

AXE: PUBLIC POLICIES AND THEIR IMPACTS ON FOREST PROTECTION

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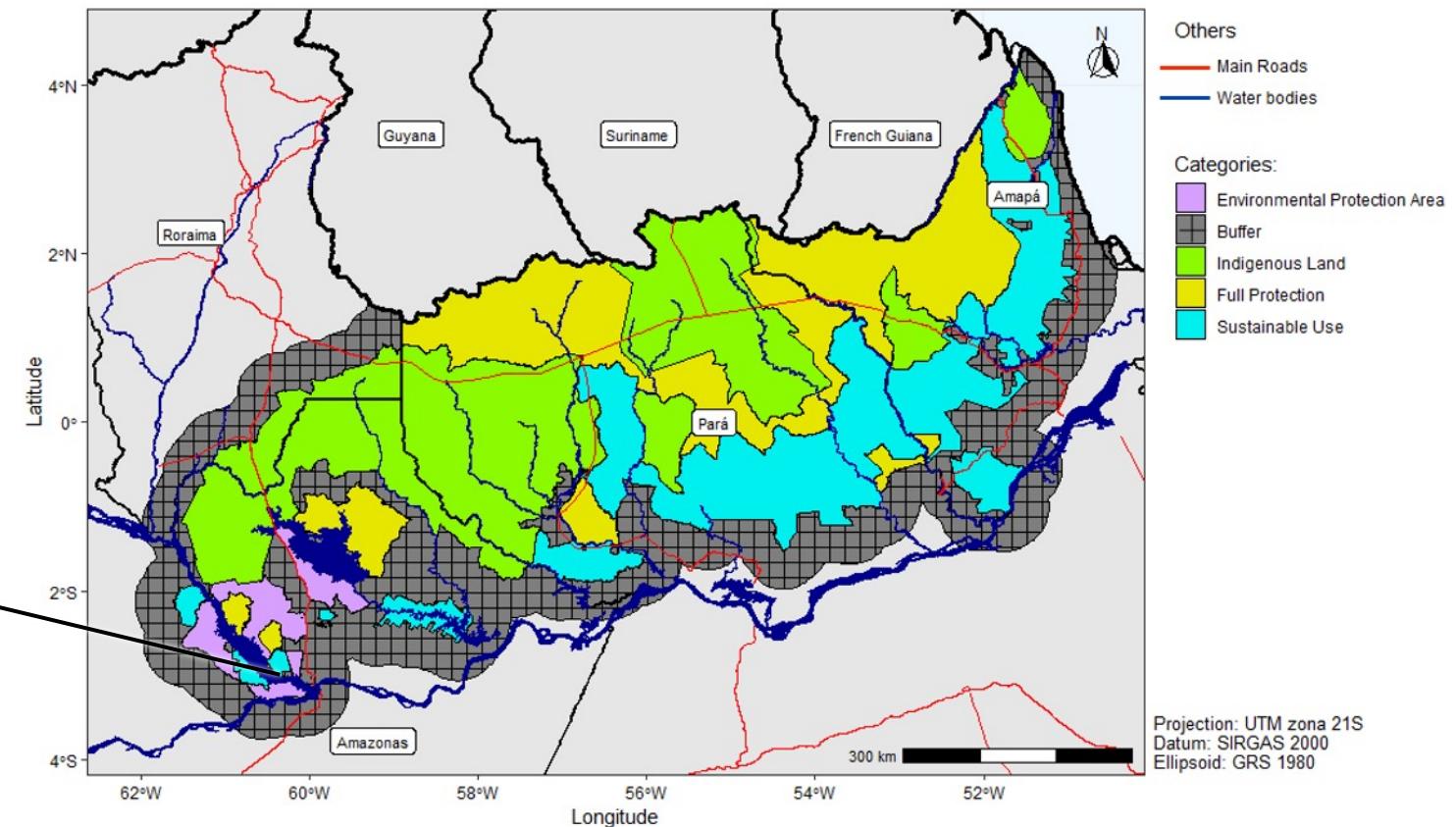
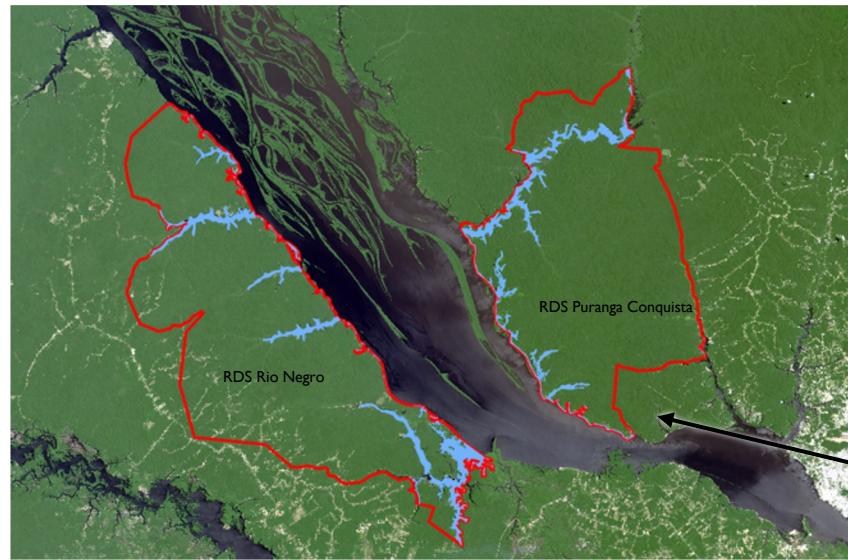
OBJECTIVES

- **GENERAL:**
 - Quantify and qualify the impact of human action on the Amazon forest mass
 - (and make it applicable, as well as accessible, on a geospace platform)
- **SPECIFICS:**
 - Analyze the effects of public policies on forest protection
 - Define indicators that estimate the impact of public policies on forest protection



PROPOSED ANALYSIS - LOCAL AND REGIONAL SCALE

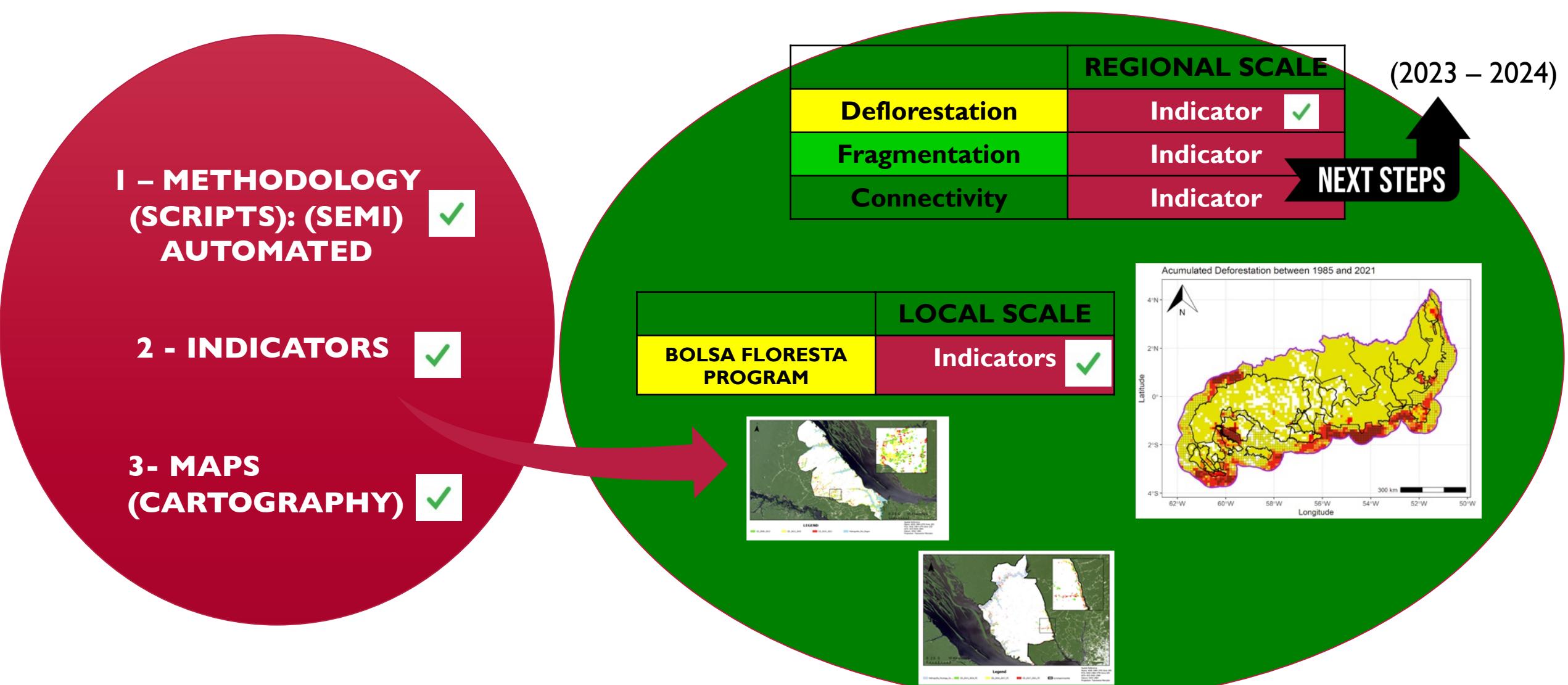
- REGIONAL: 39 Protected Areas located in the northern part of the Amazon River basin.
 - Area: 393,332 km² (+ 50 km of Influence zone, with area: 184,501 km²)



- LOCAL: Protected Areas where the Public Policy called “Bolsa Floresta Program” was implemented



