

Indigenous populations and Amazon forest reduction between 2000 and 2020

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Monitoring ecosystem changes and functioning
Spatial ecology in R exam
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This project aims to delve into the causes behind the significant reduction experienced by the Amazon forest over the last two decades and shed light on the critical role of indigenous populations in protecting this vital ecosystem.

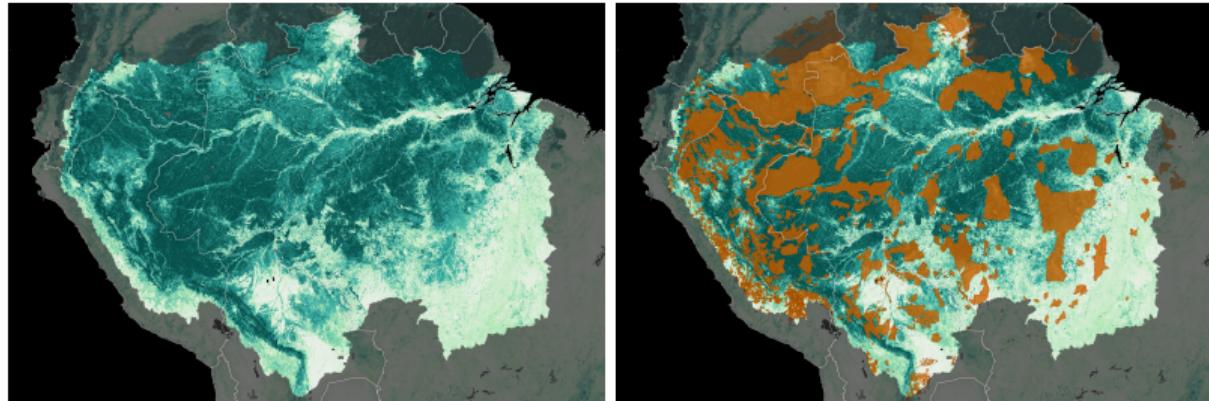


Figure: Aboveground Biomass Density (Mg/ha); Indigenous territories.

Source: Indigenous Communities Protect the Amazon (NASA Earth Observatory).

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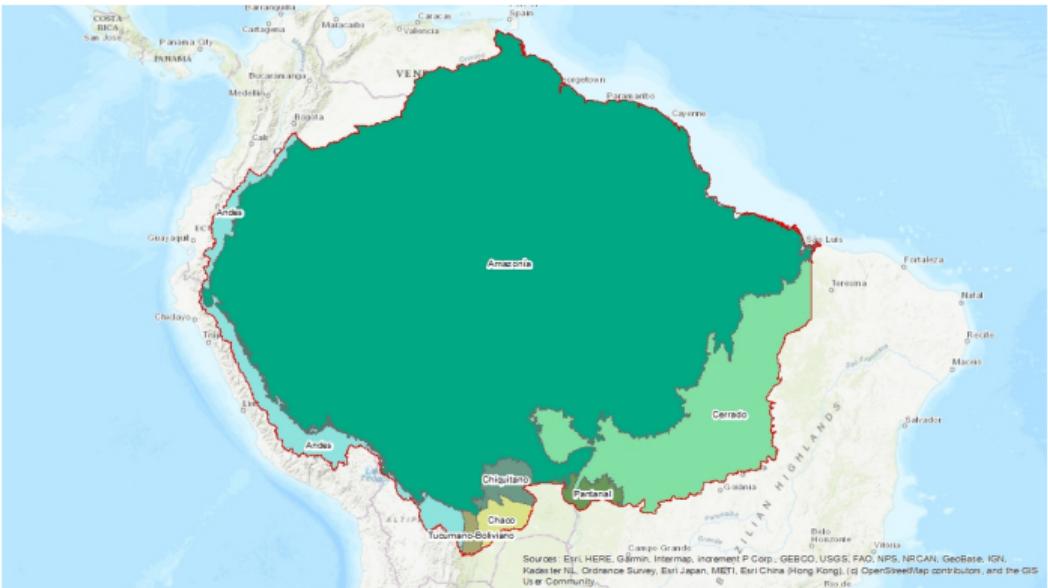


Figure: Different biomes present in the considered Amazon domain. Source: RAISG - Biomes.

