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Conservation and reforestation of biodiversity in the biological corridor La Gamba, Costa Rica

Summary of field-work conducted in La Gamba, Costa Rica 2013 – 2023

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Biodiversity Club lunch, 29 Nov 2023, Laxenburg, Austria

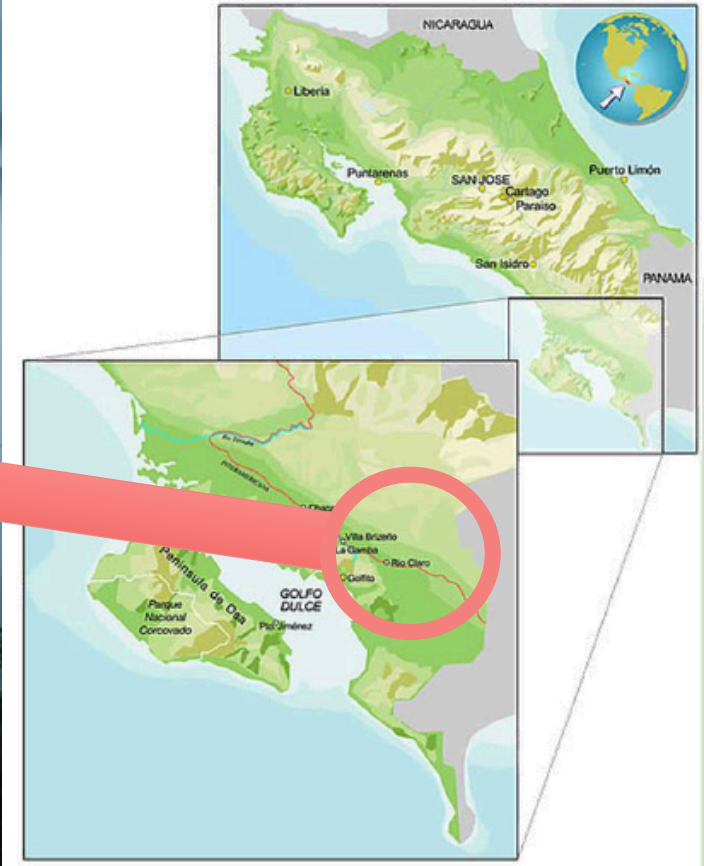
Costa Rica: hosts 5% of global biodiversity

Total area: (CR/AUT)
51.100 km²/83.878 km²

Land use:
agricultural land: 37.1%
forest: 51.5%
other: 11.4% (2011 est.)

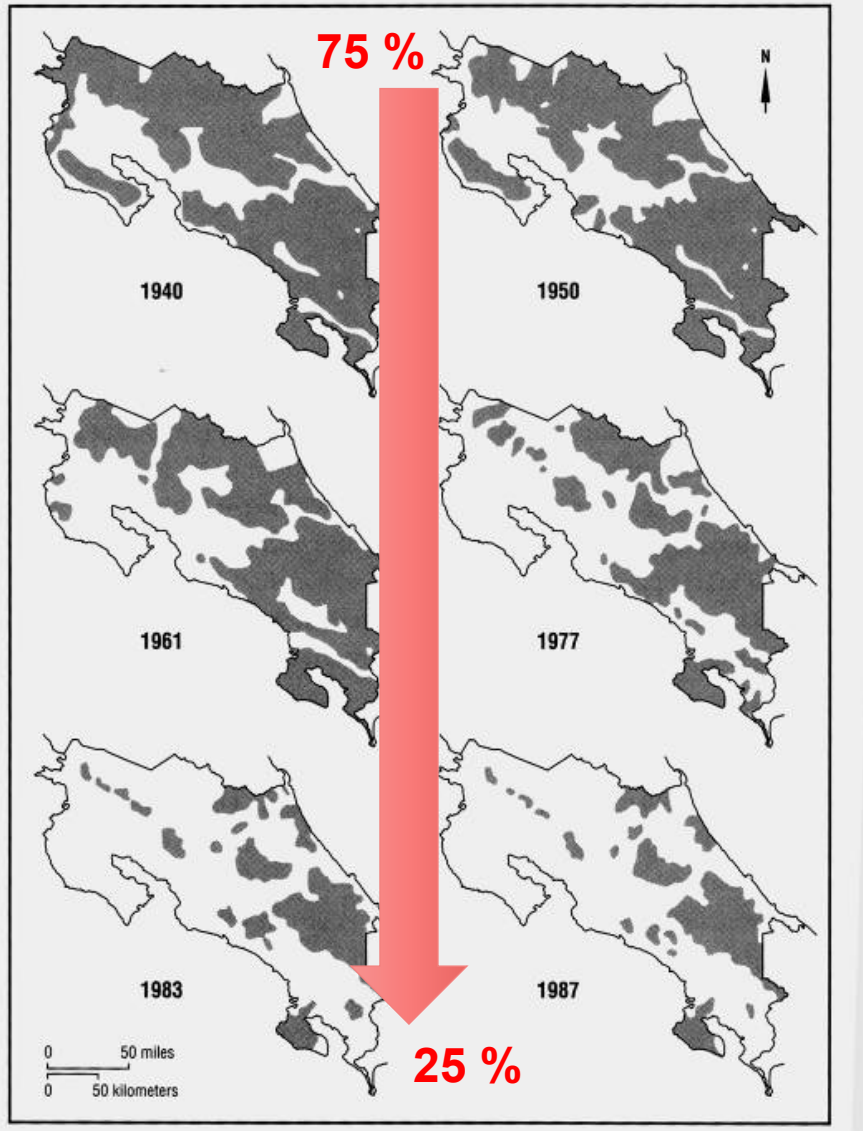
Biodiversity:
Costa Rica's rainforests
5% of the world's biodiversity and 25% of them are protected

