



RESTORATION OF TROPICAL FOREST MULTIFUNCTIONALITY

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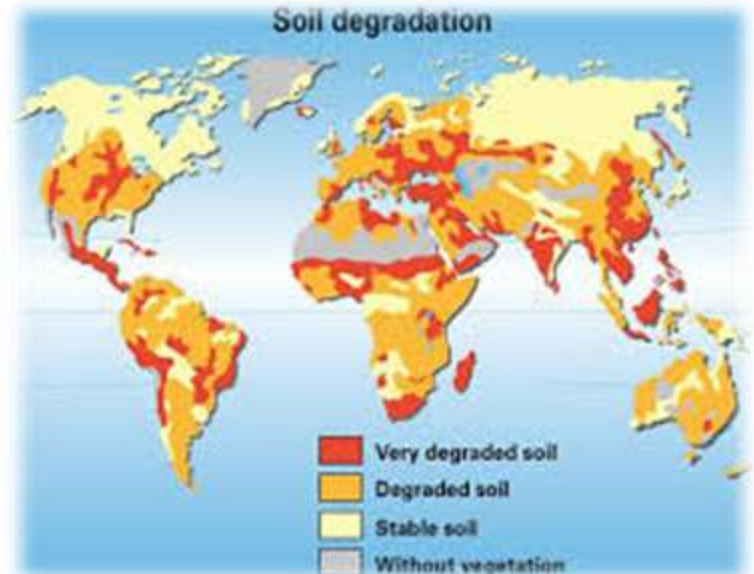
ESALQ



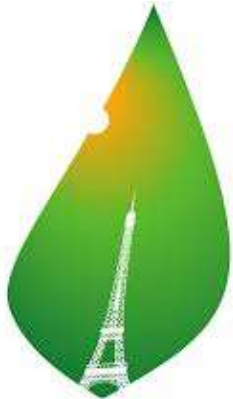
Universidade de São Paulo



Ecosystem restoration ambitions



Ecosystem restoration pledges



**1 platform,
1 community,
1 decade,
1 trillion trees.**



The need for science-based decisions

topographic position, land use, connectivity



results

where?

ecosystem services



how?

why?