PRODUCTS

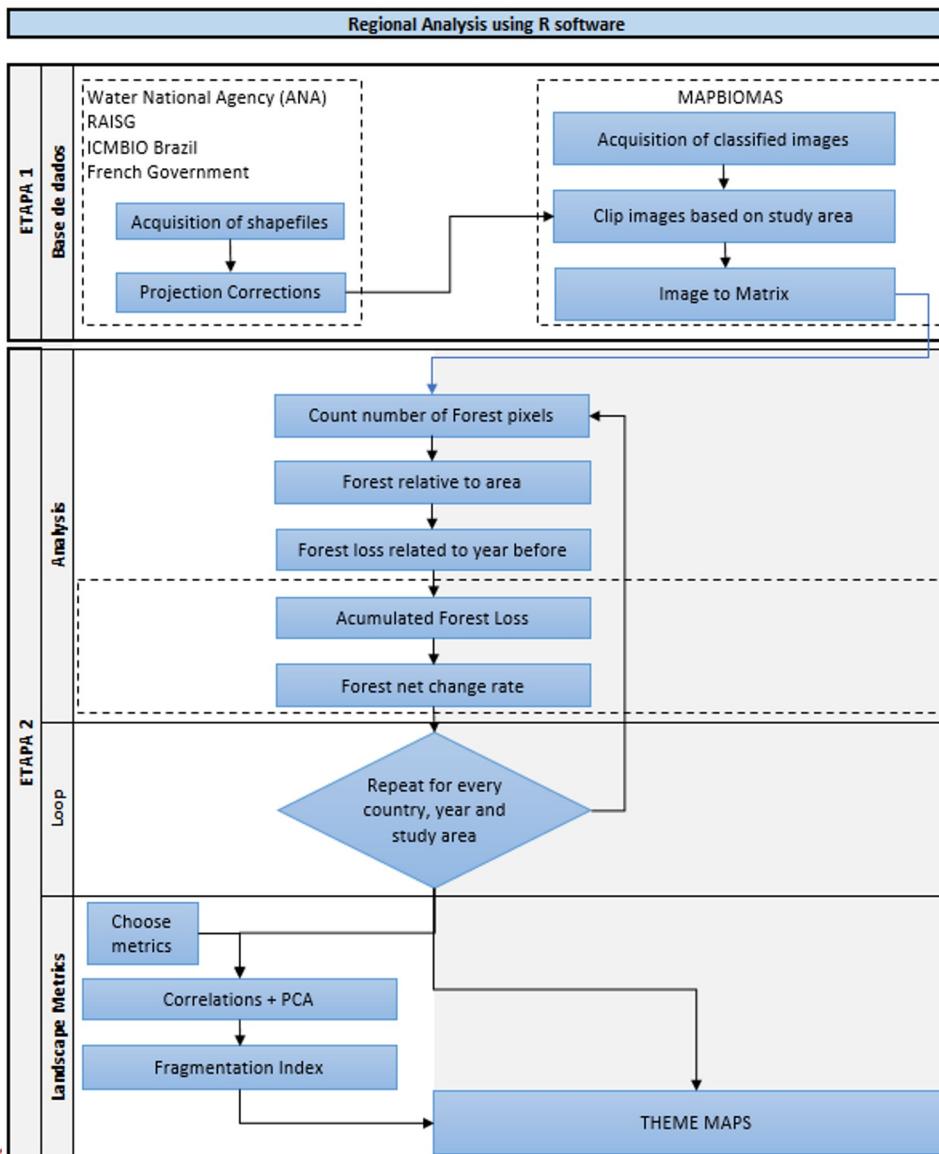


RESULTS

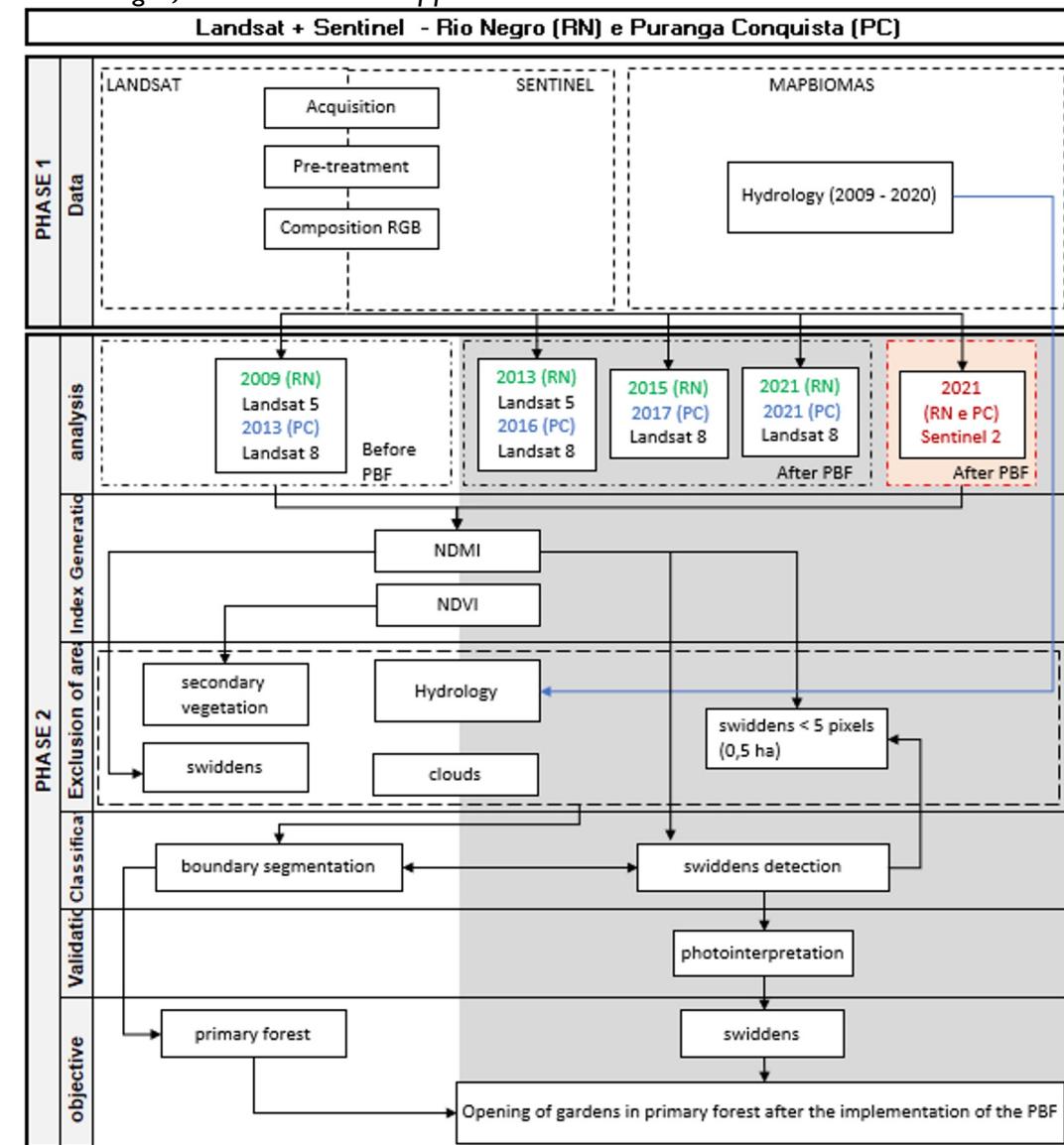
- ✓ Regional Scale: *Forest loss at the regional scale (R software). Database: Mapbioma (script)*
- ✓ Graphs and Maps in the historical series from 1985 → 2021 (year-by-year or accumulated) can be segregated by:
 - ✓ Countries (inserted in the Amazon Biome);
 - ✓ Federation units (Brazilian states);
 - ✓ Typologies of protected areas: Category (Ia, Ib; II; III, IV, V and VI: IUCN / and their buffer areas);
- ✓ Local Scale: *Forest loss at the local scale (GEE software). Database: LandSat and Sentinel -2 images, NDWI and NDVI application.*
- ✓ The analyses at the local scale are focused on the analysis of the Policy: **Bolsa Floresta**, so the objective of the analysis is exclusively the protected areas of the state of Amazonas (Brazil).
- ✓ Graphs and Maps in the historical series that have Landsat and Sentinel images, with a timeframe in 2013, (year of implementation of the Bolsa Floresta Program).

SCRIPTS (REGIONAL E LOCAL SCALES)

✓ Forest loss at the regional scale (R software). Database: Mappbioma

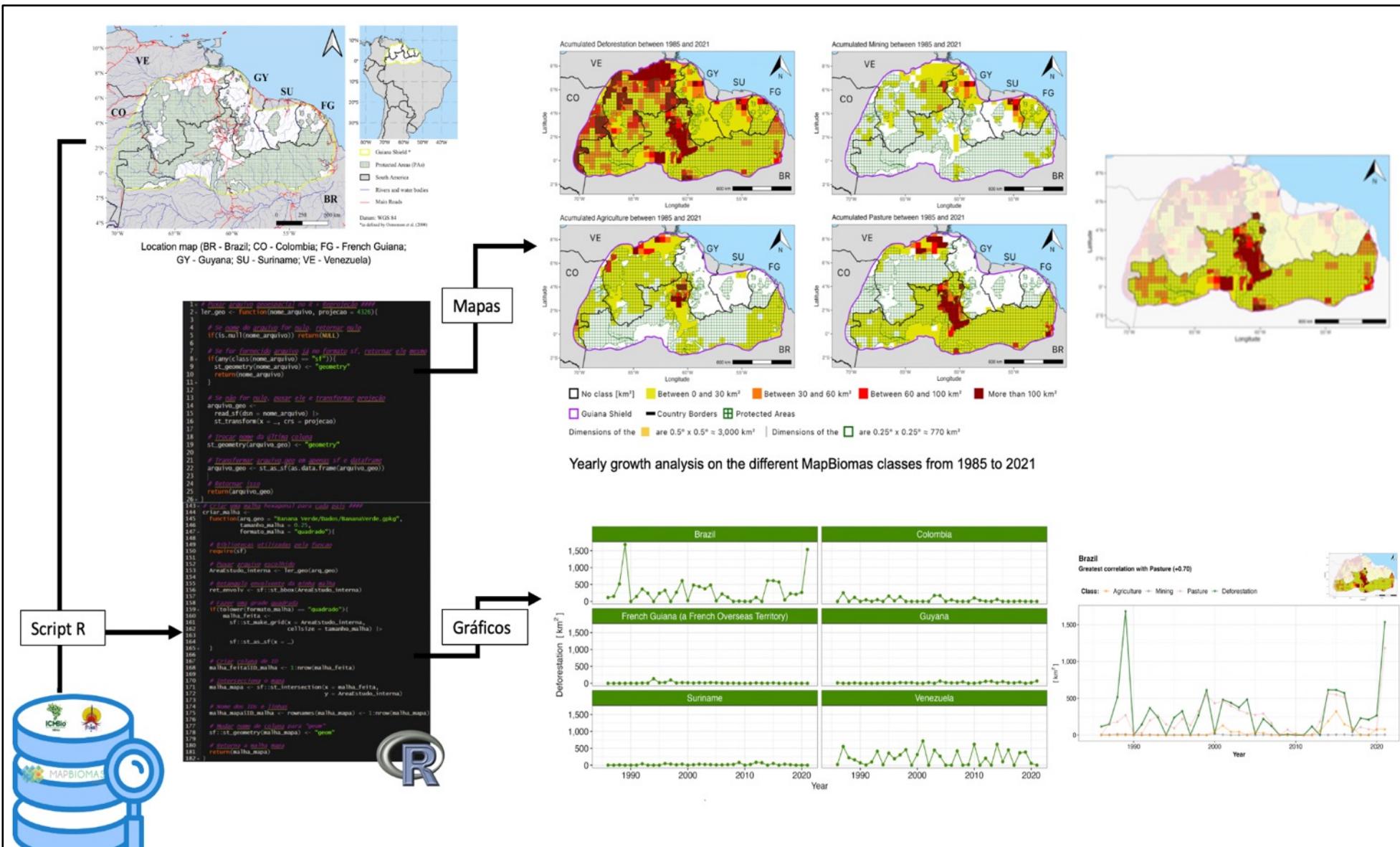


✓ Forest loss at the local scale (GEE software). Database: LandSat and Sentinel -2 images, NDWI and NDVI application.