Environment:
carbon-neutral by 2021



Source: : https://www.cia.gov/library/publications/the-world-factbook/geos/cs.htmll

Costa Rica: Deforestation & ecosystem degradation

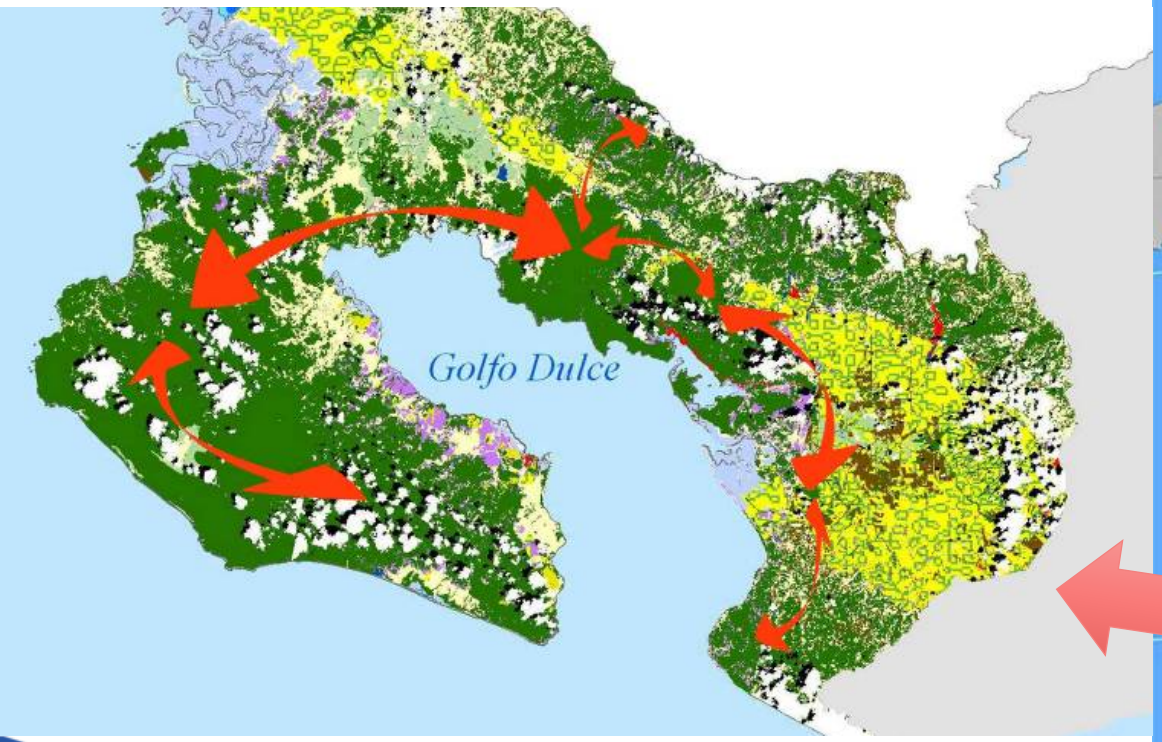


Costa Rica: National Parks & protected Areas (~25%)