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1. Therefore, some spatial and statistical analysis were carried out:

- ▶ Analyses of the distribution of indigenous territories,
- ▶ As well as of the protected natural areas of the Amazon,
- ▶ In parallel with the deforestation map relative to the period 2000-2020.

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Case study

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2. Subsequently, based on the temporal frequency distribution of deforestation events, the analysis focused on one of the most deforested parts of the Amazon: the state of **Rondônia in western Brazil**, paying attention to **Vegetation Cover indices** (2001 - 2012).



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The main tools used for this project were:

- ▶ R Studio
- ▶ GitHub
- ▶ RAISG data. The **Amazon Network of Georeferenced Socio-Environmental Information** is a consortium of civil society organizations from the Amazon countries, supported by international partners, concerned with the socio-environmental sustainability of Amazonia.
- ▶ NASA Earth Observatory
- ▶ LaTeX Software

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The functions used within this project were based on **R packages** such as:

- ▶ raster
- ▶ terra
- ▶ maps
- ▶ sf
- ▶ dplyr
- ▶ devtools
- ▶ imageRy

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1. Spatial and statistical analysis.

- ▶ Selection and download data of limits of the **domain, indigenous territories, Natural Protected Areas** (`st_read("- .shp")`), other than **deforestation** map data from RAISG database.

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- ▶ Setting of the working directory in R with the `setwd()` function.

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- ▶ Setting of the working directory in R with the `setwd()` function.
- ▶ Upload on R the data (`st_read("-.shp")` function for biome limits, indigenous territories and NPAs; and `rast("-.tif")` function for deforestation).

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- ▶ Plot maps superposing each layer.

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- ▶ Plot maps superposing each layer.
- ▶ Construction of a frequency table for the statistical analysis about indigenous territories and natural protected areas **frequency distribution**

Approaches used

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- ▶ Plot maps superposing each layer.
- ▶ Construction of a frequency table for the statistical analysis about indigenous territories and natural protected areas **frequency distribution**
- ▶ Analysis of the **temporal frequency distribution** of deforestation events over the whole domain (`hist(def_no_na)`).

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2. Spectral indices analysis.

- ▶ Download satellite images from the NASA Earth Observatory, about deforestation in Rondônia (2001-2012).

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- ▶ Download satellite images from the NASA Earth Observatory, about deforestation in Rondônia (2001-2012).
- ▶ Upload the images on R, through the function `rast(image.png)`, from the `raster` package.

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- ▶ Download satellite images from the NASA Earth Observatory, about deforestation in Rondônia (2001-2012).
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- ▶ Plot their three bands correspondent to the components RGB (`plotRGB()`), and change its components.

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- ▶ Plot their three bands correspondent to the components RGB (`plotRGB()`), and change its components.
- ▶ Search a multitemporal change detection, by making the difference between the `rond2001[[1]] - rond2012[[1]]` .

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- ▶ Plot their three bands correspondent to the components RGB (`plotRGB()`), and change its components.
- ▶ Search a multitemporal change detection, by making the difference between the `rond2001[[1]] - rond2012[[1]]`.
- ▶ Classification of vegetation cover change through the function `im.classify()`.

