



# Exploring conservation asymmetries in the transnational Alto Paraná Atlantic Forest ecoregion of South America

L. Montti, A. Trumper, M.J. Gennerich, S.E. Velazco, V. González, A.A. Eleuterio, I. Gasparri, G.A. Zurita, A. Anticoli, S. Casertano, C. Amicone, I. Baptiston & M. Piquer-Rodríguez.

## Background

- **Ecoregions** are crucial for guiding conservation efforts, but **human development** often leads to **ecosystem degradation**.
- In transnational ecoregions, **differing governance** produces distinct outcomes in natural and social dimensions.
- But **how do these different human development pathways translate into conservation asymmetries within the same ecoregion?**
- To explore this, we analyzed the **Alto Paraná Atlantic Forest (APAF)** ecoregion (Fig. 1), a resource-rich area characterized by the most divergent border in South America.

## Methods

- Using a combination of **qualitative, quantitative, and geospatial methods**, we analyzed **28 key variables** organized into **four thematic social-economic groups** (Table 1).
- We compared human development with the conservation goals of each country (Fig. 2). The **conservation score** was calculated by summing the normalized values of all 7 variables in the conservation category. The **Human development score** was generated by summing the values of 6 demographic/economic variables (PopD, UrbanExpP, Edu, HealthF, Acc, and HDI).