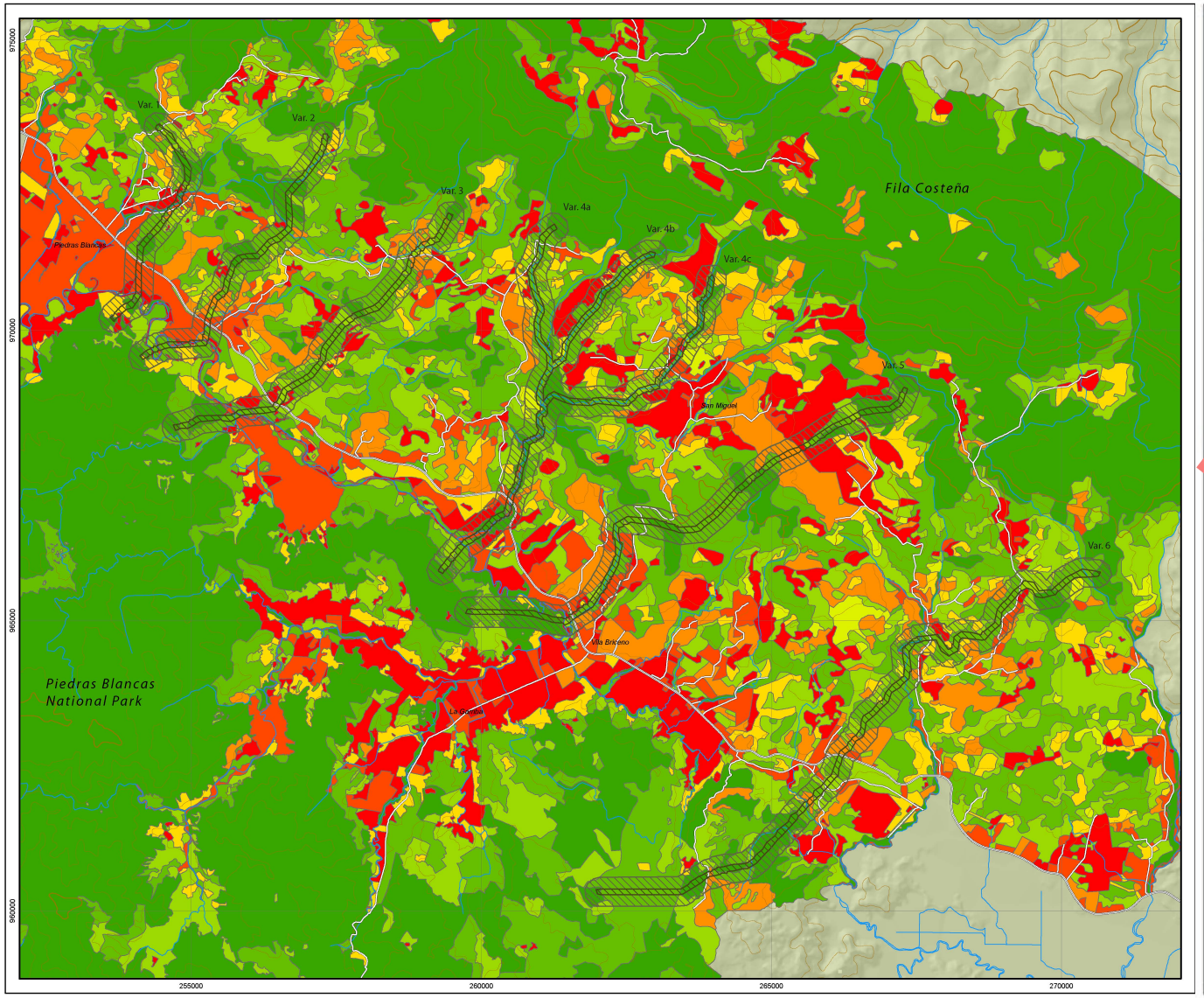
Numbers	Category	Hectare	Percent of Area
25	National Parks	623.771	12,23%
8	Biological Reserves	21.674	0,42%
32	Protected Zones	155.817	3,06%
11	Forest Reserves	227.834	4,47%
58	Wildlife Refuges	180.035	3,53%
15	Wetlands/Mangroves	77.869	1,53%
12	Other Categories	17.306	0,34%
161	**TOTALS**	**1.304.306**	**25,58%**