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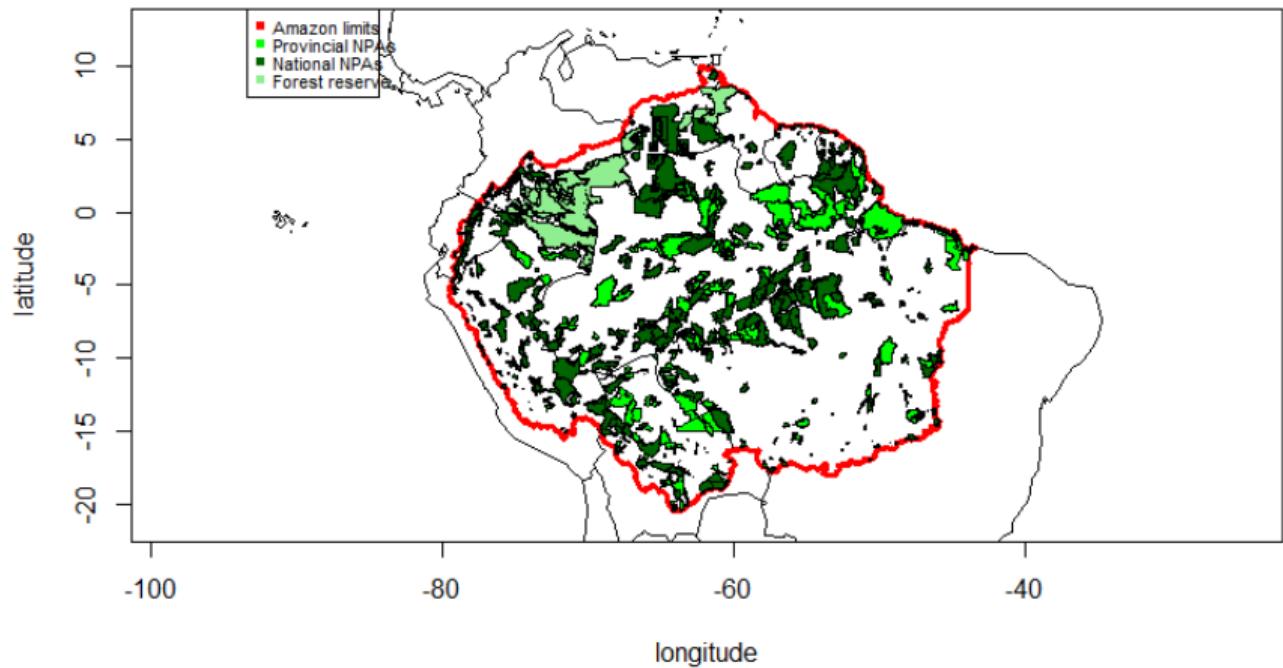
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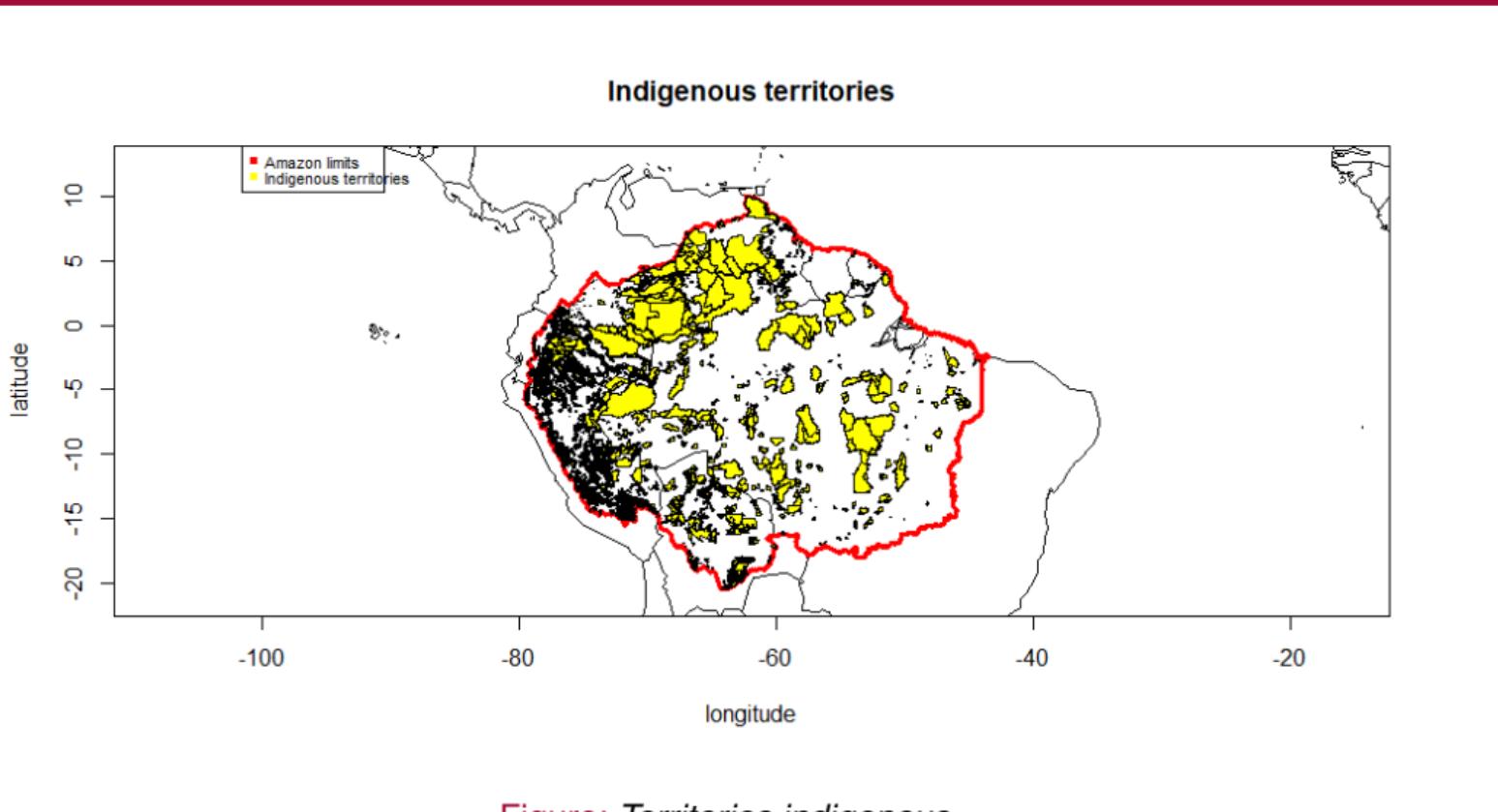