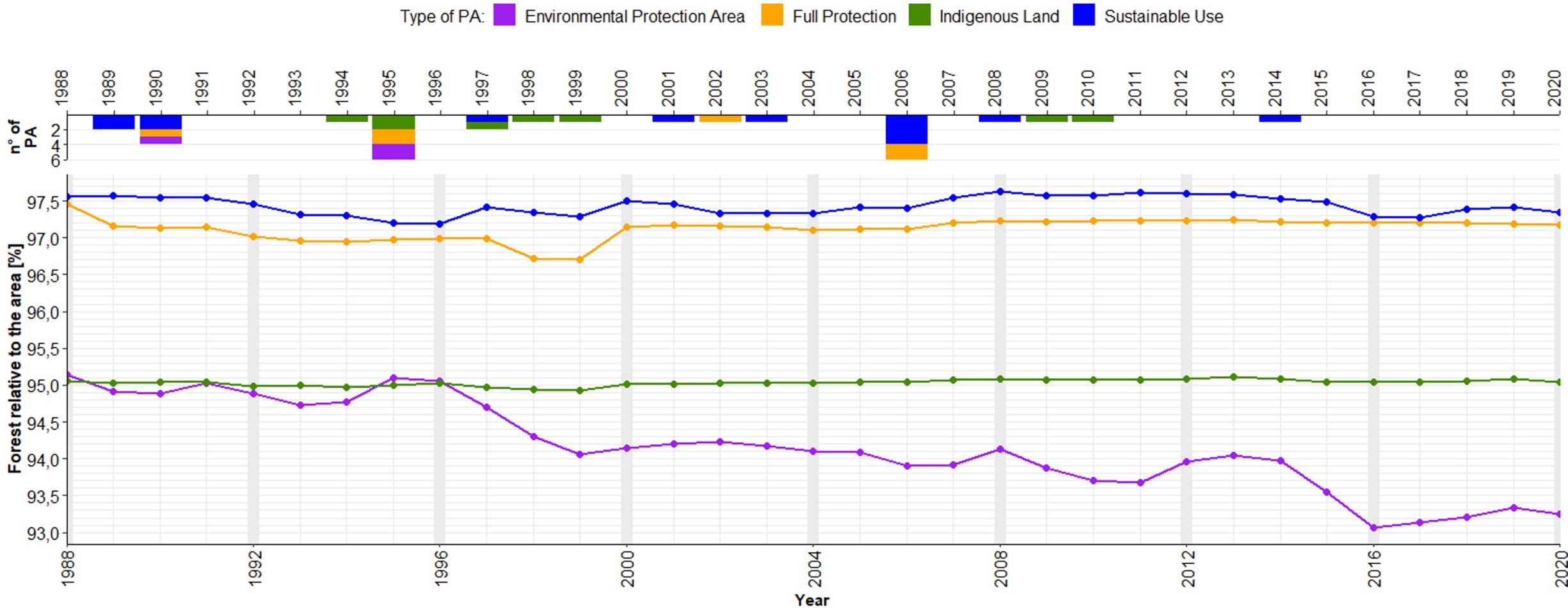
REGIONAL SCALE: RESULTS FROM SOFTWARE R

✓ <https://github.com/Lappicy/DeforestMapBiomas>



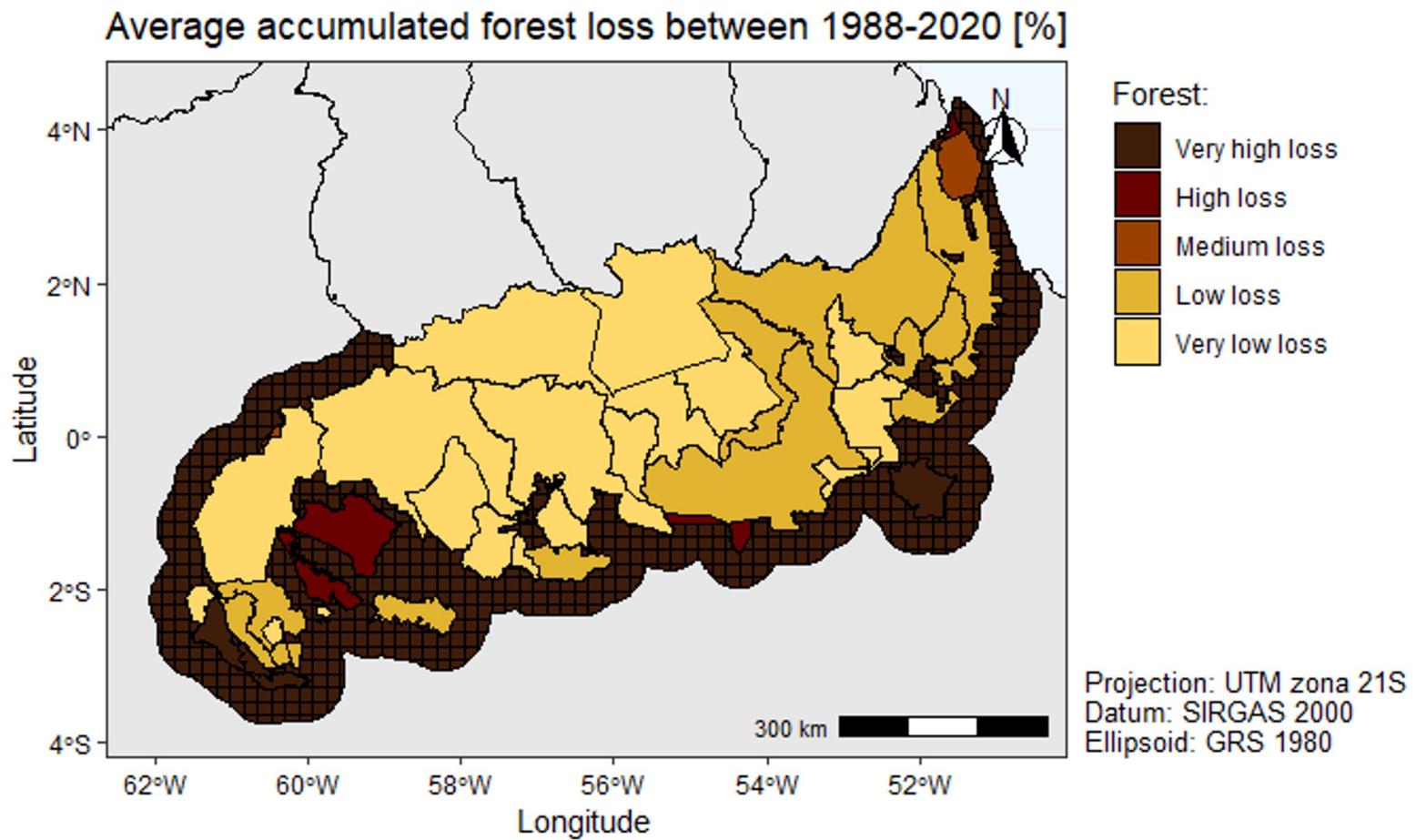
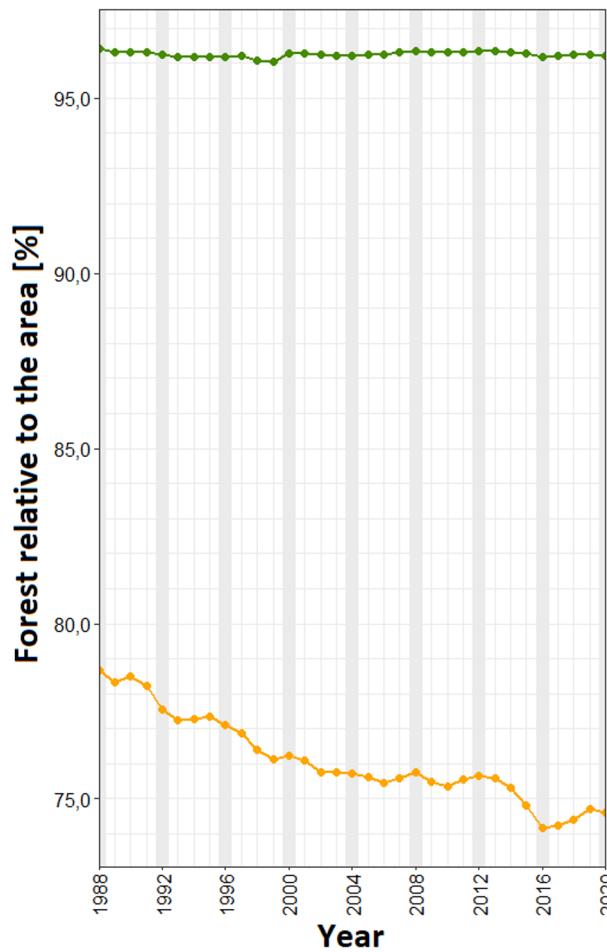
REGIONAL SCALE: DIAGNOSIS IN BRAZIL

- Protected areas (PA) are one of the most effective public conservation policies in the Brazilian Amazon.



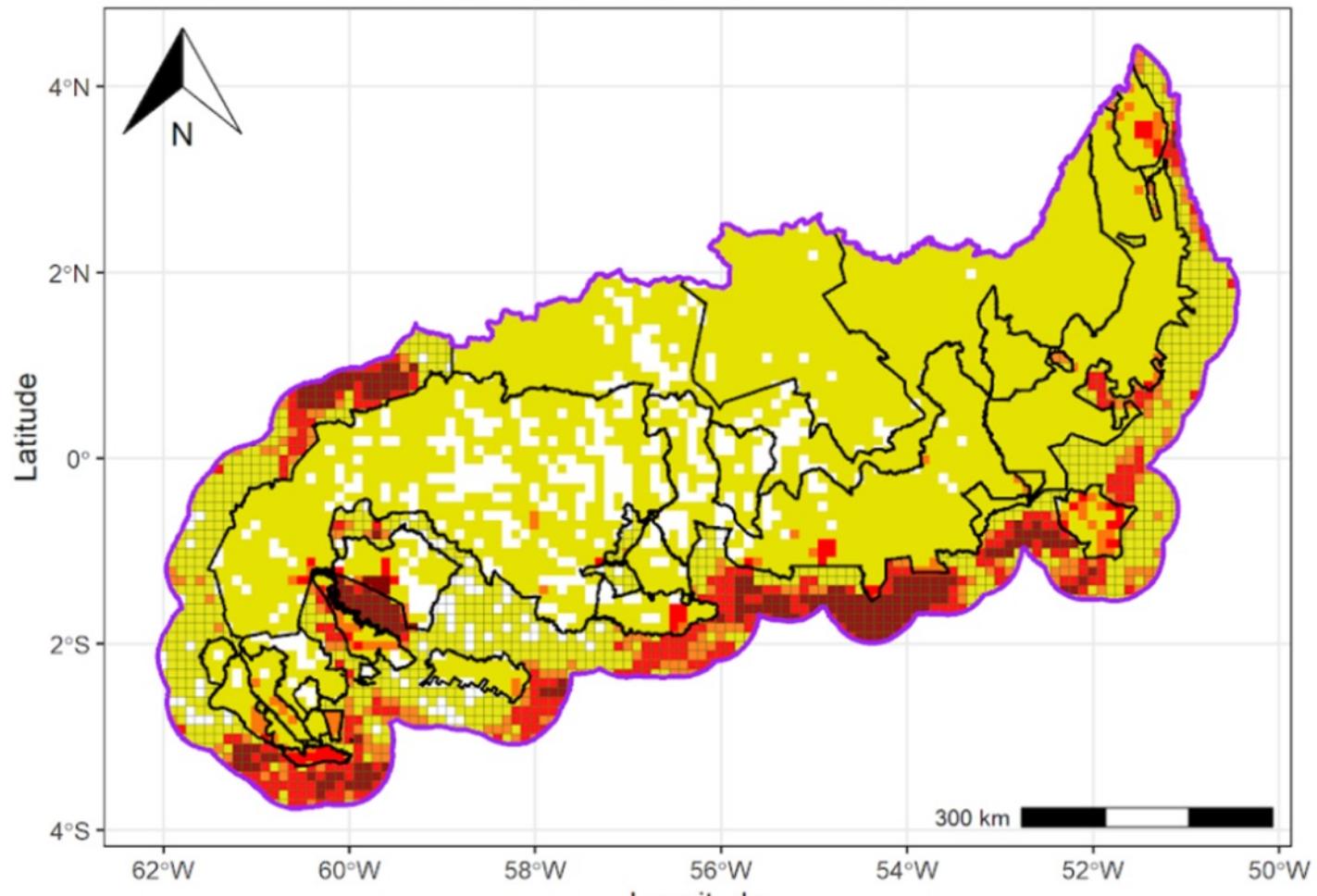
REGIONAL SCALE: DIAGNOSIS IN BRAZIL

- Protected areas are one of the most effective public conservation policies in the Brazilian Amazon.