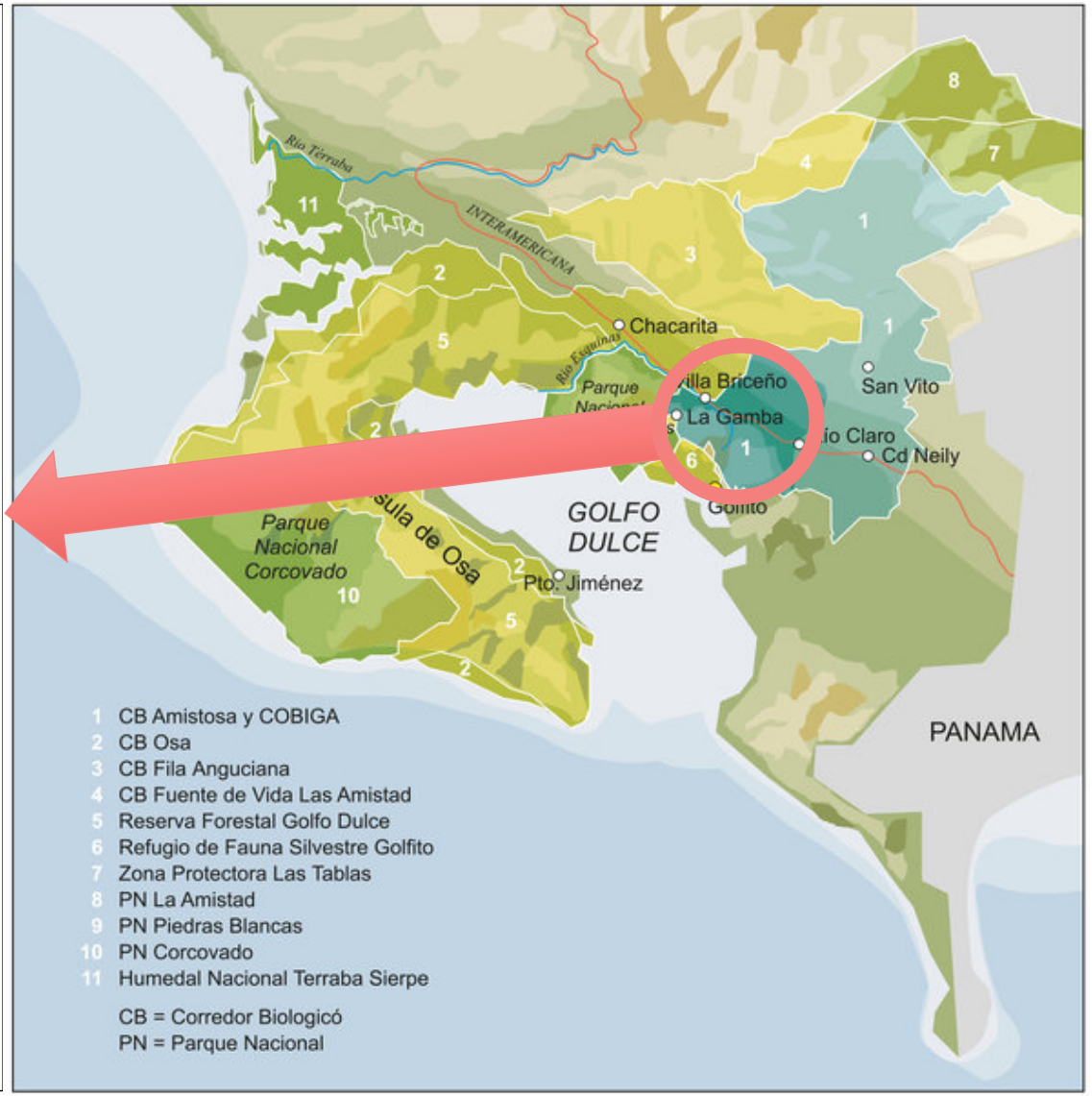
Costa Rica: Biological corridors for species migration

