Deforestation and Forest Conversion

How do we treat our forests?

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Abstract

In this project we explore the trends of deforestation in the past 3 decades. We use visualisation techniques in order to find patterns behind deforestation and it's driving factors. Following this, we attempt to answer questions regarding conversion of forests to land for other purposes and questions regarding Brazil's excessive loss of forest cover. Then we aim to develop a dashboard to explore the above posed questions.

Keywords: Deforestation, `R`, `ggplot`, visualisation

Contents

1 Introduction

We have always been told that the earth's surface is $\frac{2}{3}$ water and $\frac{1}{3}$ land. A slightly lesser popular fact is that 10% of the world is covered by glaciers, and another 19% is barren land. We call the leftover "habitable land". Of this, a little more than $\frac{1}{3}$ is covered by forests today. This is a far cry from the past when global forest area used to be a majority of the total land area.

The reasons behind this are simple enough:

- Deforestation
- Conversion of forest land to lands for agriculture, pasture, logging
- Land degradation and wastage due to erosion, natural disasters and pollution

Tackling deforestation begins with understanding where and when are we losing forest and the driving factors behind it. This is what we aim to address in this project.

2 About the data

We will be using the following 3 datasets from this `repository`:

- `Net forest conversion by country` - how much net forest area of each country has been converted to land for other uses in the years 1990, 2000, 2010, 2015.
- `Forest area by country` - how much of the global forest area (in percentage) is present in each country in years from 1993 to 2020.
- `Factors behind loss of Brazil's forest cover by year` - how much forest land (in hectares) has been lost by Brazil in 2013 to various reasons.

The data is sourced from [1].

2.1 Variables of interest

1. In the dataset of net forest conversion by country we have the following variables:
   - `entity`, `code`, `year` - country/region name, country code (if applicable) and year of observation respectively
   - `net_forest_conversion` - net forest conversion area in a country/region in a specific year in hectares (which we convert later to km^2)

2. In the forest area by country dataset:
   - we have the `entity`, `code` and `year` variables as before
   - `forest_area` - percentage of the global forest area that is present in a country in a specific year

3. In the dataset exploring factors behind loss of Brazil's forests:
   - `entity`, `code`, `year` - same as above
   - `commercial_crops`, `flooding_due_to_dams`, `natural_disturbances`, `pasture`, `selective_logging`, `fire`, `mining`, `other_infrastructure`, `roads`, `tree_plantations_including_palm`, `small_scale_clearing` - how much forest was lost in Brazil due to these reasons (in hectares).

3 Graphical analysis

3.1 Forest conversion

When we are talking about deforestation, we need to investigate in which countries did we see the maximum change in forest area in every year. The `Net forest conversion by country` dataset provides the net forest conversion in km^2 per country in the years 1990, 2000, 2010, 2015.
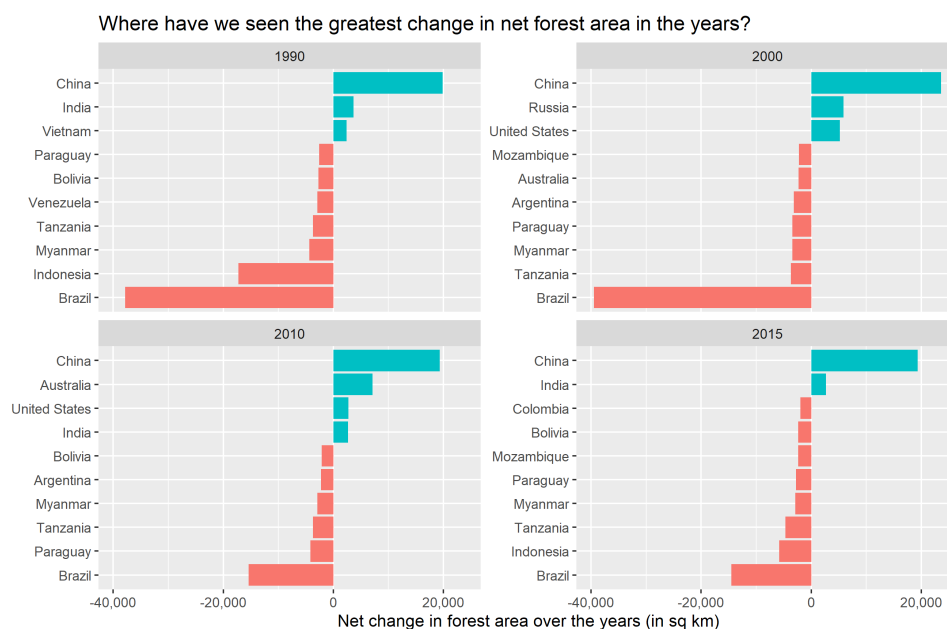