REGIONAL SCALE: DIAGNOSIS IN BRAZIL

Acumulated Deforestation between 1985 and 2021



Dimensions of the are $0.1^\circ \times 0.1^\circ \approx 123 \text{ km}^2$

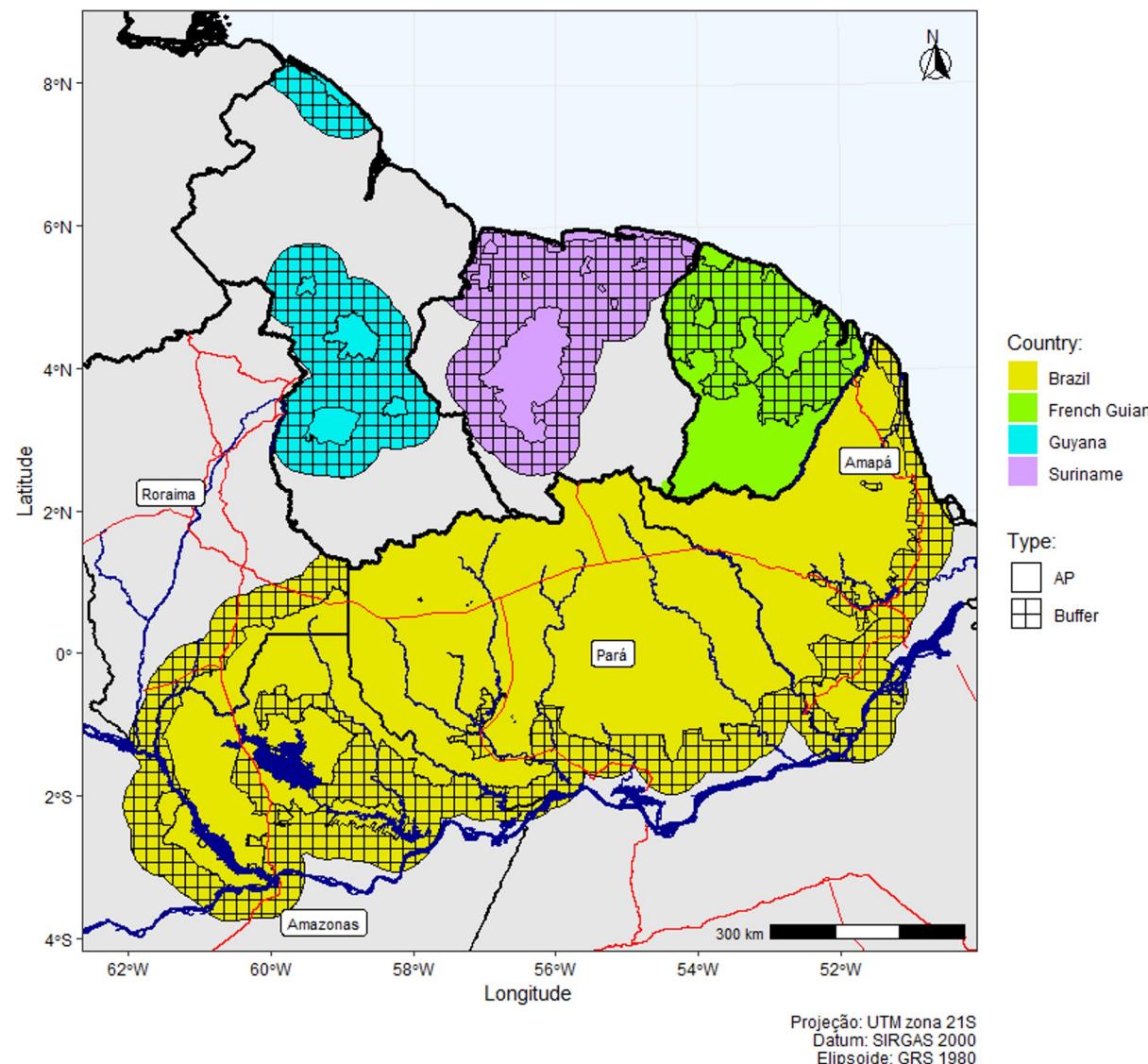
L'Europe s'engage
en Guyane

UNION EUROPÉENNE

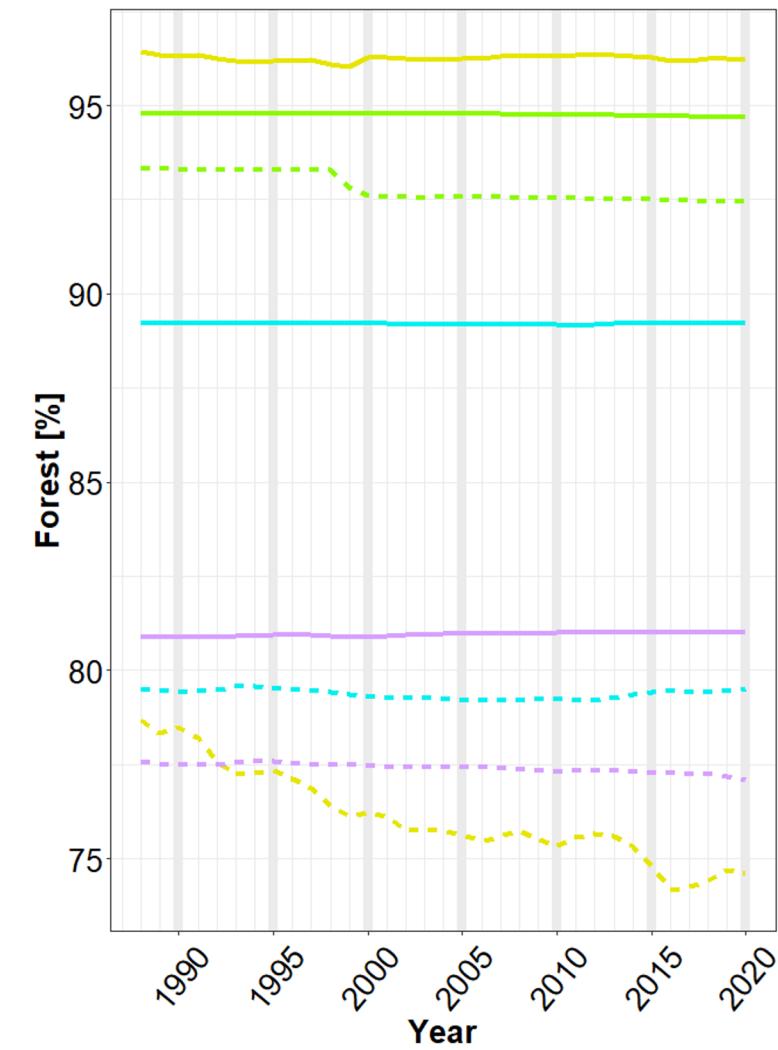
Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE



REGIONAL SCALE: DIAGNOSIS IN BRAZIL

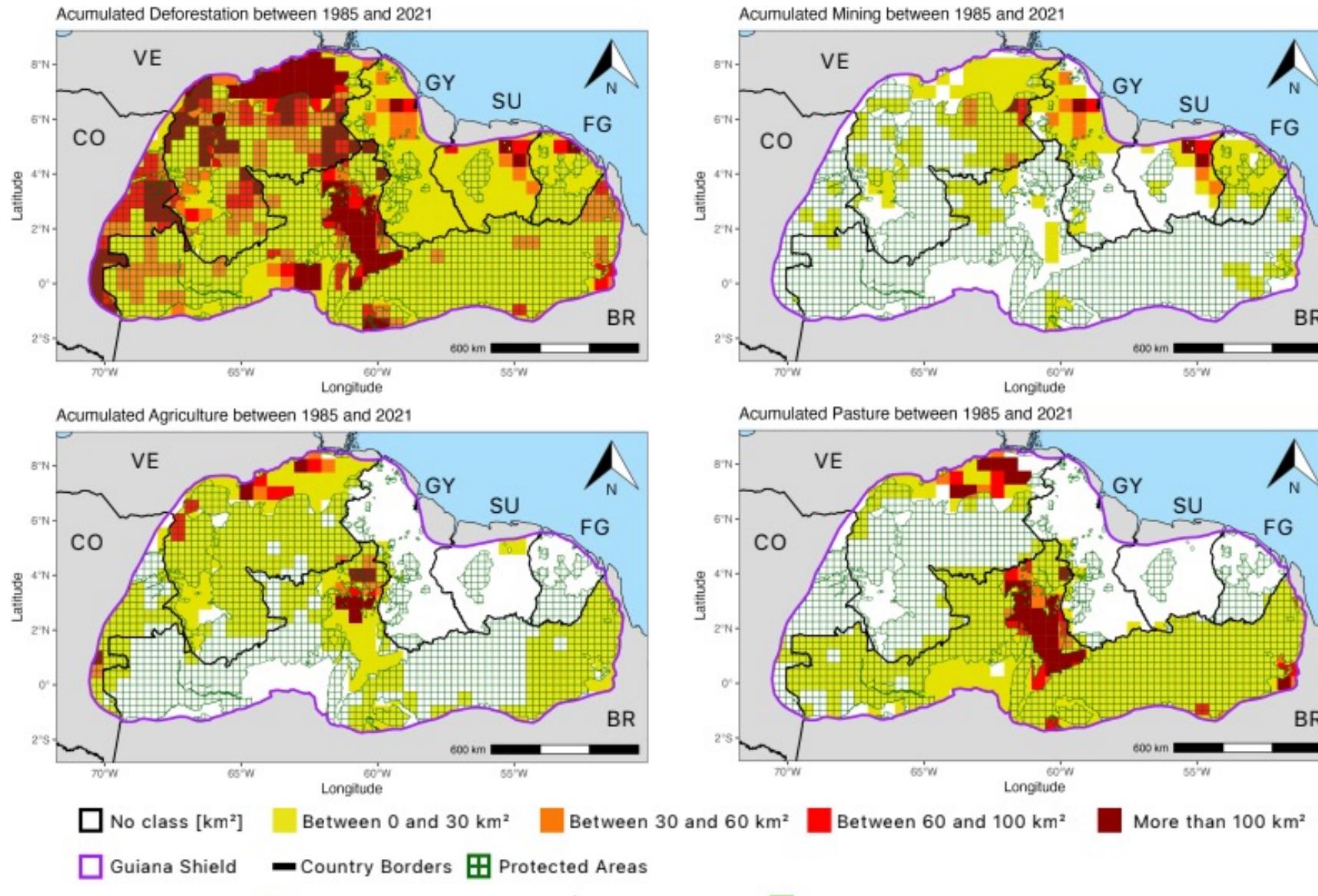


Amount of Forest relative to the total area
Collection 3

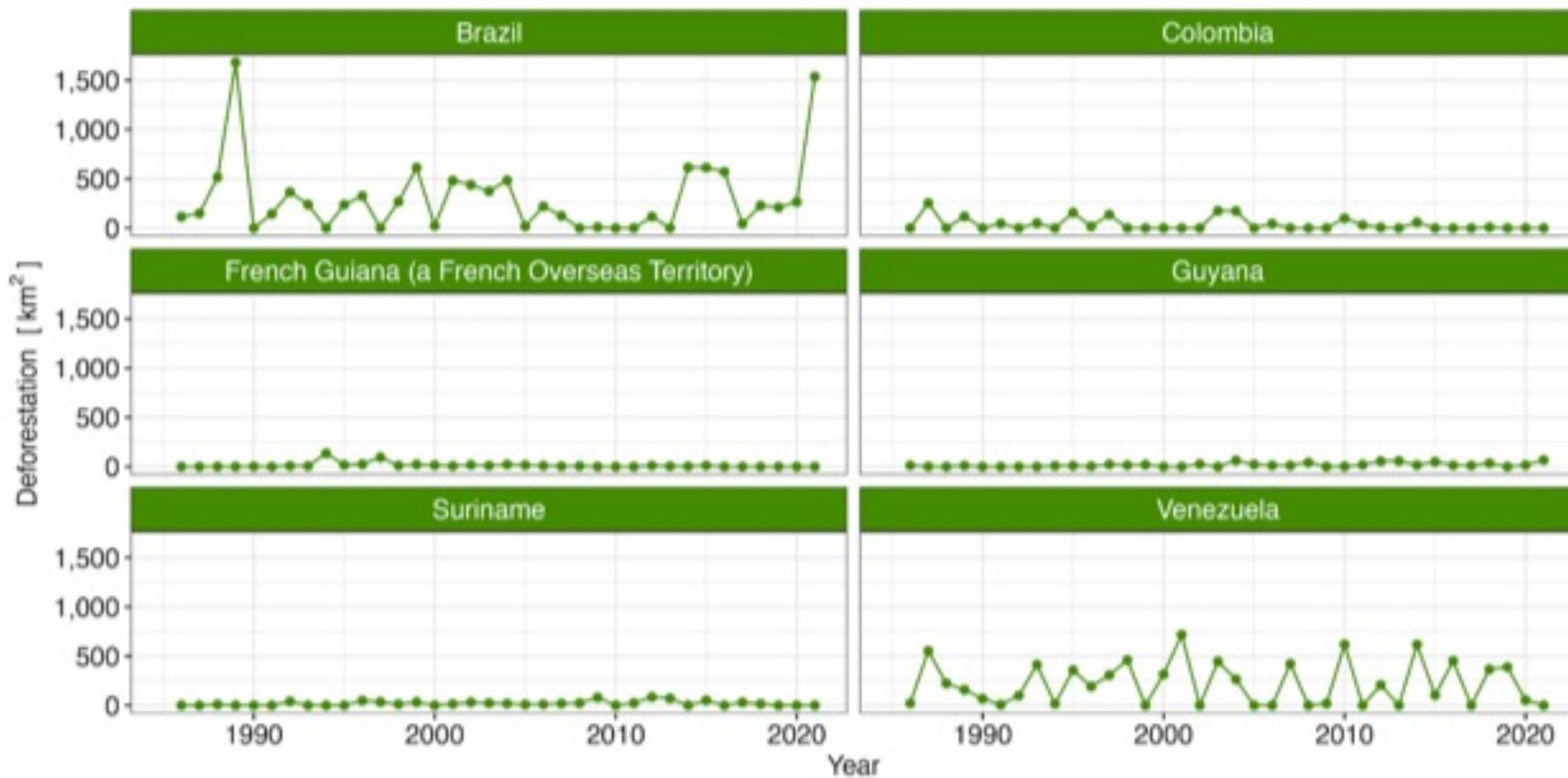


INCT - Odisseia

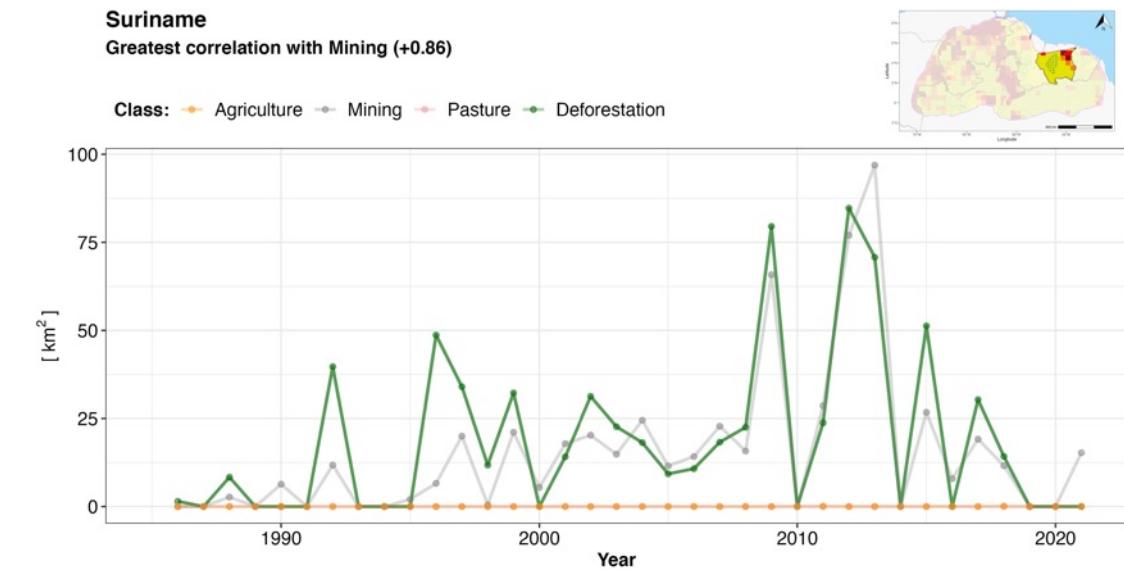
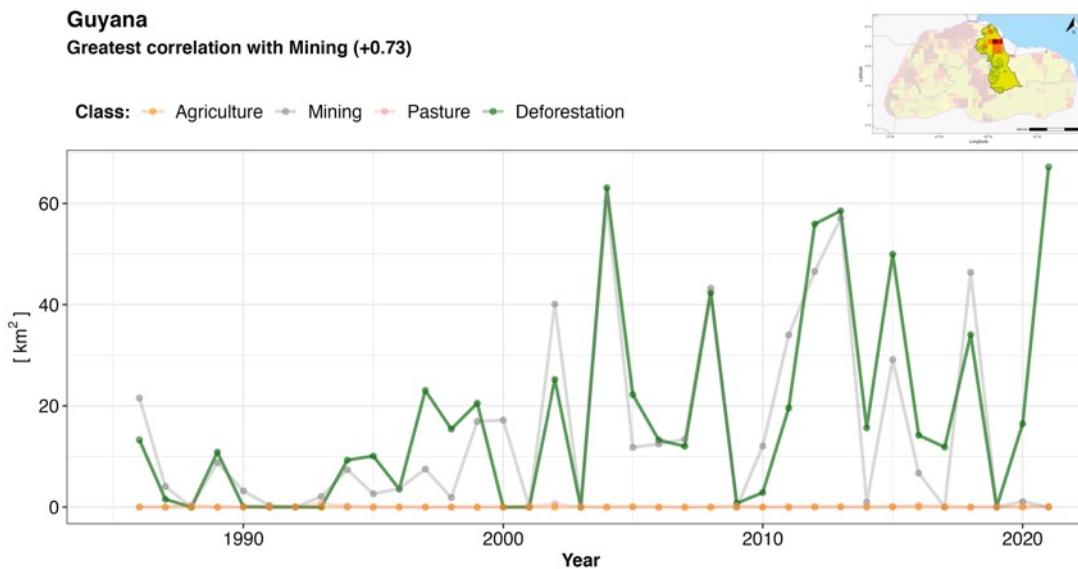
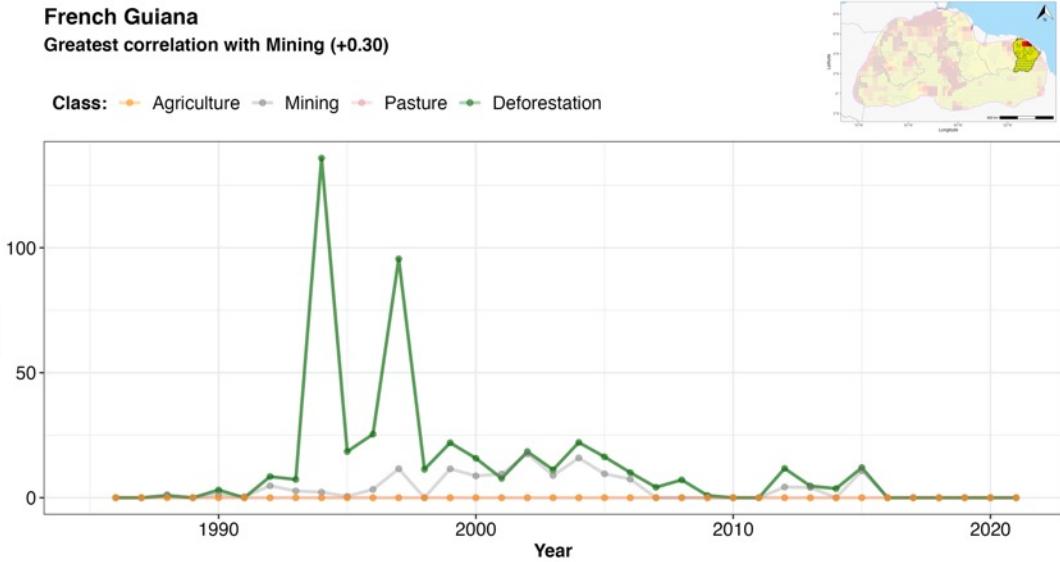
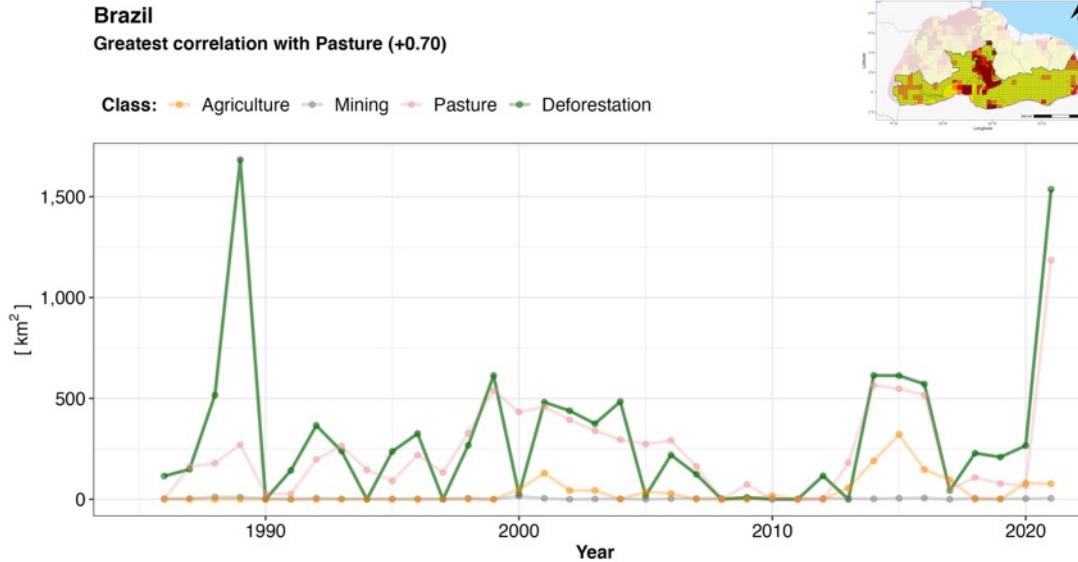
REGIONAL SCALE: DIAGNOSIS IN GUIANA SHIELD