Path of the Panther - “Paseo Pantera“
the Central American Corridor

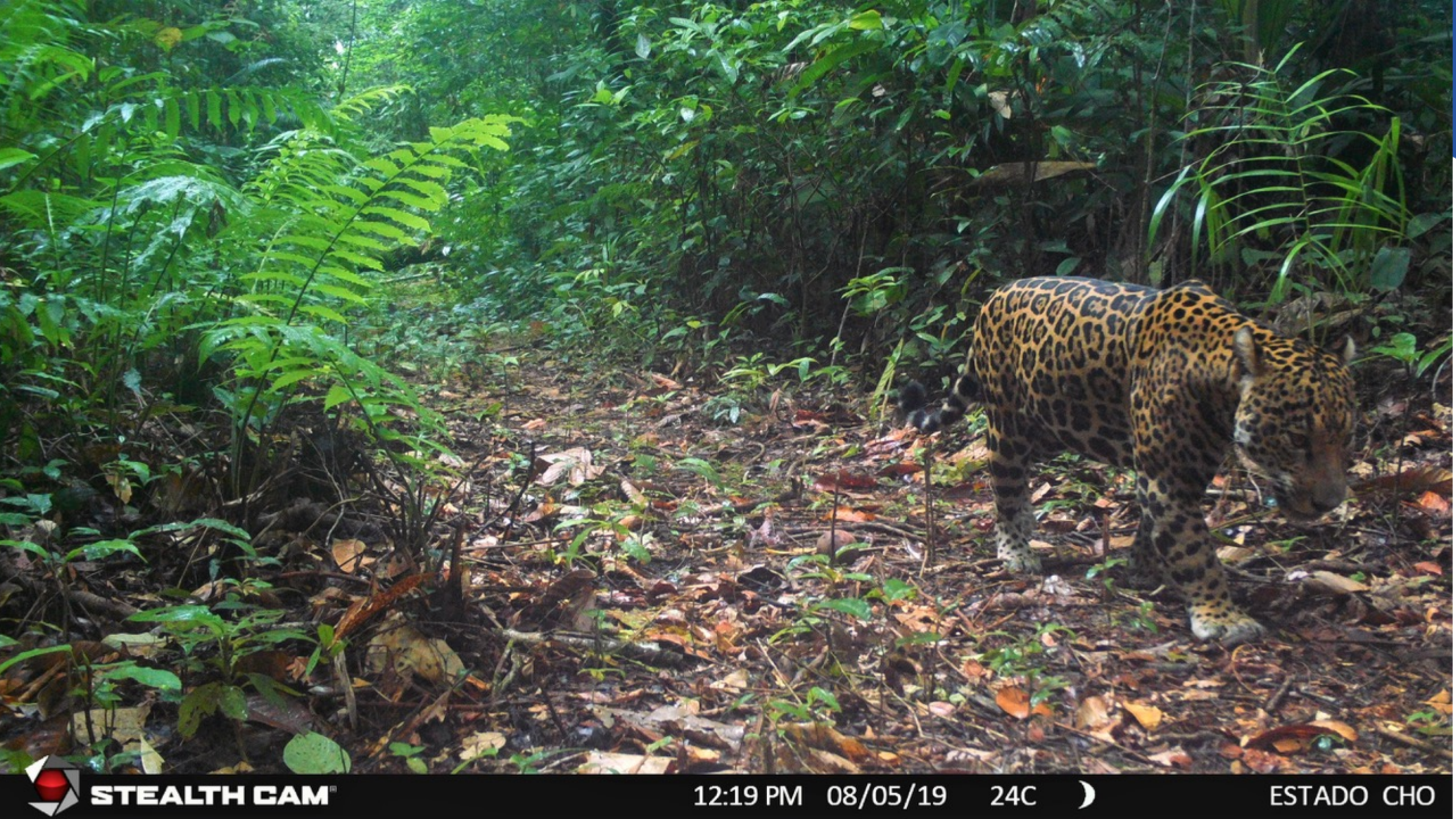


Costa Rica: Biological corridor La Gamba





Wildlife: conduct a camera survey across corridors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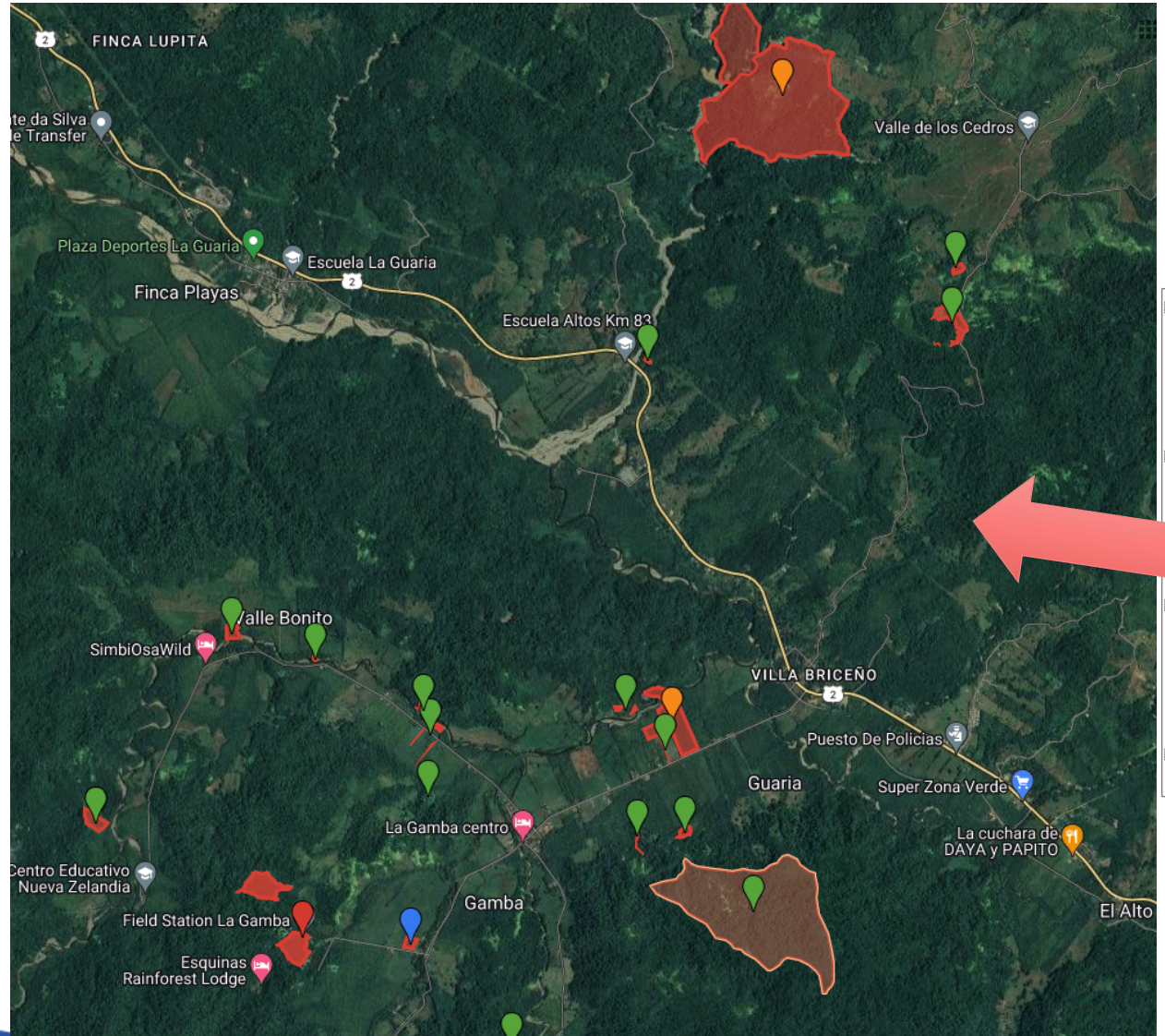
COBIGA: Biological Corridor La Gamba