Figure 1: Top 10 countries with maximum net change in forest area in the 4 years

We also analyse which countries did we see the most deforestation in these years. From Figure 2 we can see that in terms of deforestation Brazil has been the worst hit among all countries in the world.
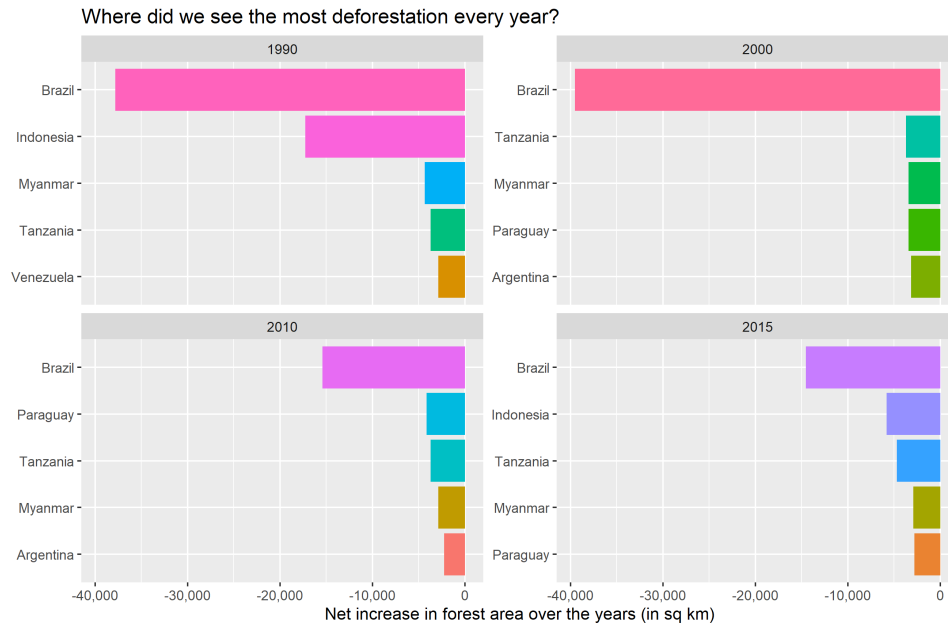
Figure 2: Top 5 countries with the most deforestation in the 4 years

A comprehensive visualisation to put into perspective the amount of change in forest land in the world is using a world map.
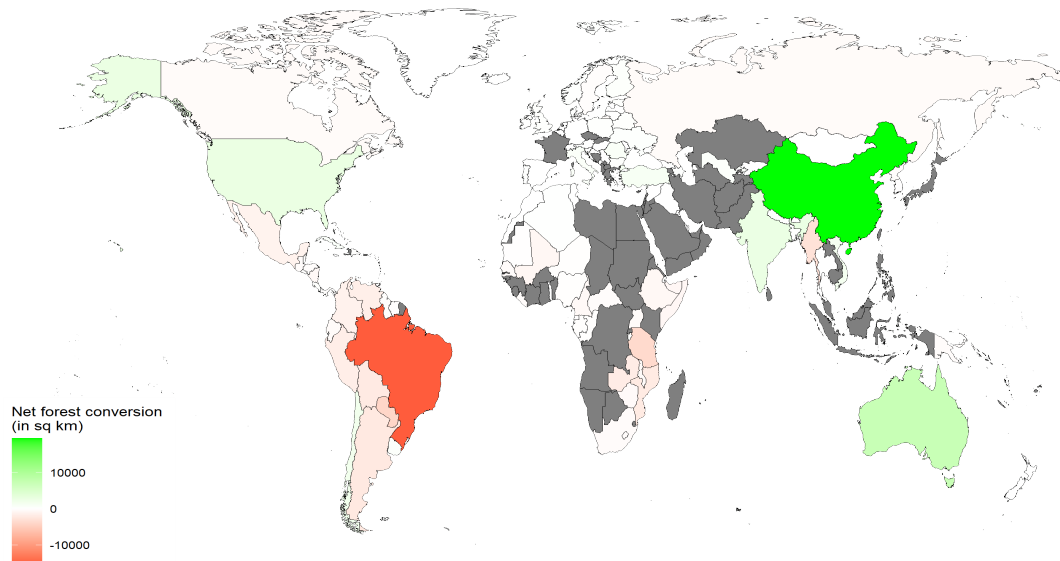

