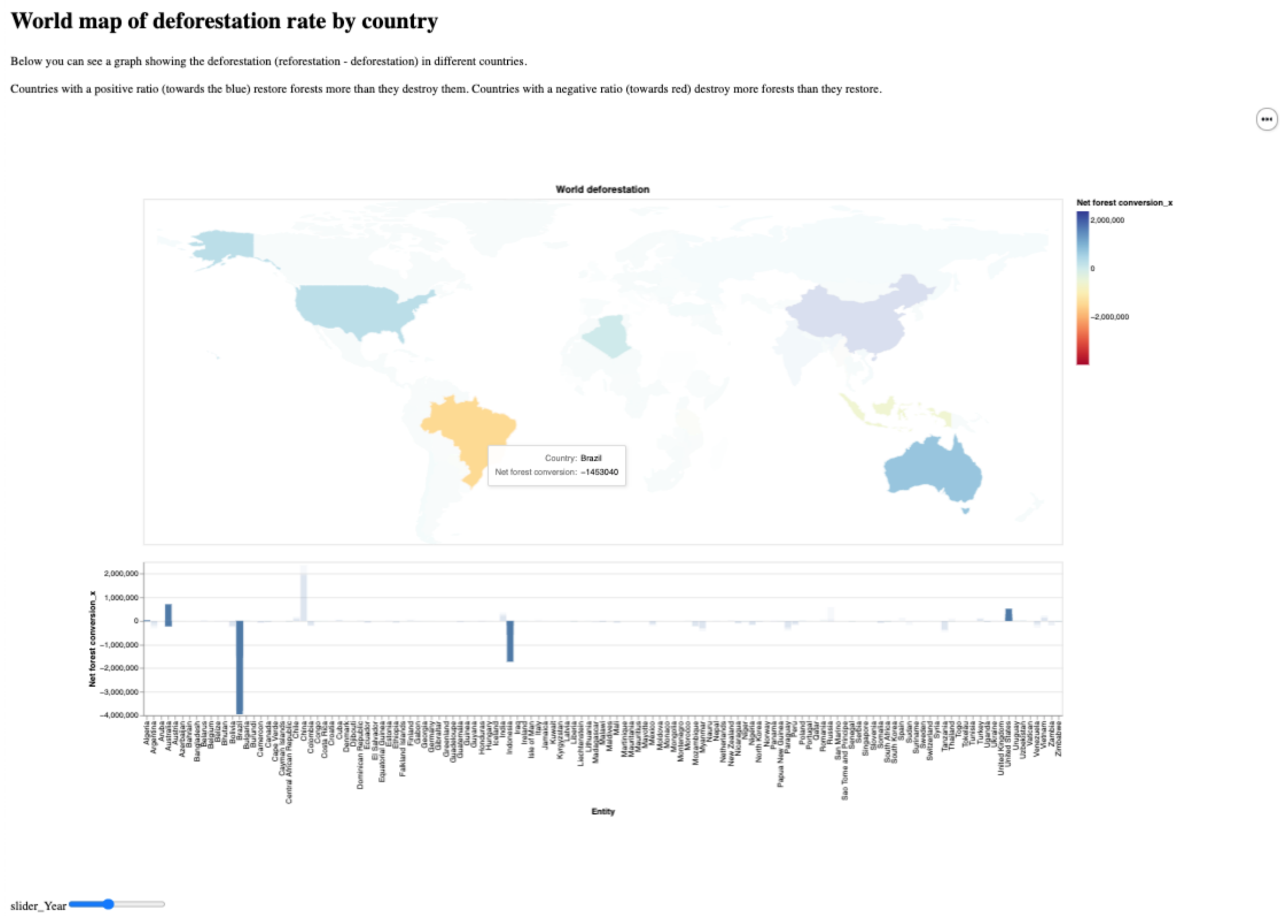


Figure 15: Dashboard showing the World Deforestation rate with 4 countries selected.

This design allows the user to select one or more countries from the map in order to have the display of this/these country(ies) on the graph below the world map that synthesizes the net forestation share (positive or negative). The design also allows the user to select directly the bars in the bar chart to display the countries on the world map. The objective of this design is to allow the user to quickly go and get the forestation share information on the main forestation actors (which are the extremes of our scale) or to go and select the countries that interest him. It also allows the user to change the year of display in order to obtain data for the last 30 years.

Design's benefits: The design allows you to quickly obtain information specific to the countries you are looking for. It also allows you to compare countries and obtain their location.

Design's limits : The design does not propose a time tracking when the year changes. It is therefore difficult to follow the evolution of the countries when the user changes the years slider. An improvement to this problem could be to put a reference year (e.g. 1990) since which the user could observe the improvement or deterioration of forests since a reference year.

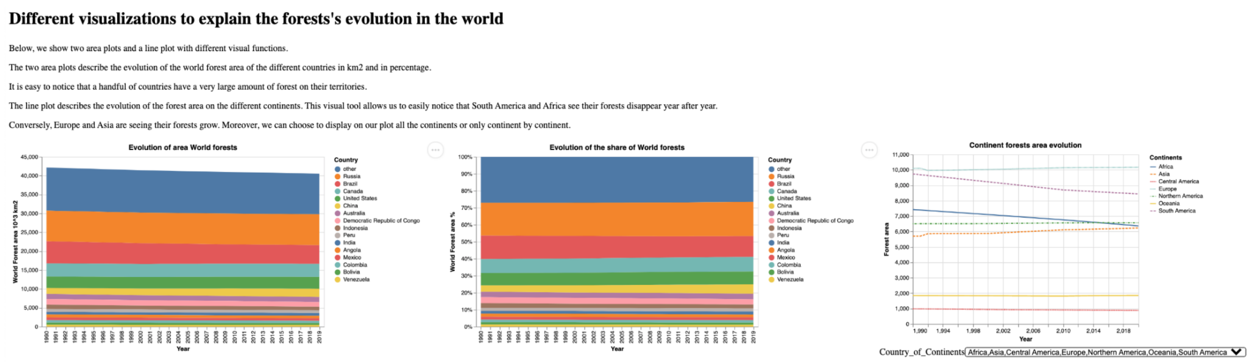


Figure 16: Dashboard showing different visualizations (area and line plots) to explain the evolution of forests in the world.

These simple graphs show us the evolution and distribution of the surface of forests in the world. We display the 15 countries with the most forest and a last variable containing the rest of the countries. These two area plots show us that over the last 30 years, Earth has lost approximately 2 million km2 of forest. The 3rd graph shows us the evolution of the surface of the forests continent by continent. It is easy to observe that Africa and South America are deforesting while Europe and Asia are planting trees massively.

We decided to make an html page because we think it is a good way to present our different visualization results to non-technical as well as technical people. Moreover, we think it is more professional than a notebook.

Conclusion

As mentioned earlier, the design chosen will complement the general culture of users who already have an appetite for environmental topics and the animal cause. Our visualizations will be useful for these people since they require some digging to extract information. What our visualizations do not do is convert people who are not convinced that environmental and animal issues are major problems. An awakening and an awareness would be necessary before these visualizations in order to maximize their impact for this part of the population. The story will succeed in attracting the interest of the public only if it is already a minimum sensitive to the environmental cause and the stakes that it represents.

We elaborate our designs on Altair which allowed us to deepen our knowledge of this tool. The implementation of a dashboard via a python server to launch our graphics and their interactions from a web interface via a browser was also a way to complete the project in a presentation process to a non-technical person.

The project also allowed us to realize that the Altair technology had some limitations. For example, when we have more than two graphics to manage, it becomes inefficient. If we had to do the project again, we would probably go for plotly or Tableau.