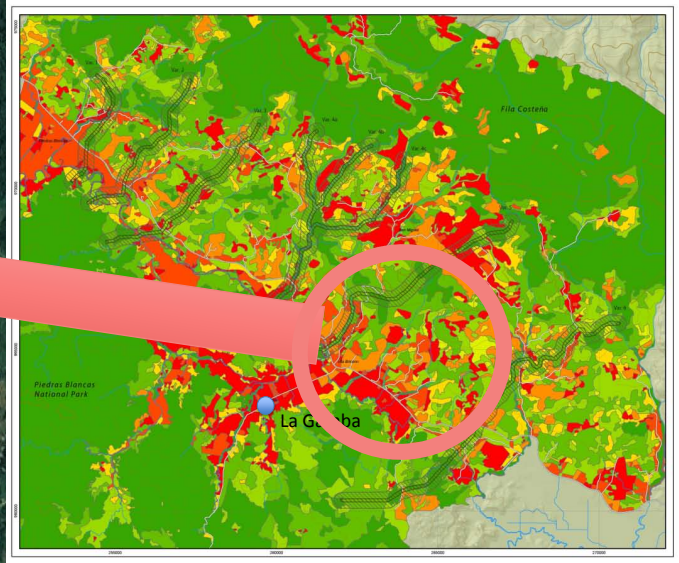
2007: Gifted by the Verein Regenwald der Österreicher

2023: 570 ha administrated by the Tropical Field Station La Gamba

Land-use types:

- Primary forest,
- secondary forest,
- riverine vegetation,
- abandoned cacao plantation,
- garden and buildings





Reforestation: sucession from pasture to forest

1996: forest law restricts the dramatic rate of deforestation in Costa Rica.
2013: more than 100 native tree species have been planted
but regeneration of damaged areas is still a huge challenge for ecologists.
2015: re-growing forest highlights succession of different plant species.
2018: collection of data from 19 planted species (12 families, 3 individuals/species).

Gradient of landscape degradation to assisted forest restoration

2013

2015

2016

Study: morphological & physiological plant traits

1) Aim: Characterize plant functional traits of tropical tree species
2) Hypothesis: Certain plant traits sustain faster growth?
3) Experiment: Collect intact **leaves** and **root** systems of different plants (i.e., 12 families, 3 individuals per species).

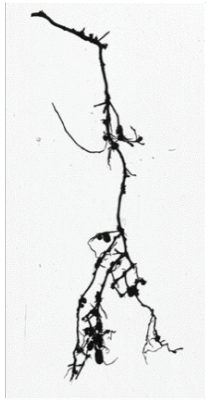
Fig. 1.: Aerial photograph of the reforestated area (Anton Weissenhofer).

Leaf: *Inga oerstediana*

Aboveground traits

- Stem diameter (DBH)
- Stem height
- Specific leaf area (SLA)
- Leaf N content (Nleaf)

Biologischer Korridor La Gamba COBGA



Root system: *Inga oerstediana*

Root morphological traits

- Specific root length (SRL),
- Specific root area (SRA)
- Root tissue density (RTD),
- Nodulation of N-fixing species