Figure 3: Net forest conversion area (in km^2) in the world (in 2010)

3.2 Country forest area as a percentage of global forest area

From `Forest area by country`, we find which countries have had the most change in forest area as percentage between 1993 and 2020.
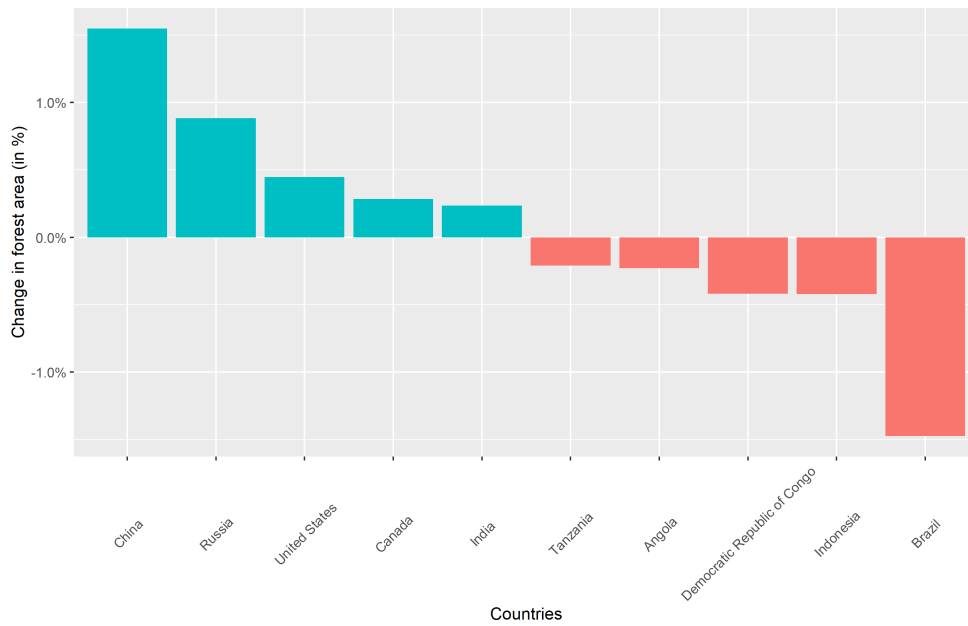
Figure 4: Top 10 countries with the maximum change in forest area between 1993 and 2020