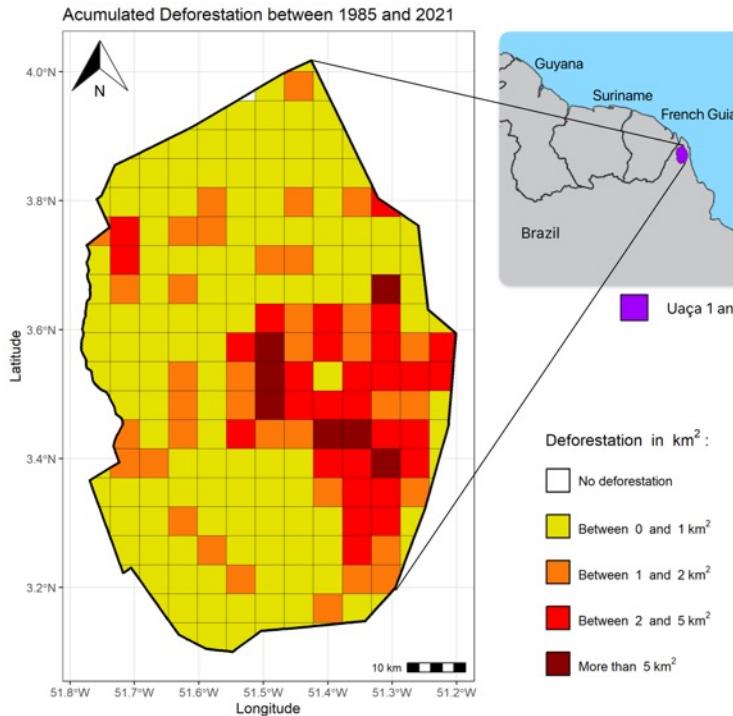
REGIONAL SCALE: DIAGNOSIS IN GUIANA SHIELD



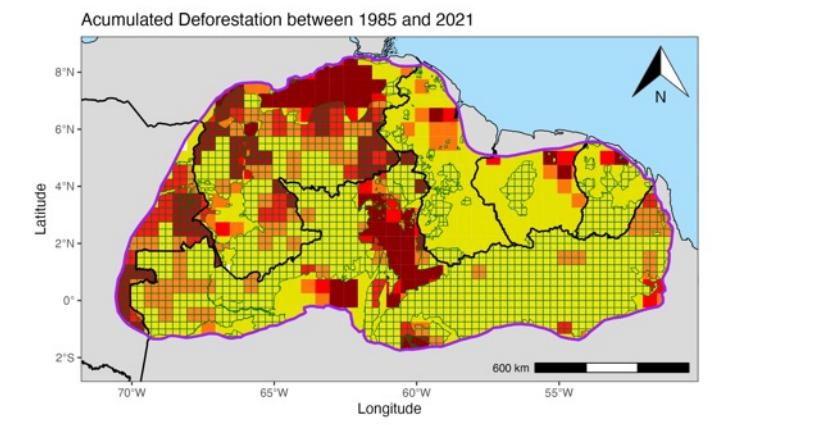
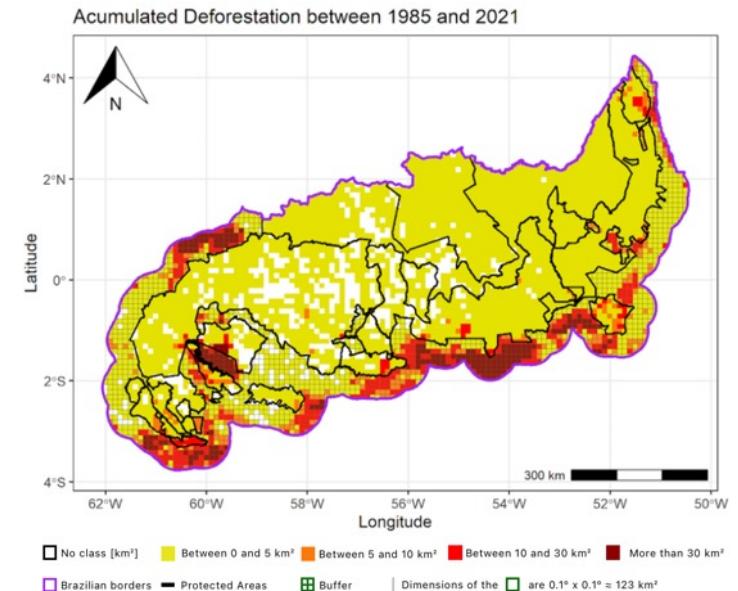
REGIONAL SCALE: DIAGNOSIS IN GUIANA SHIELD



* POSSIBILITIES *



- We may use the proposed scripts for different areas and scales.
- The main difference is for the processing time.
- 3 practical examples already used:
 - Uaça 1 and 2 ($\pm 5.000 \text{ km}^2$);
 - Northen Brazil ($\pm 600.000 \text{ km}^2$);
 - Guiana Shield ($\pm 1.700.000 \text{ km}^2$).



Maintenance of forest extension inside protected areas
Endogenous policies from **2005**

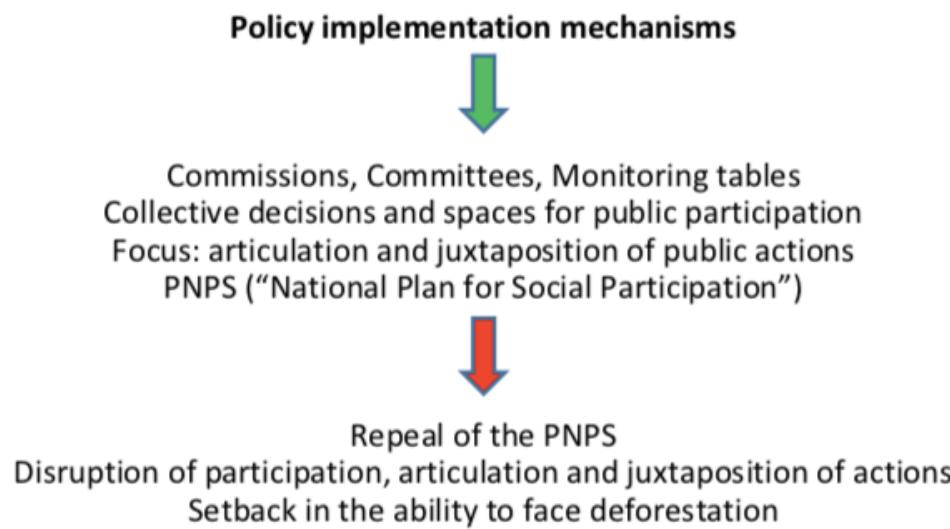
- **Territorial planning and land regularization**
 - Macro-ZEE da Legal Amazon
 - PNGATTI (Demarcation and management of Indigenous Lands)
 - SNUC (Protected Areas and Land concession)
 - Forest Code (CAR)
- **Institutional development**
 - Creation of ICMBIO and SFB
- **Social inclusion**
 - Rural retirement (also for women)
 - “*Bolsa Família*”
- **Productive inclusion**
 - PAA, PNAE, ATER indigenous and extractive
- **Environmental conservation**
 - “*Bolsa Verde*”, ARPA



REGIONAL SCALE: PUBLIC POLICY

Embracing Structural Policies:

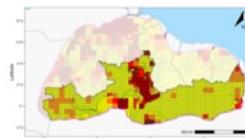
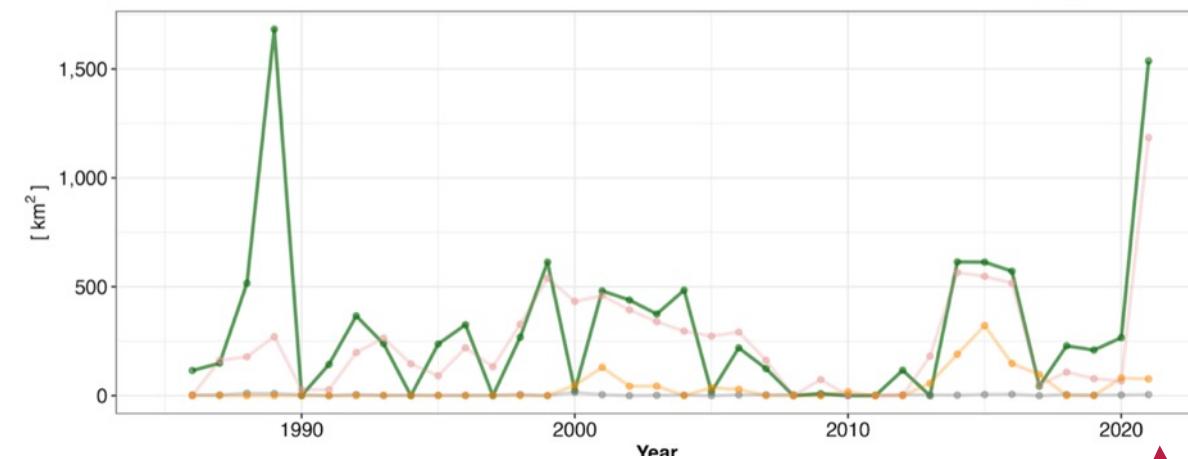
PAS, PRONAF, PNPCT, PBSM, PNPS, PNAPO, PLANAFE



Brazil

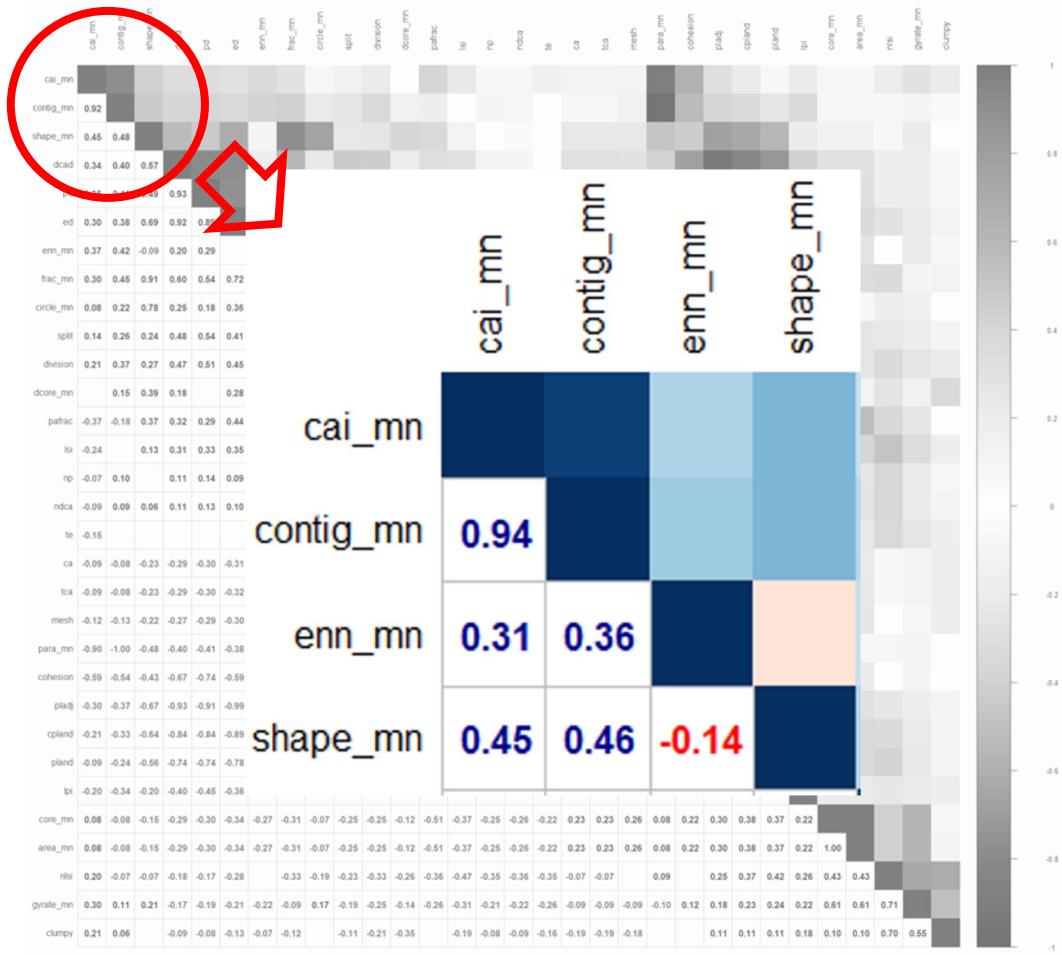
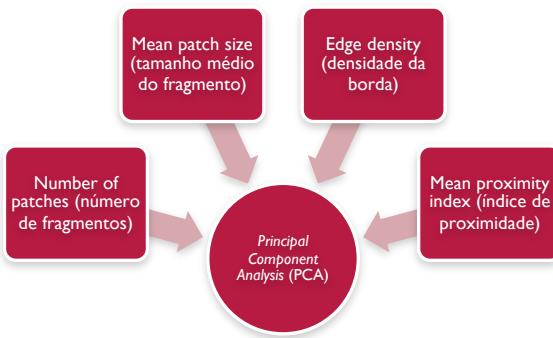
Greatest correlation with Pasture (+0.70)