Root nutrient concentrations

Physiological traits

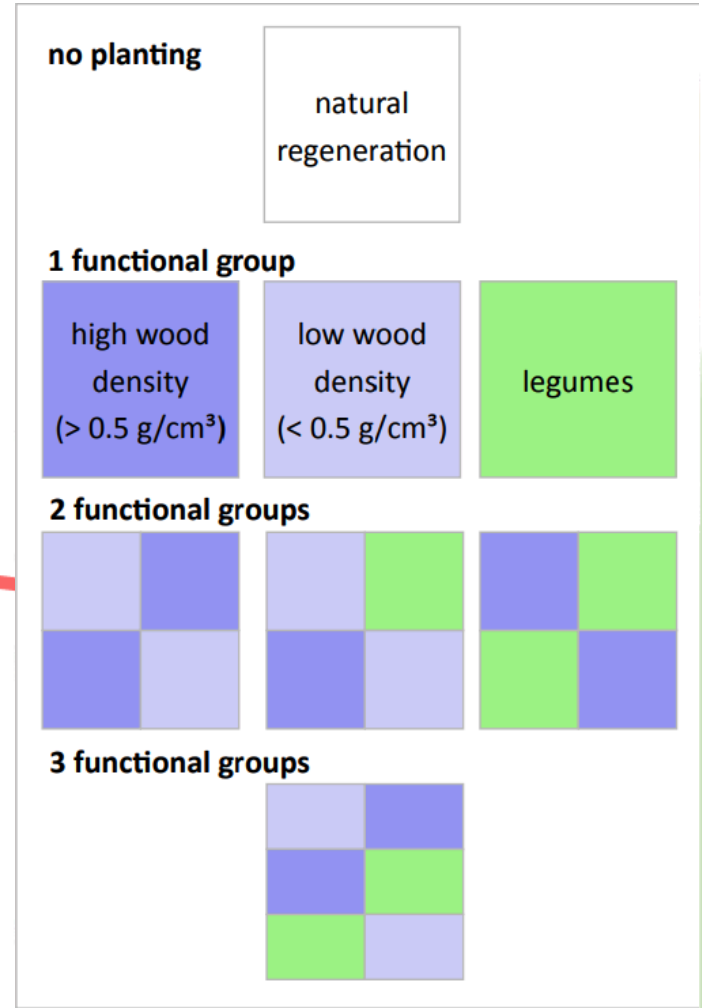
- Phosphatase enzyme rates

Interaction with soil microbes

Methods: experimental planting with randomized design

- More than 10,000 native trees have been planted 2012–2013
- Randomized plot design (3 functional groups in replicates: high density / low density / legumes)

Fig. 1.: Aerial photograph of the reforestated area (Anton Weissenhofer).



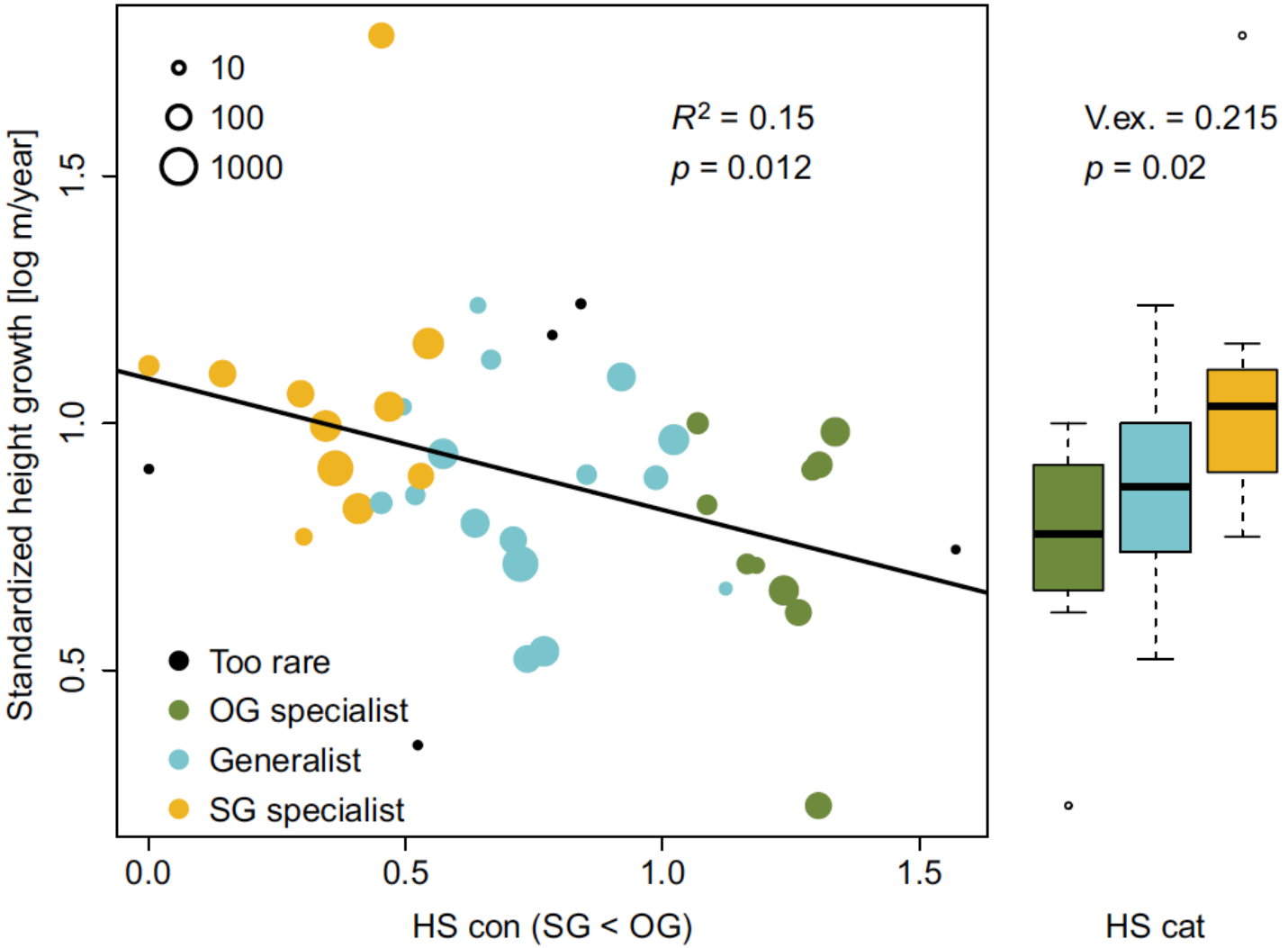
Results: performance related to plant growth strategy