Figure: Territories indigenous

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Indigenous population territories and NPAs frequency distribution

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	country	NPAs	rel_NPAs	area_NPAs	rel_areaNPA	ind_territories	rel_ind	area_ind	rel_areaind
1	Bolivia	843	0.61667886	26575547	0.097755302	154	0.02190923	19634142.1	0.080320526
2	Brasil	364	0.26627652	133398744	0.490692992	391	0.05562669	116122361.3	0.475040318
3	Colombia	87	0.06364301	46166127	0.169817153	242	0.03442879	27828565.0	0.113842762
4	Ecuador	44	0.03218727	4484226	0.016494745	640	0.09105136	7488978.0	0.030636360
5	Guyana	0	0.00000000	1040147	0.003826068	112	0.01593399	3178434.1	0.013002529
6	Guyane Française	0	0.00000000	5169946	0.019017092	22	0.00312989	715428.4	0.002926717
7	Perú	29	0.02121434	21080154	0.077541089	5395	0.76753450	36201178.4	0.148093951
8	Venezuela	0	0.00000000	31337995	0.115273457	73	0.01038555	33278293.0	0.136136837
9	Suriname	0	0.00000000	2604970	0.009582102	0	0.00000000	0.0	0.000000000
10	Total	1367	1.00000000	271857855	1.000000000	7029	1.00000000	244447380.3	1.000000000

Figure: Frequency distribution

The Natural Protected Areas constitute together the 32.1% of the Amazon biome. On the other hand, Indigenous populations occupy 28.9% of total area.