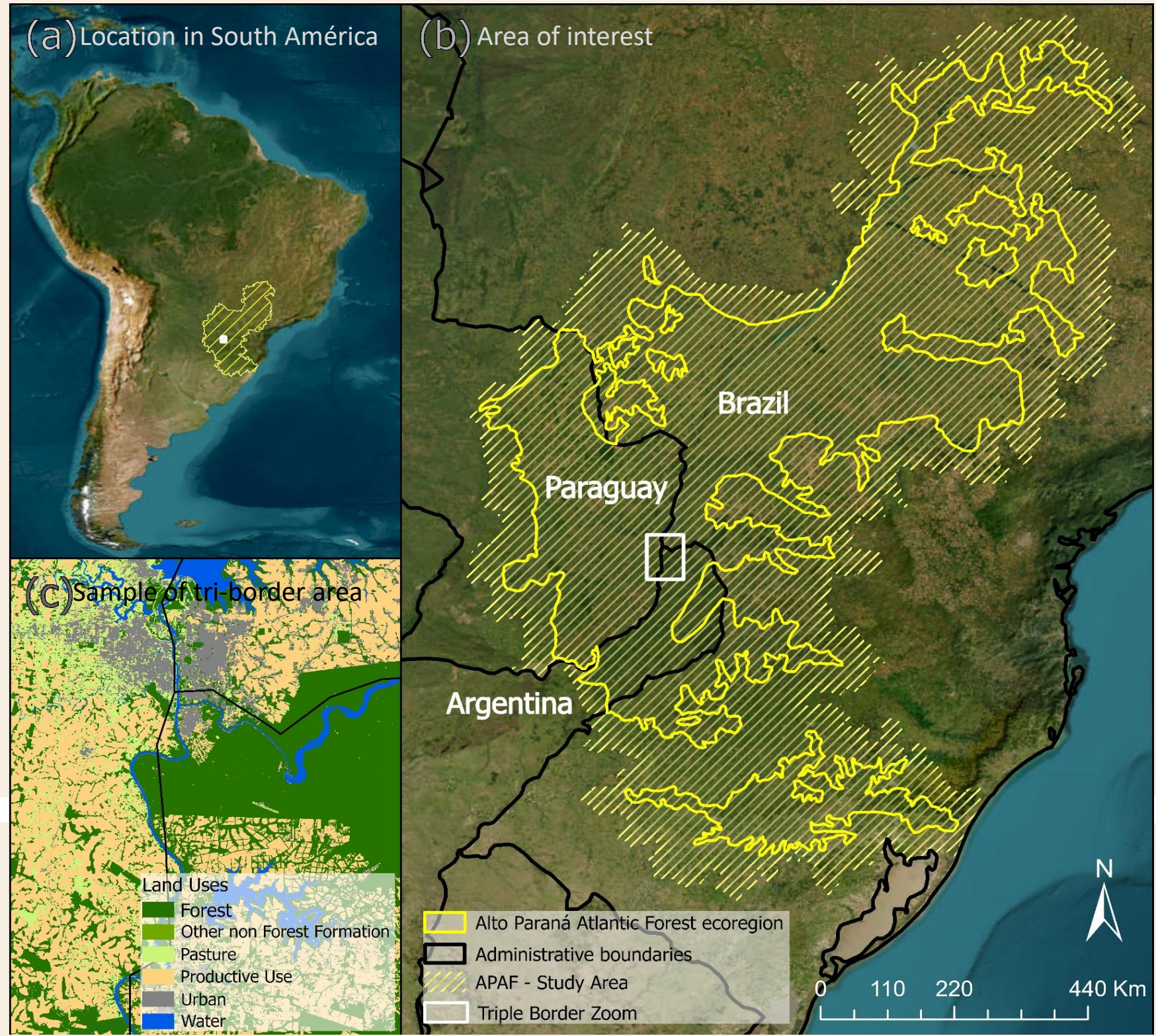


Fig. 1. The APAF Study area

- We analyzed the **Euclidean distances** of variables per group and for each pair of countries (BRA-PAR, ARG-PAR, ARG-BR) to understand the level of asymmetry per group (Fig. 3).