- Hypothesis: Certain plant traits sustain faster tree growth

- Results: indicate some degree of habitat specialization:

- SG (secondary-growth): fast
- Generalist (G): in between
- OG (old-growth) specialist: slow

→ Functional differences need to be considered in models (cf Plant-FATE)



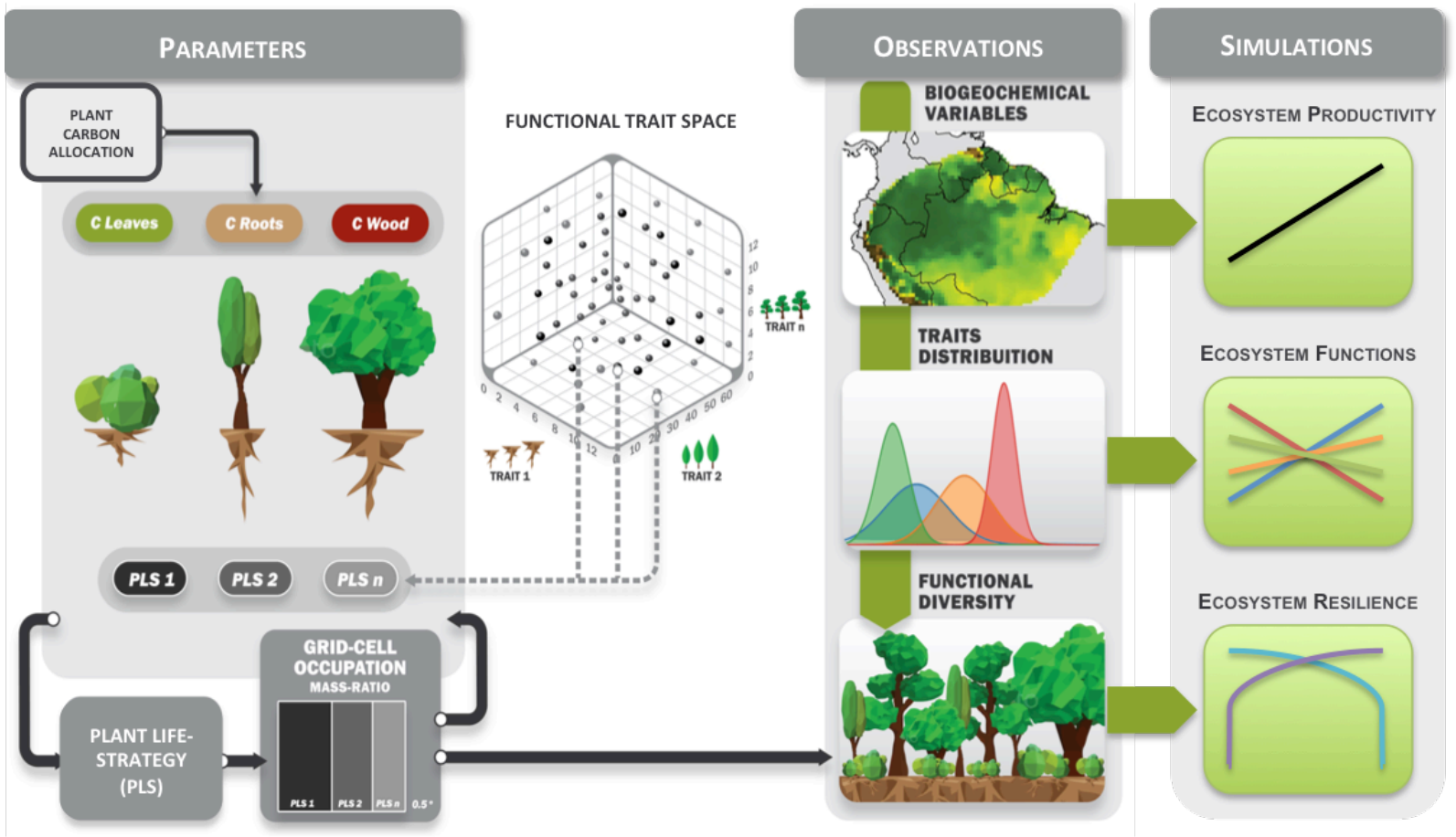
Model: simulating vegetation response to the environment

Explore research questions:

R1: Does a more diverse system support more ecosystem functions?

R2: Is a functionally diverse system more resilient to climatic fluctuations?

R3: What are the mechanisms determining forest resilience to climatic extreme events?



Rius, B.F., …, Hofhansl, F., et al., (2023). Higher functional diversity improves modeling of Amazon forest carbon storage. *Ecological Modelling*. 481, e110323.

‚Immerse yourself in a tropical rainforest...‘

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Acknowledgements & Partners

Thank you for listening!

Happy to take your questions…

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