Class: Agriculture (orange), Mining (grey), Pasture (pink), Deforestation (green)

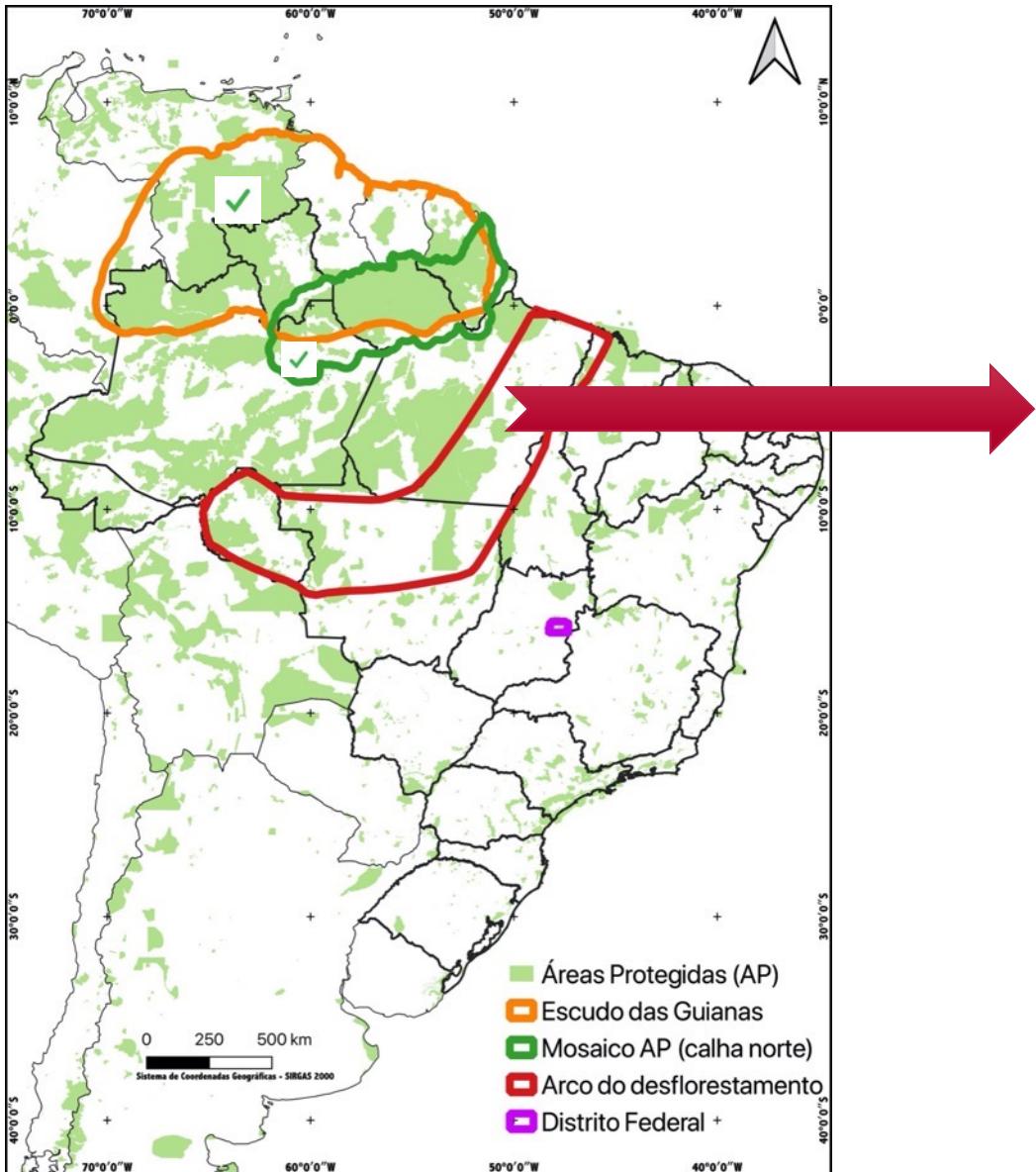


NEAR STEPS, NEW APPROACHES

- Analysis of deforestation, fragmentation and connectivity within the massif of protected areas and in its area of influence → Identify areas and zones with greater susceptibility to fragmentation.



NEW AREAS OF STUDY AND DATABASE



Apply regional methodology in the Arch of deforestation:
Analysis of more local public policies (state, municipal level)

LOCAL SCALE: RESULTS (AUTOMATED METHODOLOGY ON GOOGLE ENGINE)

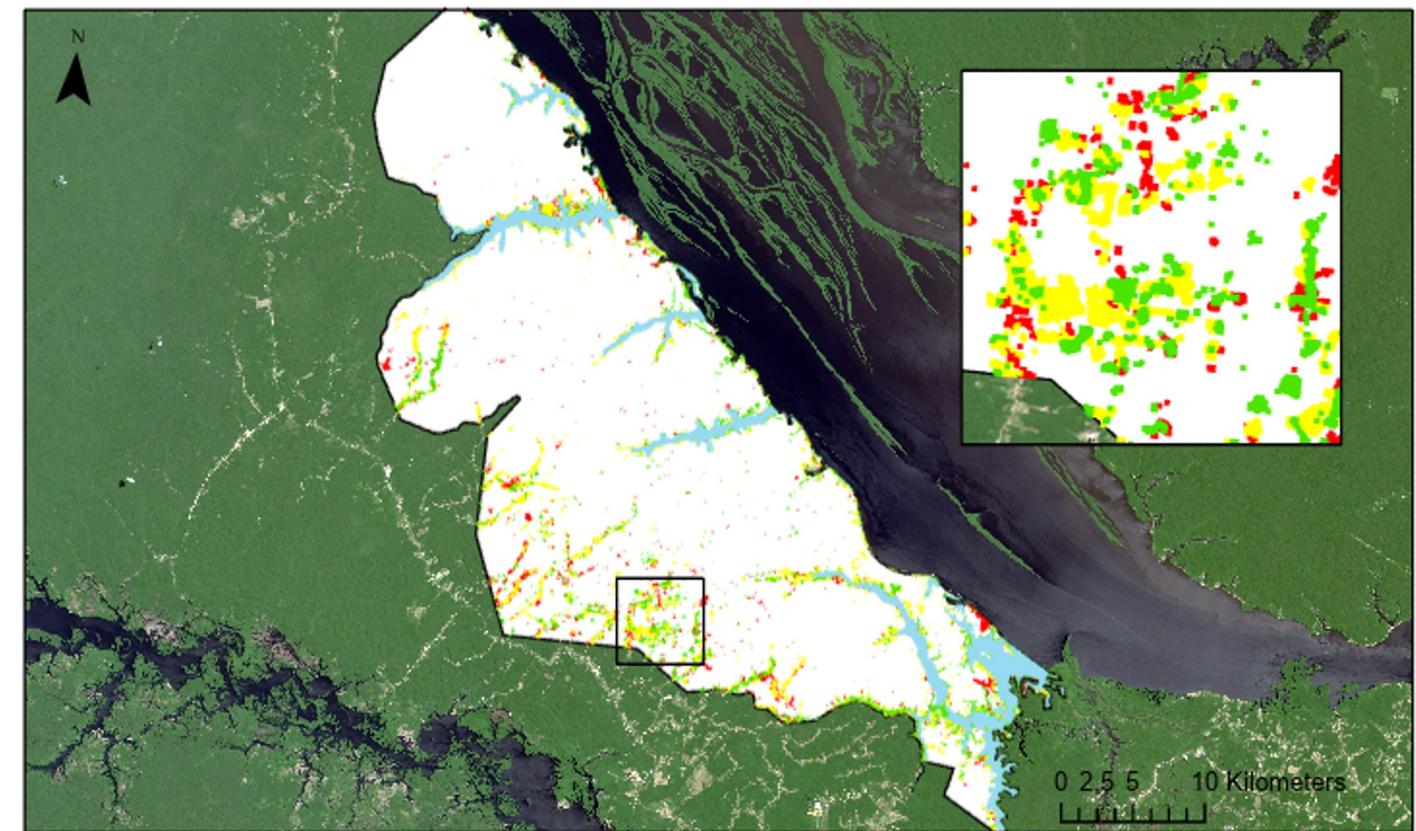
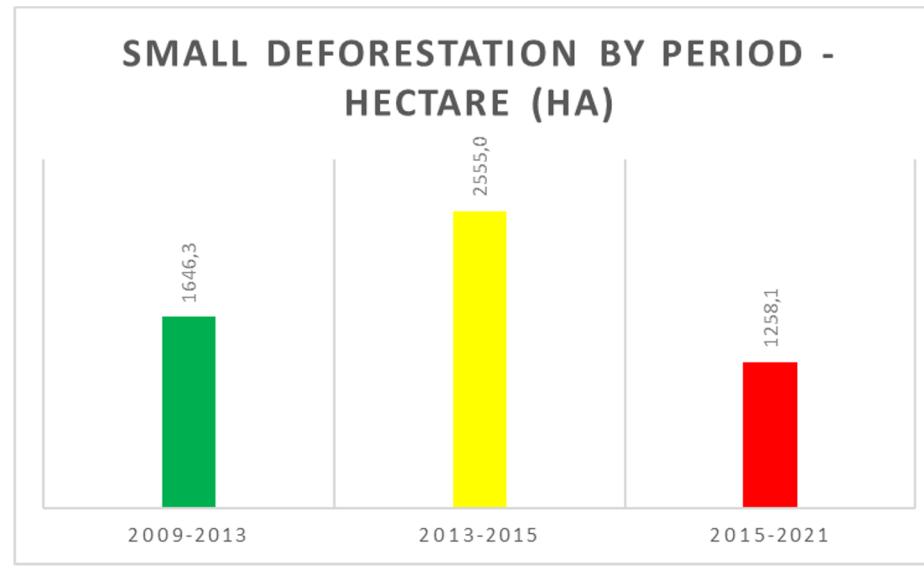
✓ <https://code.earthengine.google.com/605d7ba4109f2c5d7998b355b12dbe04>

The screenshot displays the Google Earth Engine interface with the following components:

- Code Editor:** Shows the script titled "Co_NDVI_Rio_Negro *". The code implements a methodology to calculate NDVI over time, including thresholds for change detection and long-term average calculations.
- Line Graph:** Titled "NDVI ao Longo do Tempo", it plots NDVI values from 2014 to 2020. The Y-axis represents NDVI (0.0 to 1.0) and the X-axis represents Time (2014 to 2020). The NDVI value starts around 0.25 in 2014, rises sharply to approximately 0.9 by 2015, and remains relatively stable until 2020.
- Map View:** A map of the Rio Negro region in Brazil. The map shows the river network, roads (e.g., AM-352, AM-070), and several towns: União, São Luís, Concepção, Agroindustrial, Paracatuba, Vila de Paracatuba, Col. do Limão, Efigênio Sales, Cidade Nova Flores, and Manaus. A red point is marked near the town of Paracatuba. The map includes a legend for editing points and a scale bar indicating 10 km.