## Results

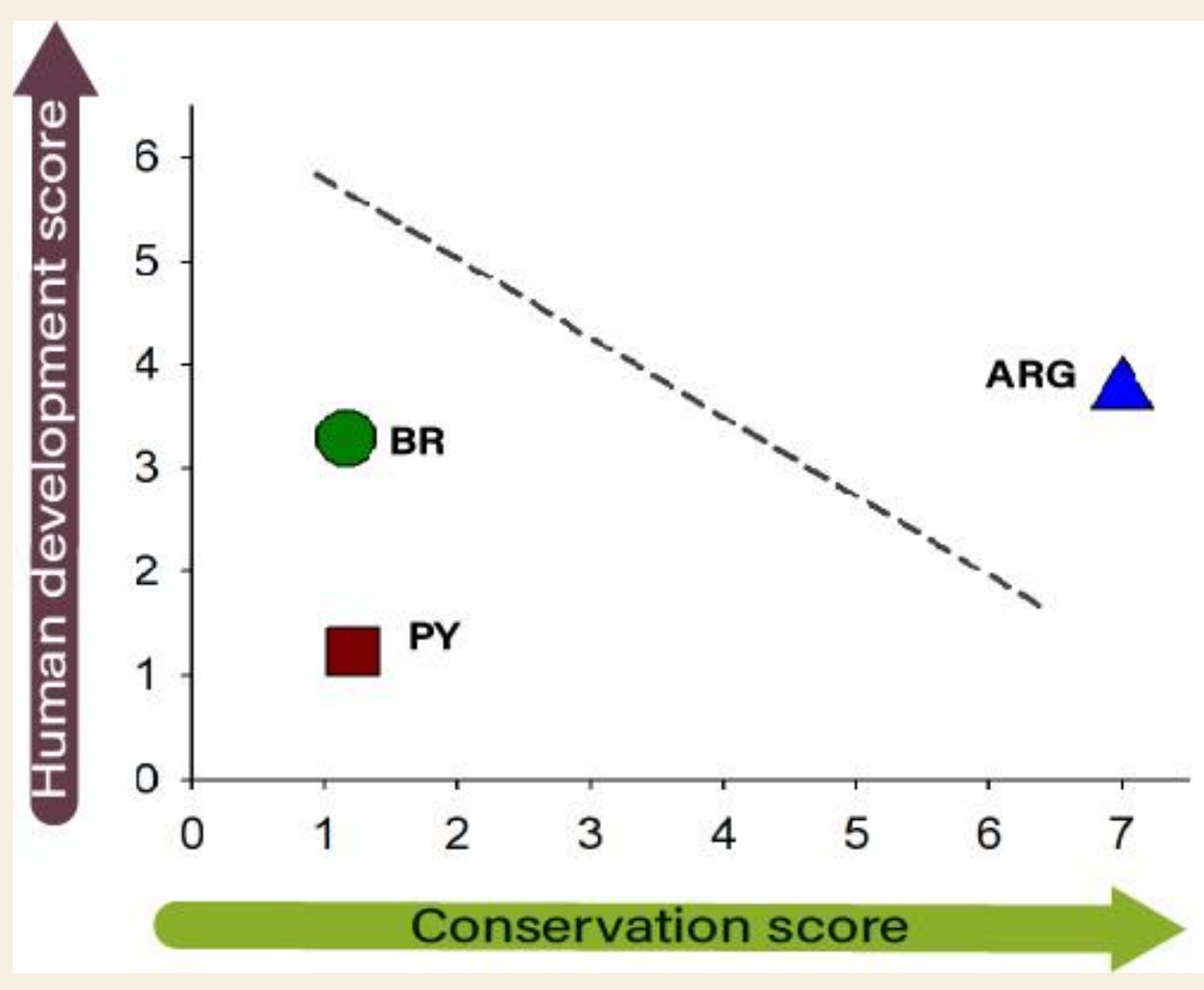
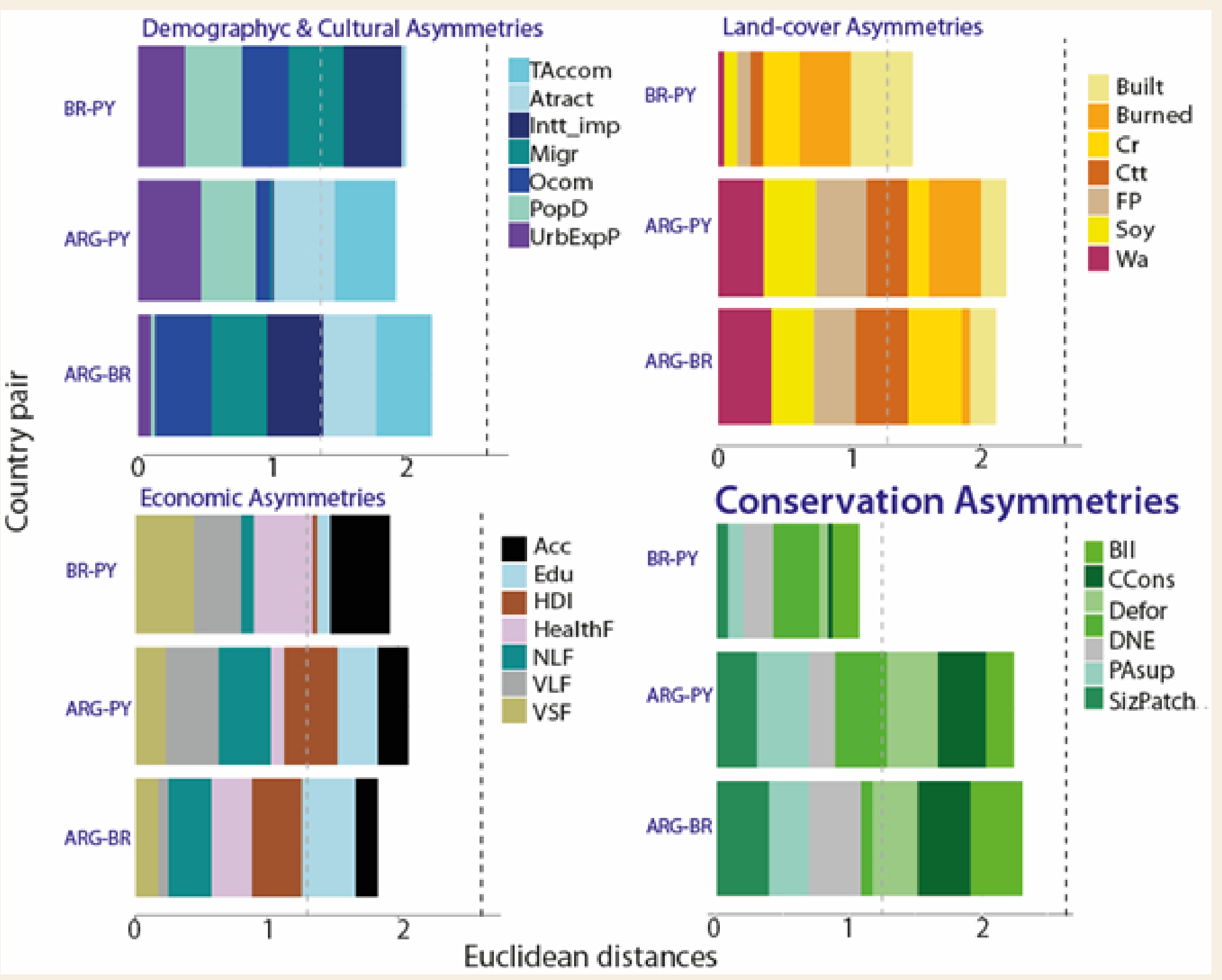