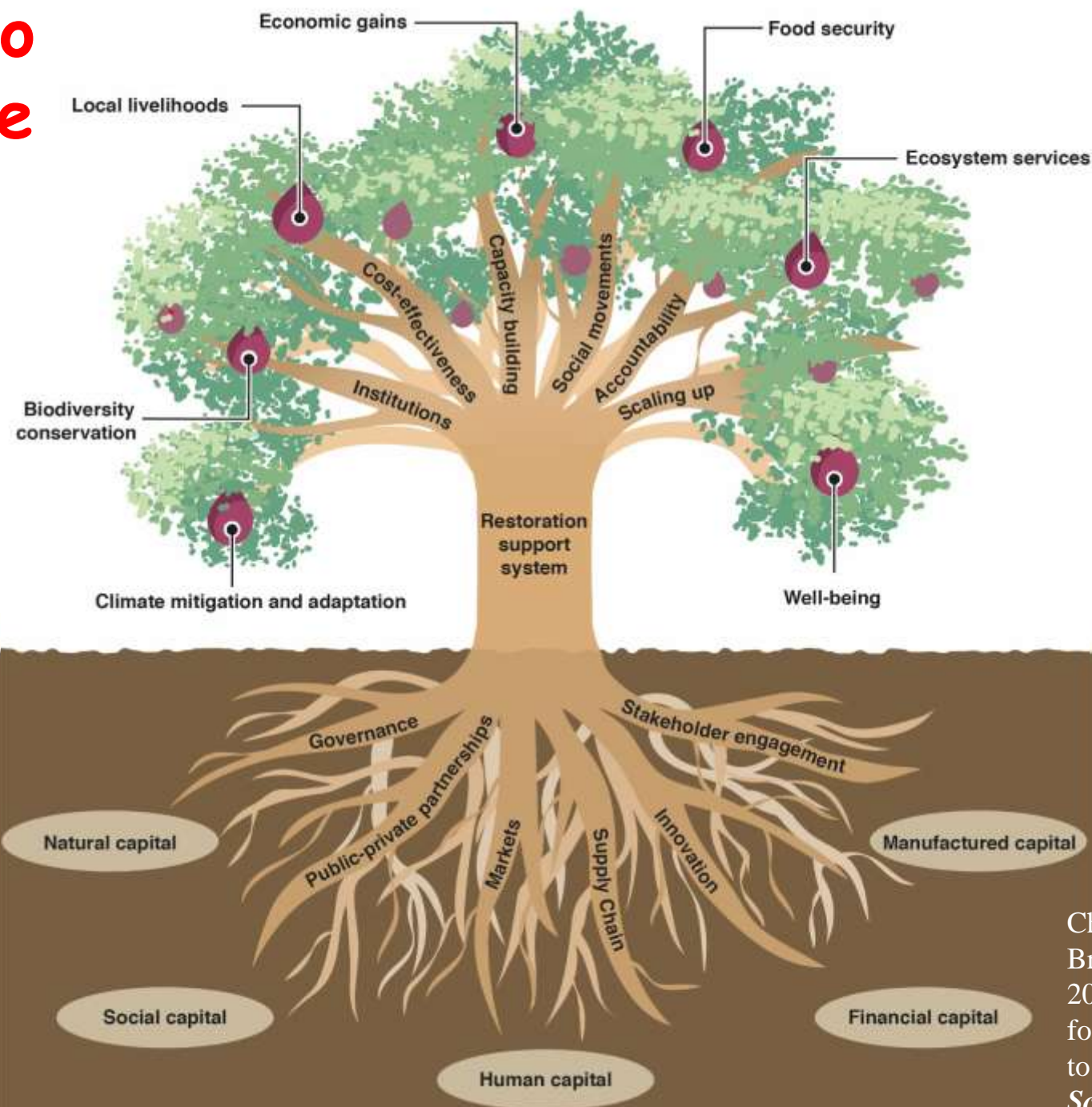
fuel, food, fiber
biodiversity



monocultures,
restoration plantings,
natural regeneration,
agroforestry



Why to restore ?



Chazdon, R.L. & Brancalion P.H.S. 2019. Restoring forests as a means to many ends. *Science* 365: 24.

