Global impacts of deforestation and restoration in the Cerrado and Brazilian Amazon on plant diversity

Level: MSc
Start: Anytime
Project form: literature study and data analysis
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Background

Increased rates of deforestation have been measured in the Brazilian Amazon in the last decade (Silva, Almeida, and Carvalho 2023). The increase in severe droughts and floods events suggest that the Amazon is reaching a tipping point where the biome could switch from forest to savannah vegetation (Lovejoy and Nobre 2018). In this context, two actions are urgent: to stop the deforestation in the Amazon and to restore deforested areas.

These actions have been set as targets in the 2015 Paris Conference of the Parties and at COP 27, when Brazil committed to restore 12 million ha of land and to stop illegal deforestation until 2030. Illegal deforestation is characterized as forest removal in Units of Conservation, in public land without destination, in Areas of Permanent Protection (APPs), such as riparian vegetation and hilltops, and in Legal Reserves (LRs). The Brazilian Native Vegetation Protection Law (NVPL) stablishes Legal Reserves as portions of Amazon and Cerrado biome that need to be protected in private land. In the Brazilian Amazon, 80% of the area of a private land is Legal Reserve, whereas in areas of transition between Amazon and Cerrado 35% are LR, decreasing to only 20% of LR in areas of Cerrado biome (NVPL 2012). Legal deforestation is the forest removal in private land, outside the LR and APPs, that has been licensed by the local environmental agency.

Unfortunately, due to the weak enforcement of the law, illegal deforestation still occurs in these legally protected portions of private and public land (Rajão et al. 2020). The Brazilian Native Vegetation Protection Law stablishes that Legal Reserves that have been illegally deforested should be either active/ passive restored, or be compensated with the protection of a similar area (NVPL 2012). Restoring legally protected areas and stopping the illegal deforestation of native vegetation could have regional and global impacts on climate and water availability (Arantes, Ferreira, and Coe 2016; Rodrigues et al. 2022). However, the impacts that such measures may have on the regional and global diversity of plants is still unknown.

Aim

The aim of this study is to quantify the regional and global impacts of deforestation and restoration targets in the Cerrado and Brazilian Amazon on plant diversity. We aim to answer the following research questions: 1) What is the global extinction threat of vascular plants due to the current land use in the Amazon and Cerrado biomes? 2) What is the global extinction threat of vascular plants due to land use if the Brazilian environmental policies were effectively implemented?

Approach and outcome

You will overlay the map of private properties with potentially deforested area (Fig 1.) with the map of terrestrial ecoregions in order to calculate the potentially deforested area per ecoregion in the Amazon and Cerrado biome. Another option is to overlay the map of rural property boundaries (Cadastro Ambiental Rural – CAR), with the yearly area of deforestation mapped by the project Forest Monitoring of the Brazilian Amazon by Satellite (PRODES).

You will use the list of vascular plants per ecoregion (Moreira et al. 2023) and the list of endemic plants of Brazil (Flora do Brasil 2020) to calculate the relative endemism richness of the ecoregions in the Cerrado and Amazon biome. Next, using the potentially deforested area per ecoregion, you will calculate the regional and global extinction threat of vascular plants due to the current land use in the Cerrado and Amazon biomes. Finally, you will calculate the regional and global extinction threats of vascular plants in the scenario where the deforested areas are restored and the deforestation is set to zero, and in the scenario where deforestation continues until 2030. In order to predict the areas of future deforestation you will use the short-term deforestation prediction model of Sales et al. (2017) to predict the areas of deforestation for the coming years.

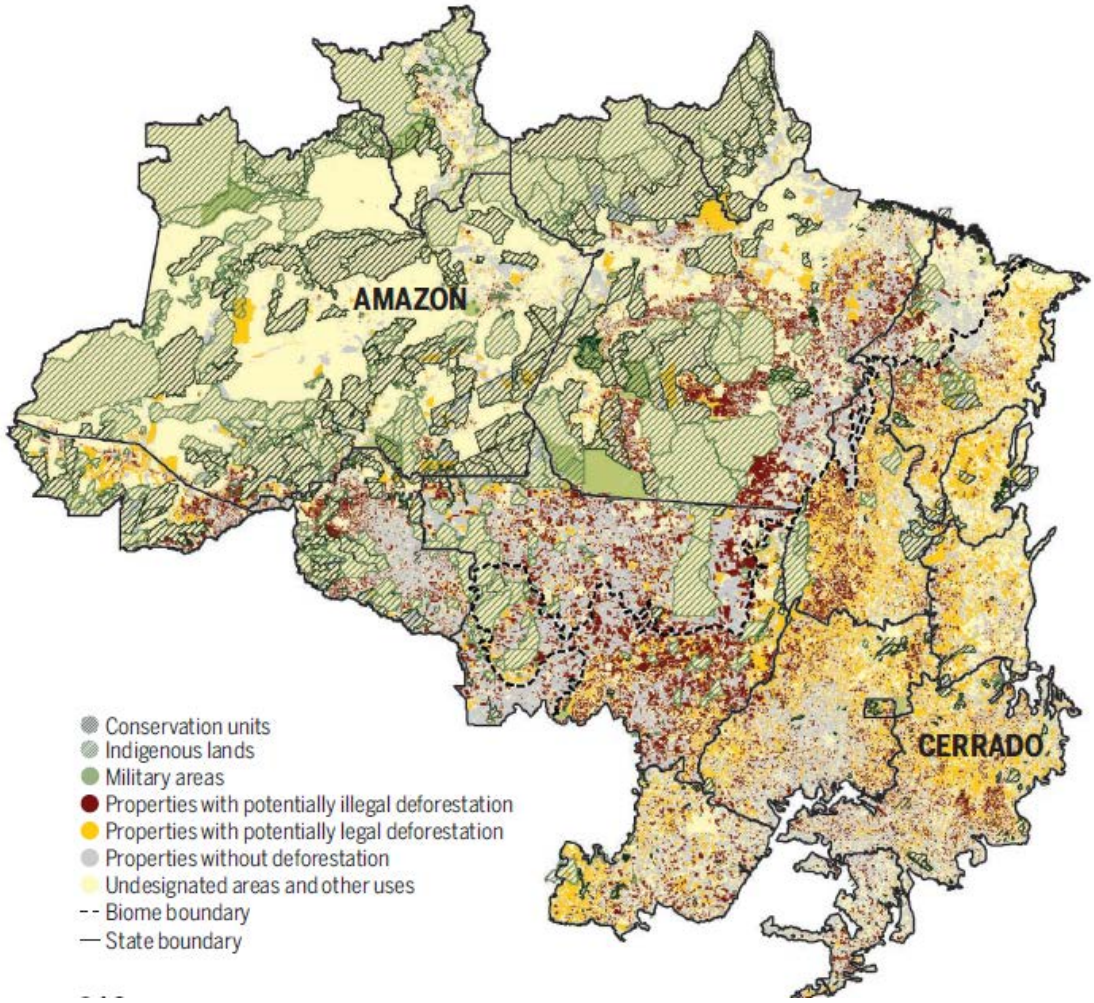

Figure 1. Example of possible outcome from the analysis showing the areas with potentially illegal deforestation that could be restored. Source: Rajão et al. (2022).

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