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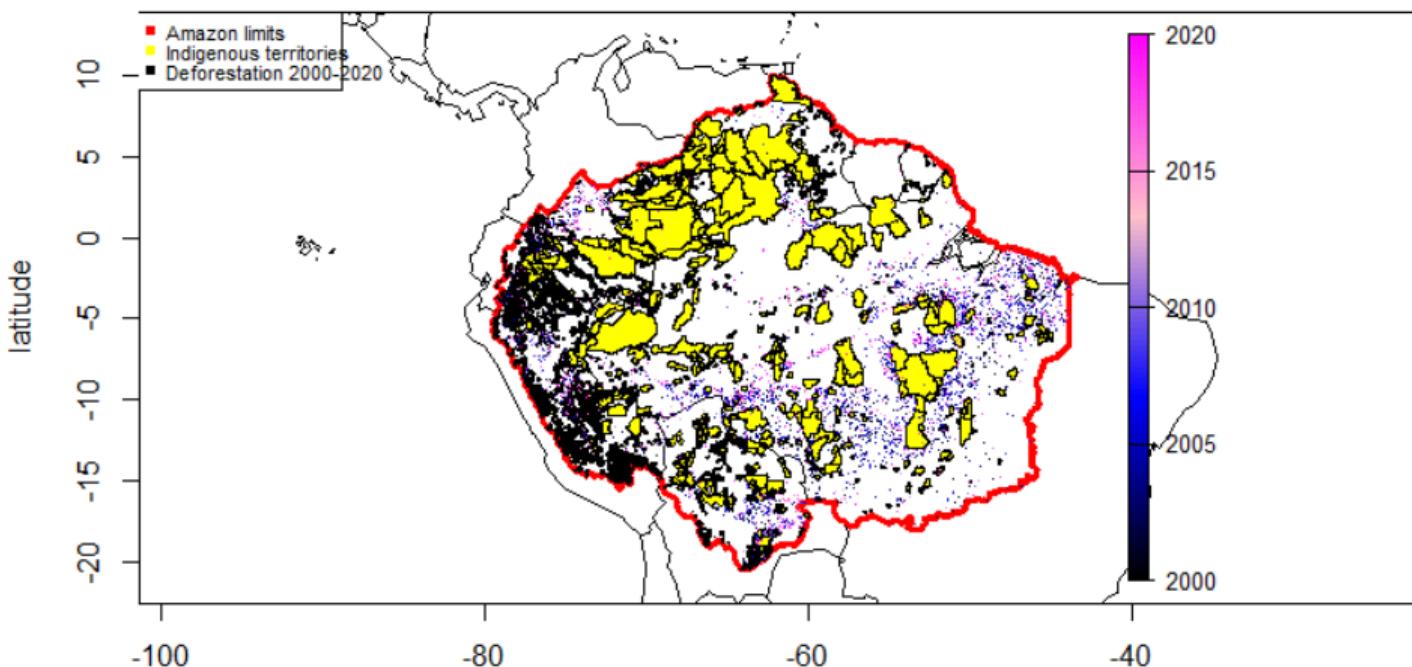
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Deforestation, NPAs and Indigenous population distribution