Problems



resources wasted



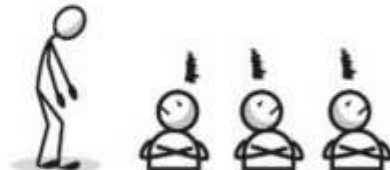
water yield reduction



destruction of native grasslands and dissemination of invasive tree species



displacement of farmland



social conflicts

Benefits



carbon stocking and hydrologic cycling



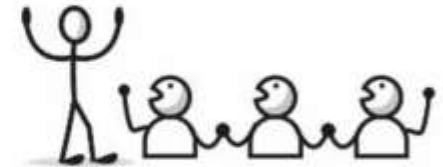
cost reduction by natural regeneration



increase landscape connectivity and reintroduction of native species



restoration of abandoned lands

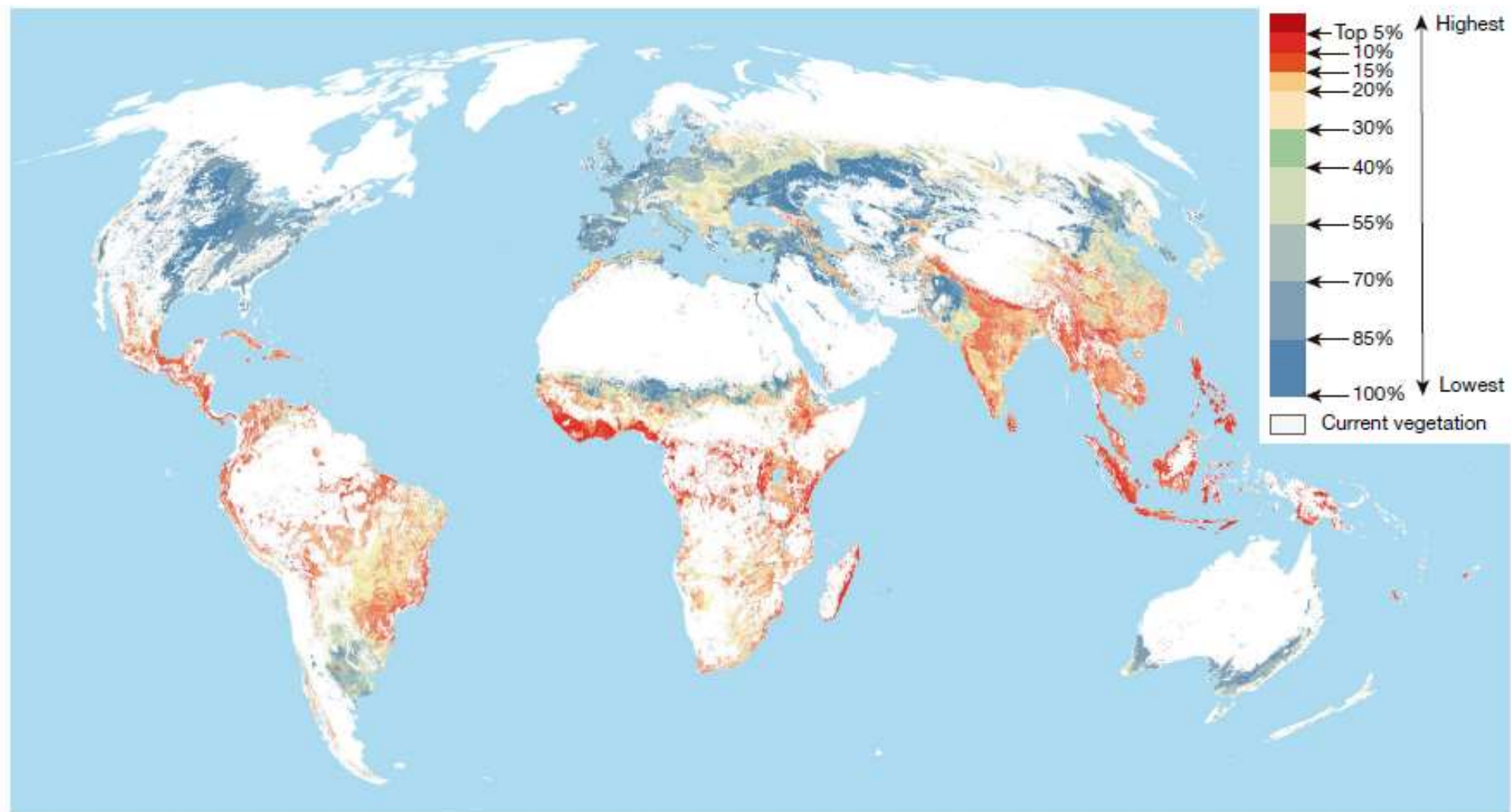


enhancement of livelihoods

Holl K.D. & Brancalion P.H.S. 2020. Tree planting is not a simple solution. *Science*

Brancalion P.H.S. & Holl K.D. 2020. Guidance for successful tree planting initiatives. *Journal of Applied Ecology*