Fig. 2. Trade-offs between conservation goals and human development pathways.

Table 1. Variables

1. Conservation
Total Protected Area (PAsup)
Deforestation Rate-1 1985-2022 (Defor <sup>-1</sup> )
Patch Size (SizPatch)
Connectivity Index (Connect)
Biodiversity Intactness Index 2020 (BII)
Remnants of the Original Carbon Stock (Ccons)
Native Dominance Index (DNE)
2. Land-Cover
Forest Plantation (FP)
Crops (Cr)
Water (Wa)
Soy Crop 2000 (Soy)
Built up area -V-2020 (Built)
Burned Area (Burned)
Cattle density 2010 (Ctt)
3. Demographical & Cultural
Population (Pop)
Original people communities (TOcom)
Internal_migration 2020 (Migr)
International_imp index 2020 (Intt_imp)
Tourism Accommodation (TAccom)
The number of tourism attractions (TAttract)
Urban Expansion 2021 per Total Population 2020 (UrbanExpP)
4. Economics
Very Large Field Size per crop cover (VLF)
Large Field per crops cover (NLF)
Very small Field per crop cover (VSF)
Education centers per Total Population (Edu)
Healthcare Facilities per Total Population (HealthF)
Accessibility 2015 (Acc)
Human Development Index (HDI)

Fig. 3. Pairwise Euclidean distances across the variables and categories.



Higher values indicating greater divergences between the pairs under comparison. Light gray dotted line means media asymmetry value and dark grey line, the maximum possible asymmetry

## Insights

- In the Alto Paraná Atlantic Forest (APAF) humans have altered original natural conditions increasing differences unevenly across borders.
- Yet, Argentina shows no clear trade-off between conservation and human development (Fig. 2), both can coexist.
- However, Brazil and Paraguay show similar lower forest conservation outcomes (Fig. 3).
- **Our results can help guide future sustainable pathways for forest conservation in transnational areas, fostering interdisciplinary collaboration.**



## Contact

liamontti@gmail.com  
maria.piquer-rodriguez@fu-berlin.de

## Acknowledgements

We express our gratitude to CONICET & Freie Universität for supporting this project. To MAPBIOMAS Atlantic Forest project team for providing the customized dataset. To GLP OSM5 for the Travel Grant of LM.