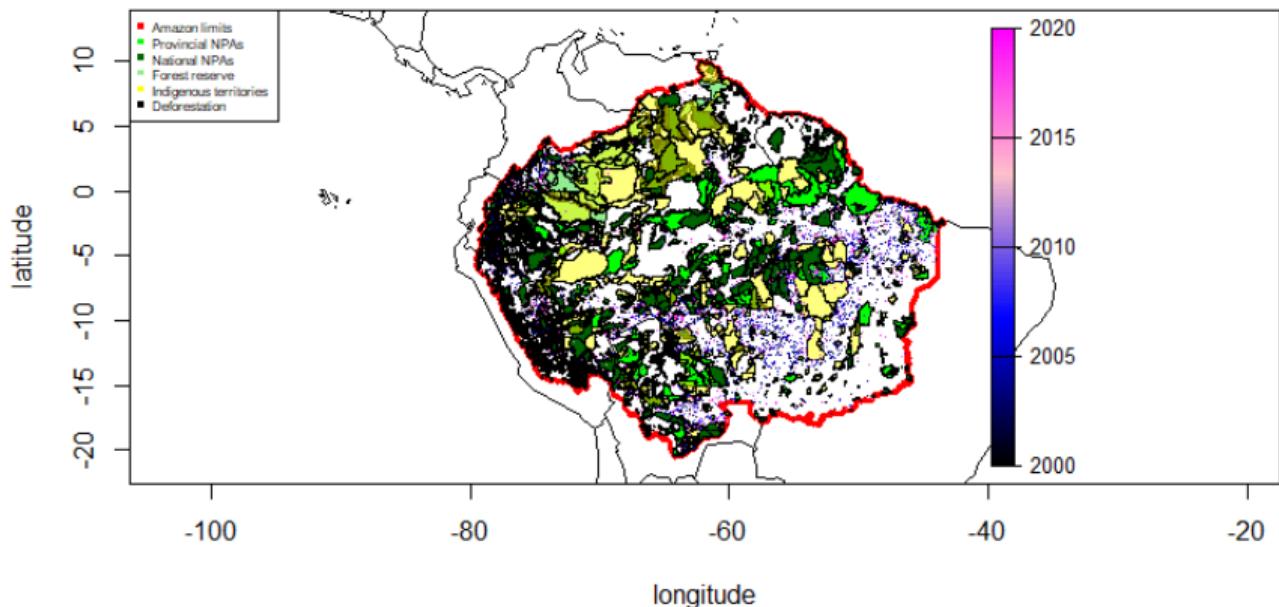


Figure: Deforestation, NPAs, and indigenous territories

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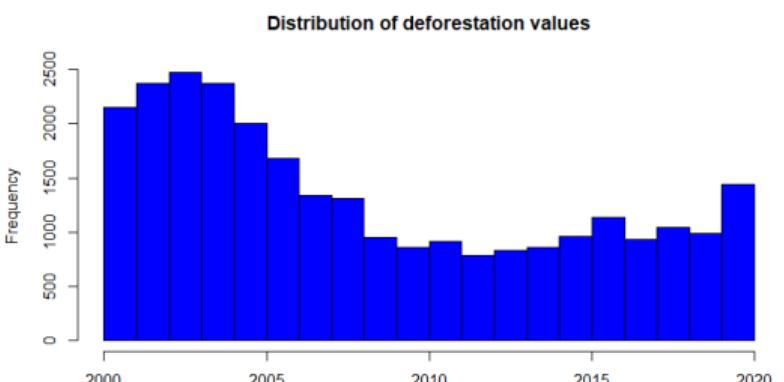
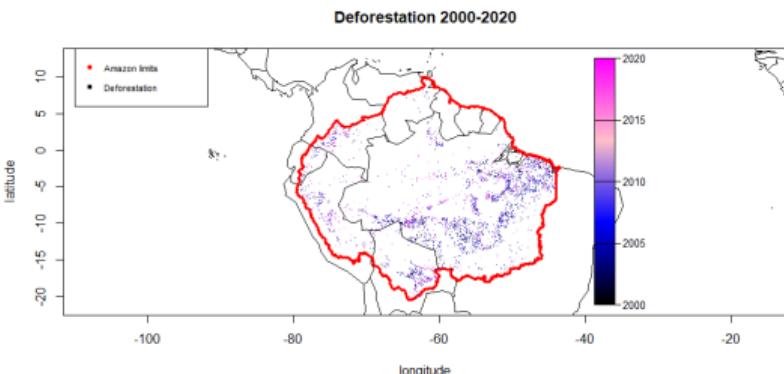
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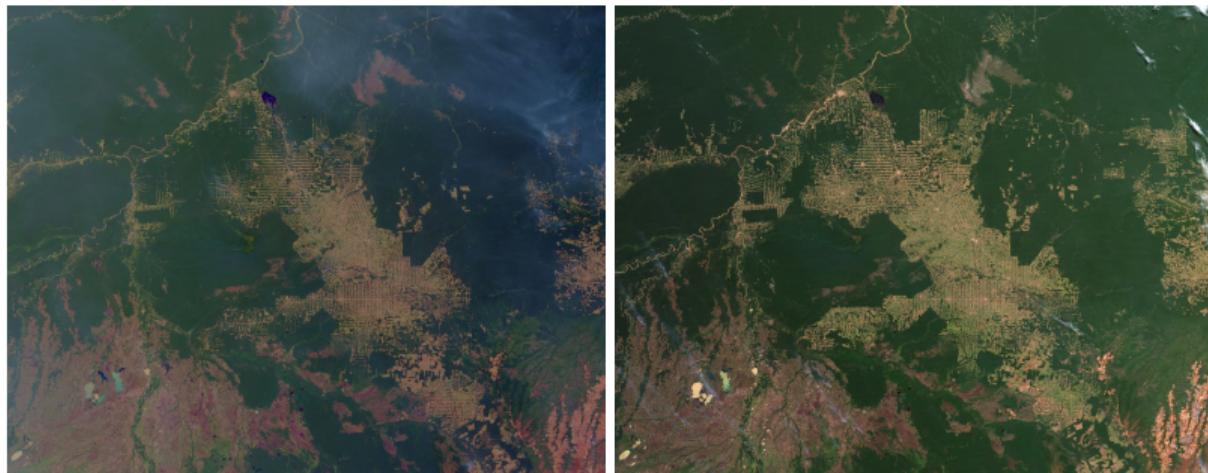
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Rondonia deforestation 2000-2012

This is a comparison between satellite images of the same site in Rondonia in 2000 and 2012, coming from NASA Earth Observatory. It is one of the most deforested area of the entire Amazonia.