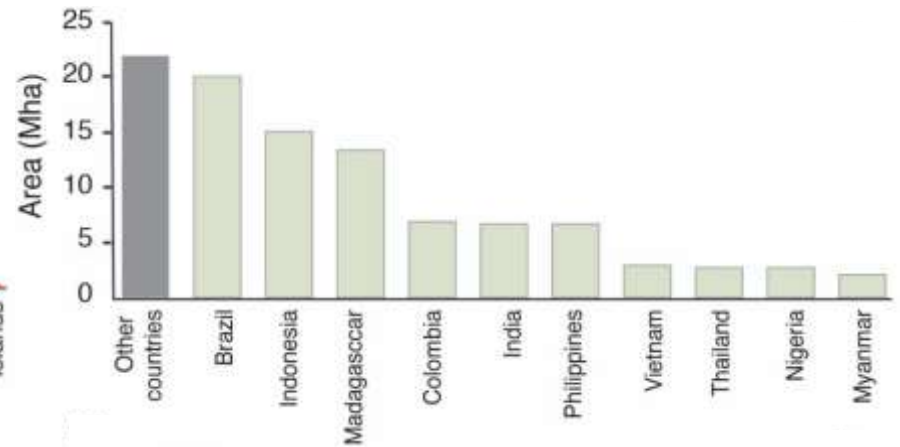
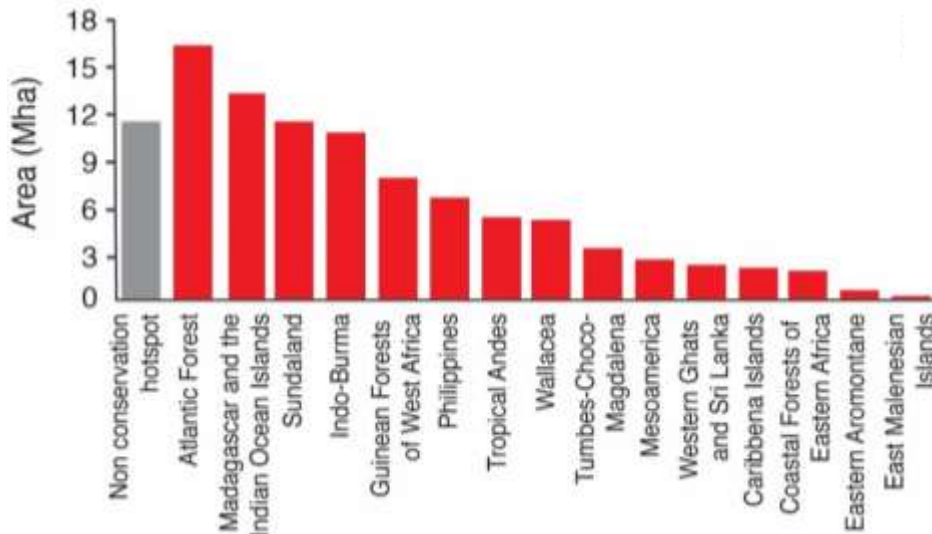
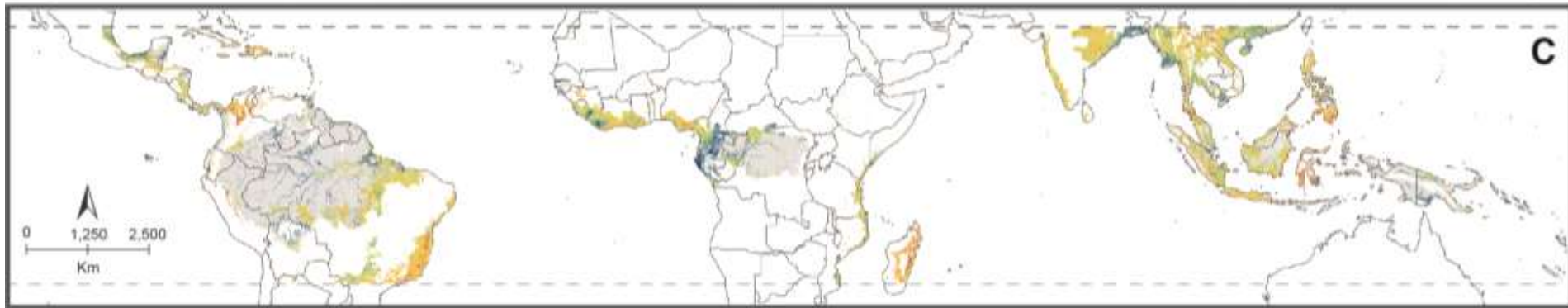
Where to restore