We visualise the percentage of forest area in the countries having the 9 highest percentage of forest area using an area plot. From Figure 5 we can see that China, USA and Canada have actually reported an increase in forest area, while Brazil has lost forest area, confirming our past observations.
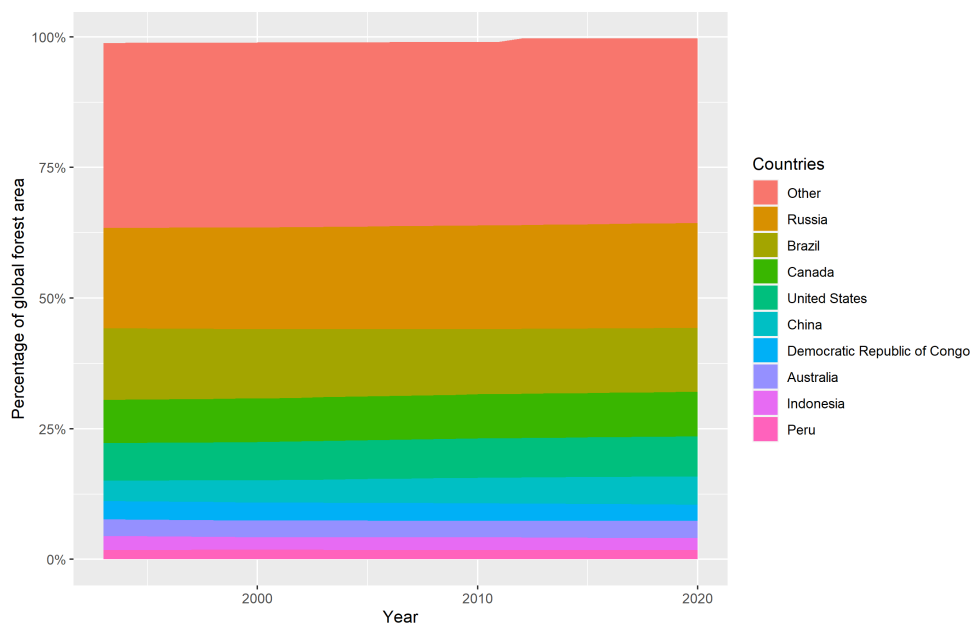

Figure 5: Top 9 countries with the highest percentage of global forest area from 1993 to 2020

3.3 Driving factors behind Brazil's loss of forest cover

While investigtaing the driving factor behind Brazil's loss of forest cover we find that the biggest offenders are pastures. Apart from pastures the oher driving factors are visualised below.
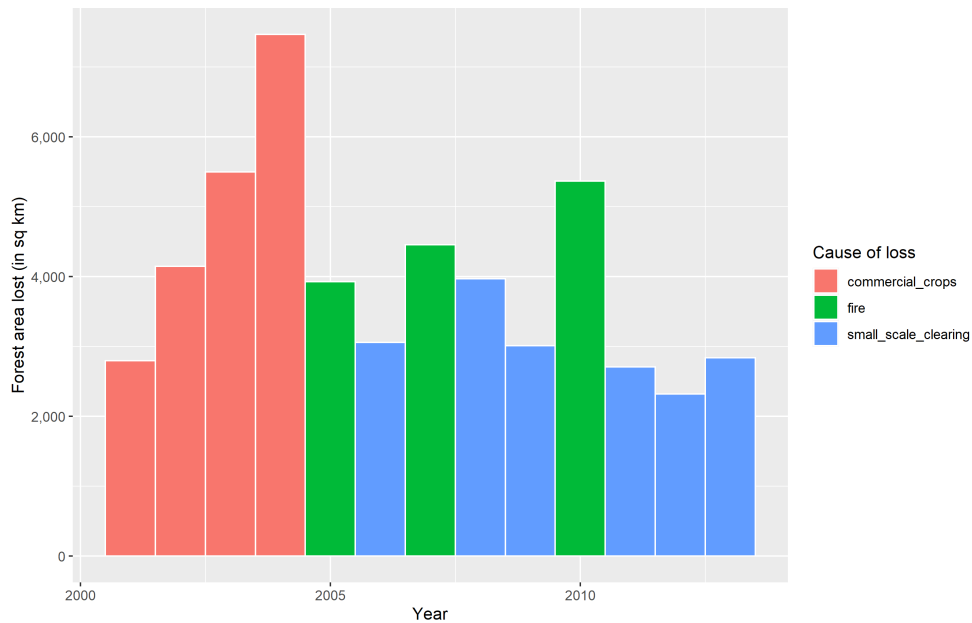
Figure 6: Leading causes of loss of Brazil's forest cover apart from pastures

4 Summary

We can see that while some countries have gained forests, most other countries have lost forests and among them, most notably Brazil. The leading natural causes of deforestation are forest fires, natural disasters and the leading man made causes of deforestation are pastures, logging, agriculture.

Acknowledgments

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Important Links

Project GitHub: link
R Shiny dashboard: link
YouTube video: link

References

[1] Hannah Ritchie and Max Roser. "Forests and Deforestation". In: *Our World in Data* (2021). URL: https://ourworldindata.org/forests-and-deforestation.