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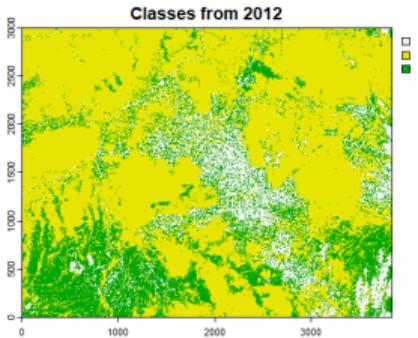
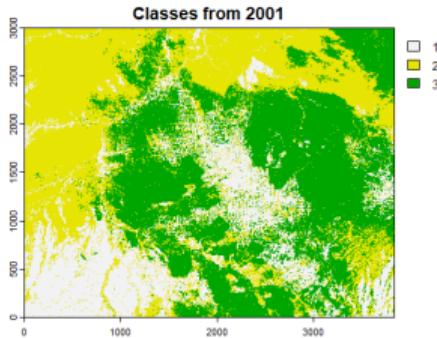
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Classification of vegetation

The classification in clusters allow to define three classes of vegetation cover for the Amazon forest, such as:

1. **absent** forest
2. forest **threatened** by human activities
3. the forest is **present**



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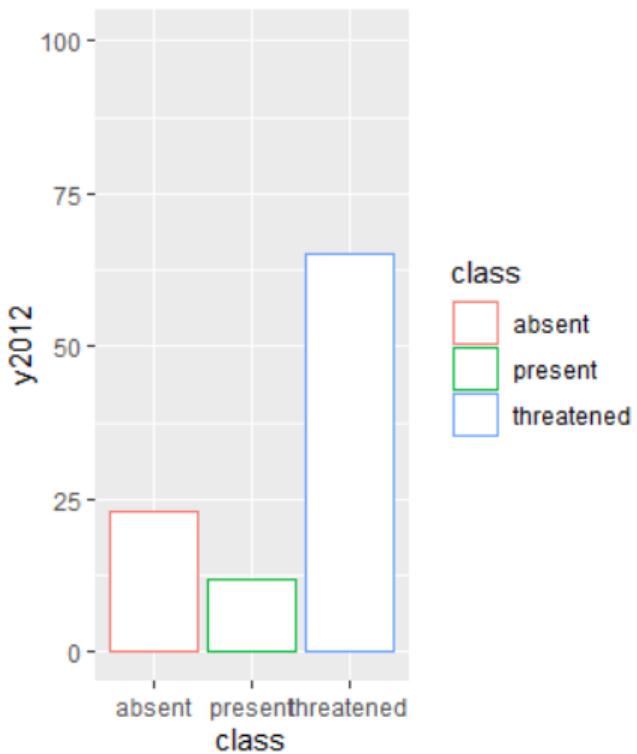
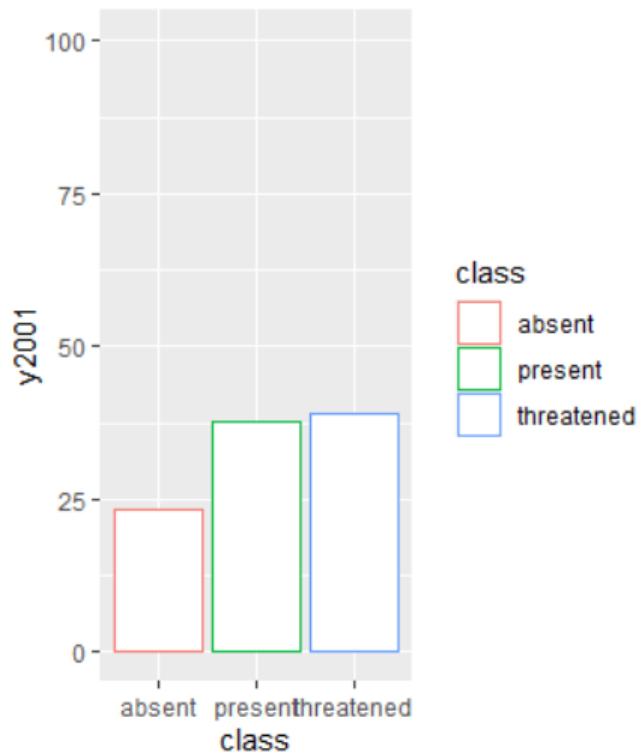
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My GitHub account:
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