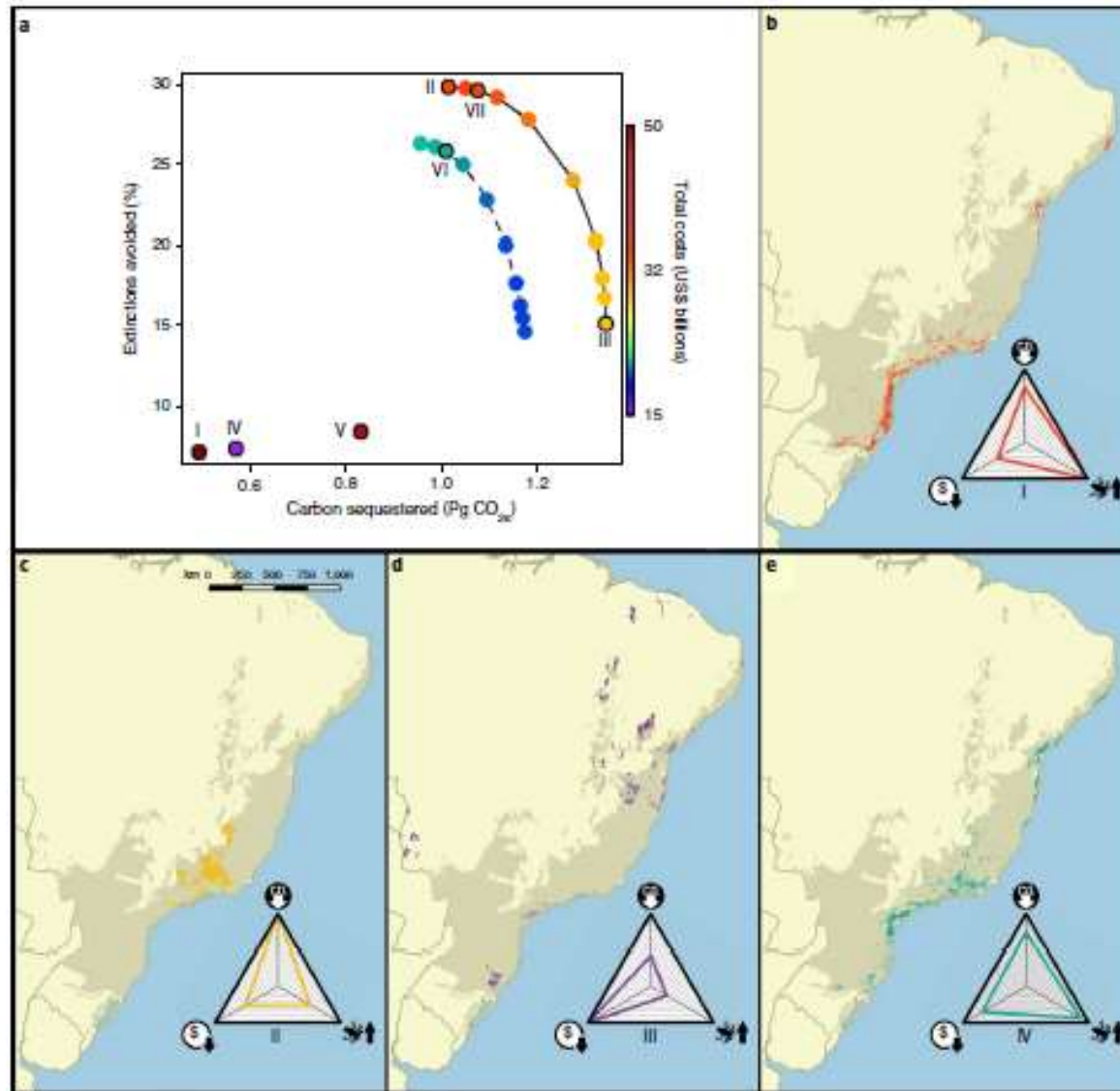
Where to restore

Benefits

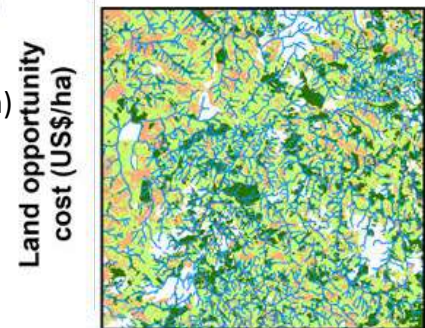
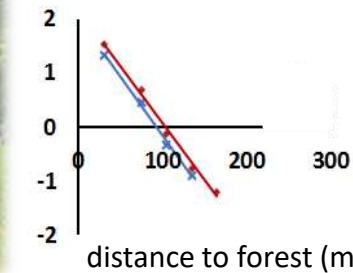