LOCAL SCALE: RESULTS

- In the RDS of Rio Negro, we found that areas are being opened mostly in areas close to access roads. However, there are small openings near the banks of the Rio Negro.



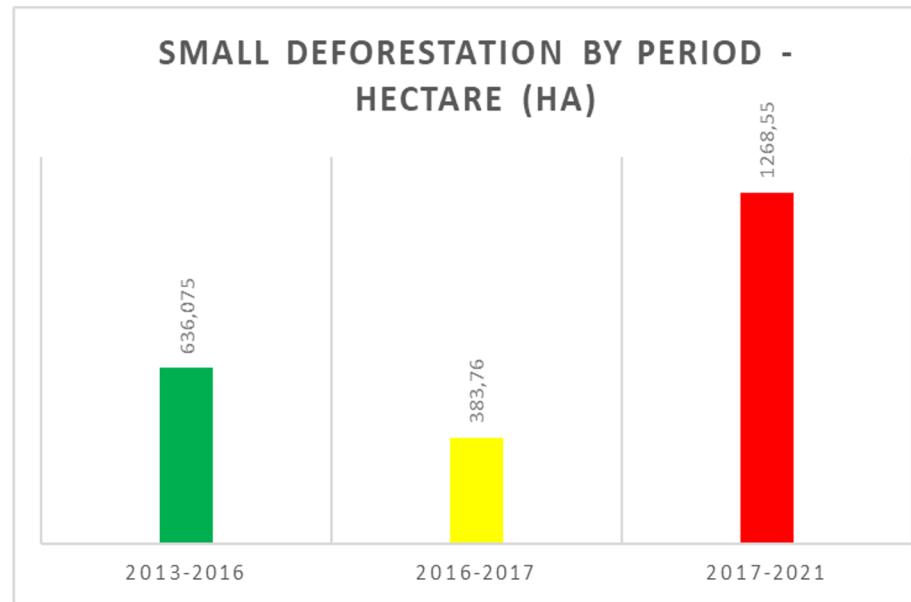
LEGEND

CD_2009_2013 CD_2013_2015 CD_2015_2021 Hidrografia_Rio_Negro

Spatial Reference
Name: WGS 1984 UTM Zone 20S
PCS: WGS 1984 UTM Zone 20S
GCS: GCS WGS 1984
Datum: WGS 1984
Projection: Transverse Mercator

LOCAL SCALE: RESULTS

- In the RDS Puranga Conquista, the dynamics of deforestation occurred near the access roads to the capital Manaus.



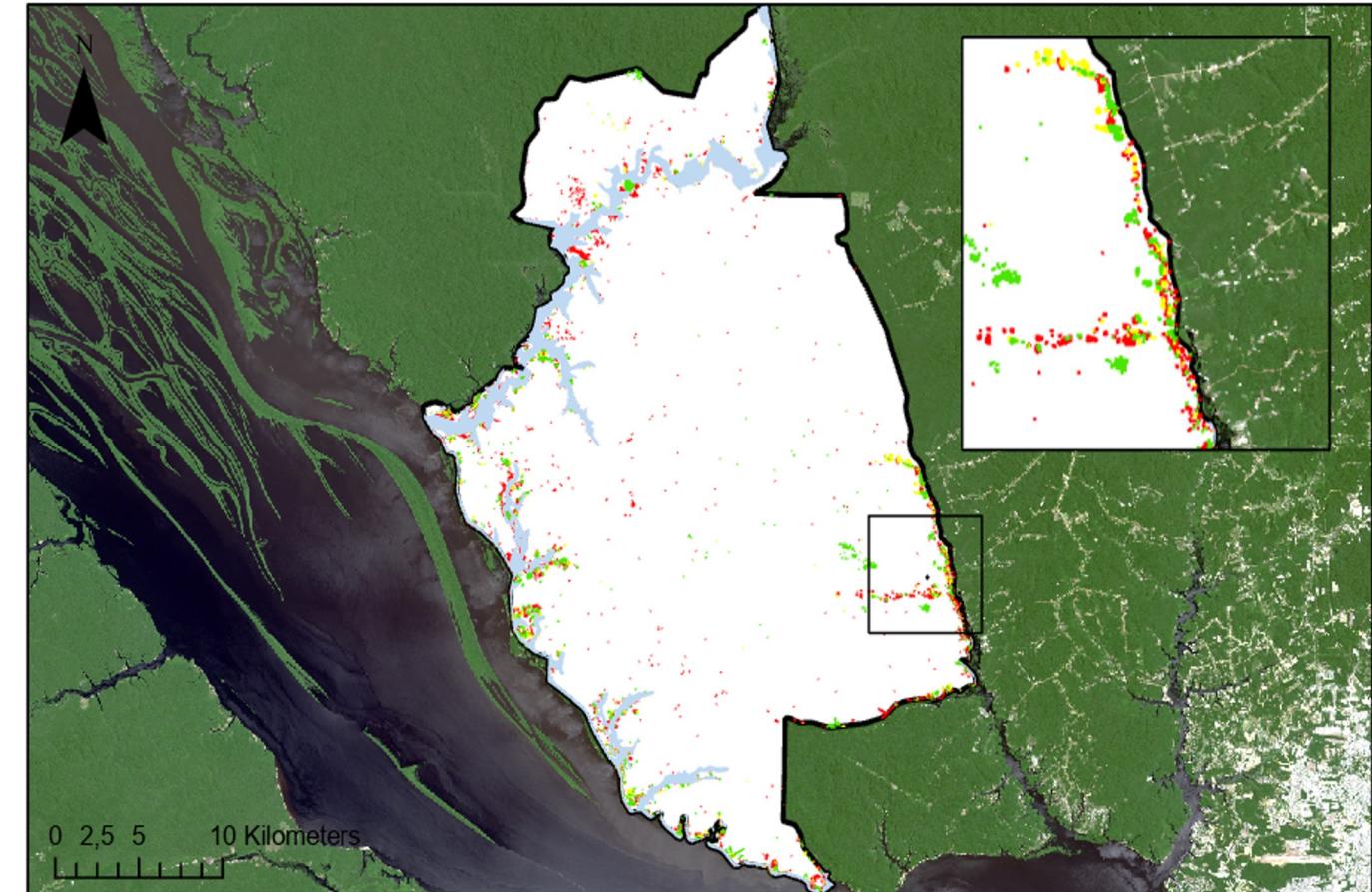
Before PBF - 1st period after PBF



1st period after PBF - 2nd period after PBF



2nd period after PBF - 3rd period after PBF



Legend

Hidrografia_Puranga_Co ... CD_2013_2016_FC CD_2016_2017_FC CD_2017_2021_FC purangaconquista

Spatial Reference
Name: WGS 1984 UTM Zone 20S
PCS: WGS 1984 UTM Zone 20S
GCS: GCS WGS 1984
Datum: WGS 1984
Projection: Transverse Mercator

LOCAL SCALE: SENTINEL IMAGE ANALYSIS



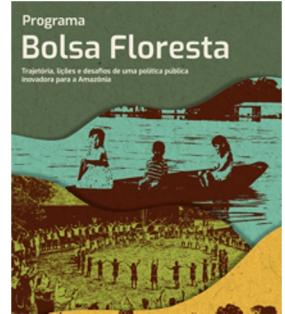
Hidrografia
LandSat
LandSat - Sentinel

Spatial Reference
Name: WGS 1984 UTM Zone 20S
PCS: WGS 1984 UTM Zone 20S
GCS: GCS WGS 1984
Datum: WGS 1984
Projection: Transverse Mercator

...



LOCAL SCALE: PUBLIC POLICY



Policy implementation mechanisms

The Bolsa Floresta Program aims to compensate residents for not deforesting primary forest.



Rio Negro RDS



Decrease in the opening of small areas of primary forest (same result in the Uatumã RDS - previous study)

Indicates the effort of families to comply with the program.



Puranga Conquista RDS

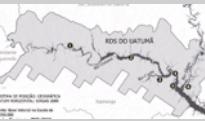


Increase only in the last analyzed period

Indicates that families make an initial effort, but in the last 5 years (either due to need and/or lack of supervision, families increased the open areas in primary forest).

Before PROGYSAT

Local analysis – Bolsa Floresta Program – RDS Uatumã



PROGYSAT (2021-2023)

Regional analysis
(39 protected areas + Buffer;
Guyana Shield)

Local analyzes – Bolsa Floresta Program
2 Protected Areas

(scripts)



(2023)

Arc deforestation
(involve cerrado Biome)

All 16 areas with
Bolsa Floresta
Program

Return RDS Uatumã
Interviews
network analysis
(Public Policy)

(2024)

- Return of the results (Workshops)
- Target public: managers of the analyzed protected areas

SCIENTIFIC PRODUCTIONS

- ✓ Paper: Land use dynamics under the Bolsa Floresta Program: a case study of the Uatumã Sustainable Development Reserve (Amazonas, Brazil). *Acta Amazônica*. 2021.
- ✓ Paper: Potential Economic Effectiveness of Payment for Environmental Services in a Protected Area in the State of Amazonas (Brazil). *Revista de estudos Brasileños*. 2021.
- ✓ Paper: Assessment of the effect of landowner type on deforestation in the Brazilian Legal Amazon using remote sensing data. *Artigo. Environmental Conservation*. 2022.
- ✓ Book chapter: Ecologia da Paisagem e Geografia. Books name: Geografia da Paisagem: múltiplas abordagens. 2022.
- ✓ Book chapter: Integração e aplicação de análises da paisagem em áreas protegidas na Amazônia. Books name: Dinâmicas socioambientais no Brasil: atores, processos e políticas. 2022.
- ✓ (1 chapter submitted. 2023.)
- ✓ (1 paper submitted. 2023.)
- ✓ (1 dissertation in progress. 2023.)



Research grant support:

INCT-Odisseia Partnership

✓ The Brazilian project will provide until November 2024:

- ✓ 1 postdoctoral scholarship (pos-doc)
- ✓ 1 research scholarship for a master's degree student in the Technological Development and Innovation modality (DTiB)
- ✓ 1 research scholarship for a doctoral degree student in the Technological Development and Innovation modality (DTiA)

Financial support prospects:

- ✓ Submission to: EDITAL N°10/2023 FAPDF Learning Program and Edital CNPq/MCTI N° 10/2023 - UNIVERSAL
- ✓ Objective: obtain resources to **maintain research grants** and expand the application of scripts in other biomes
 - ✓ The result will come out in July 2023



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THANK YOU!