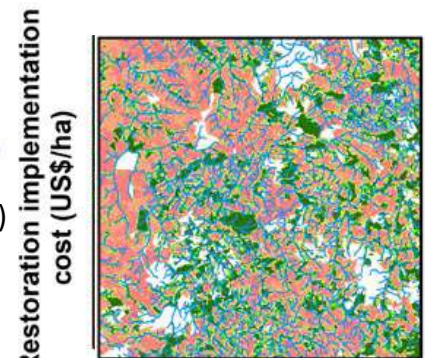
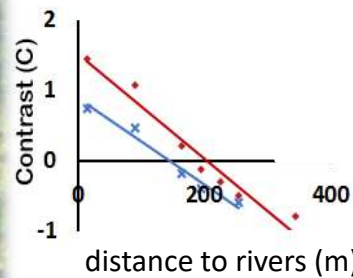
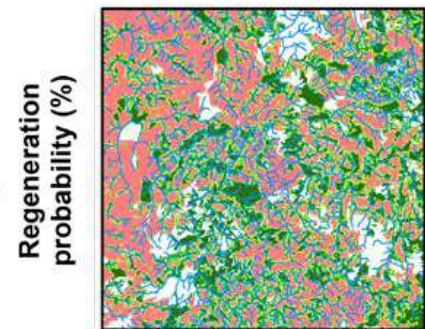
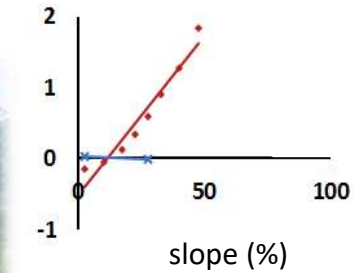
+ Feasibility



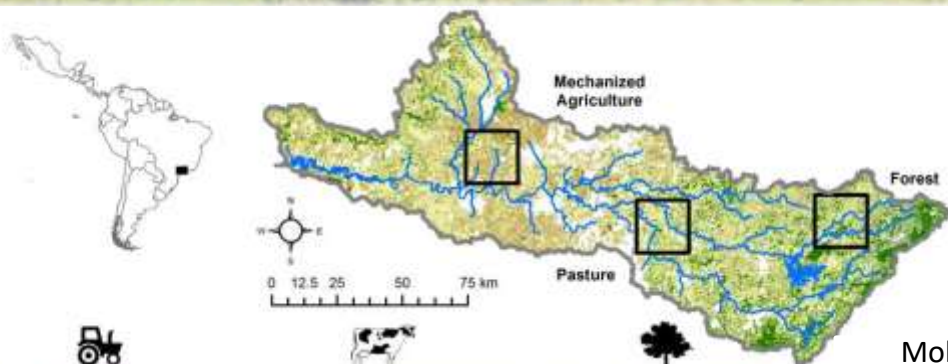
Where to restore



Where to restore



Study Area



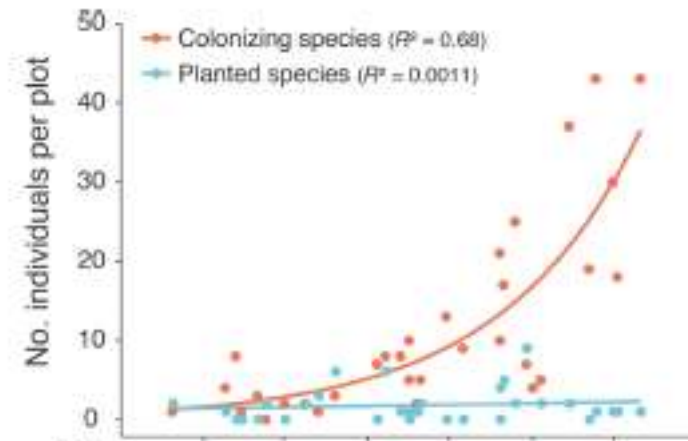
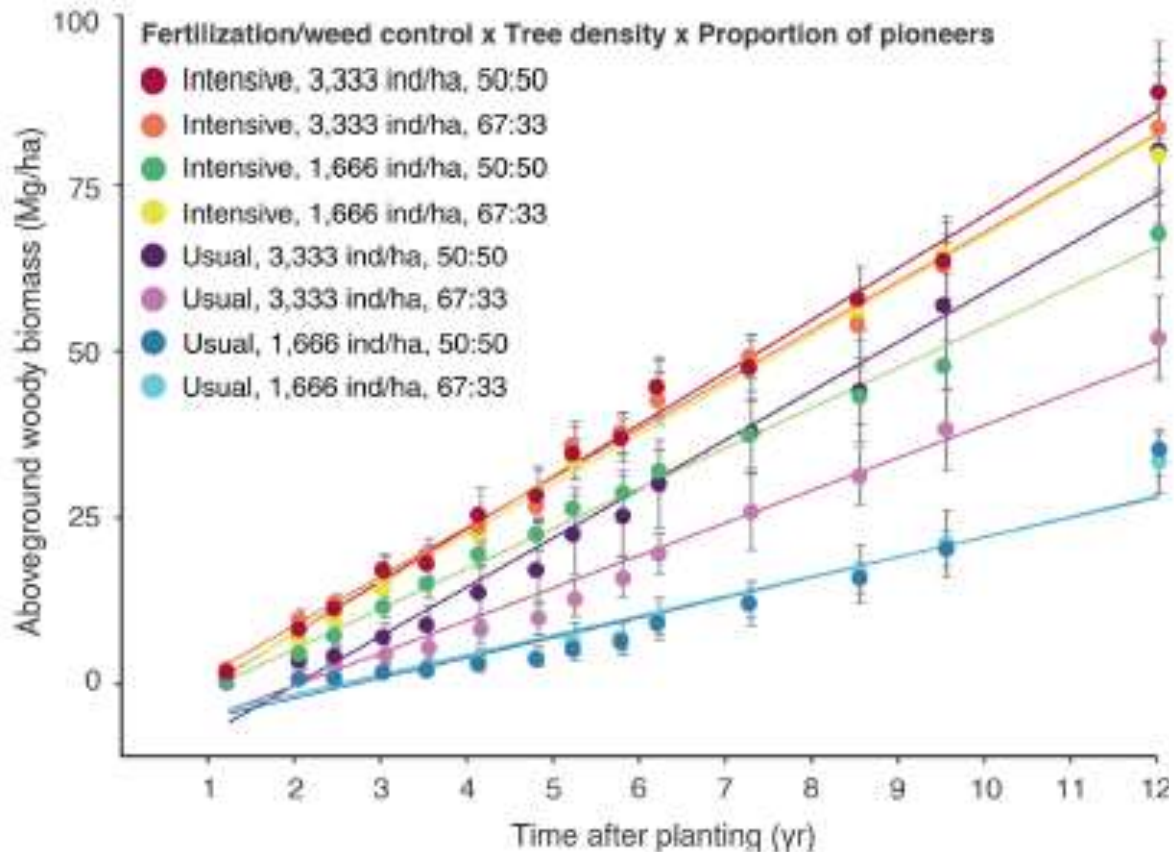
How to restore



Image: WRI

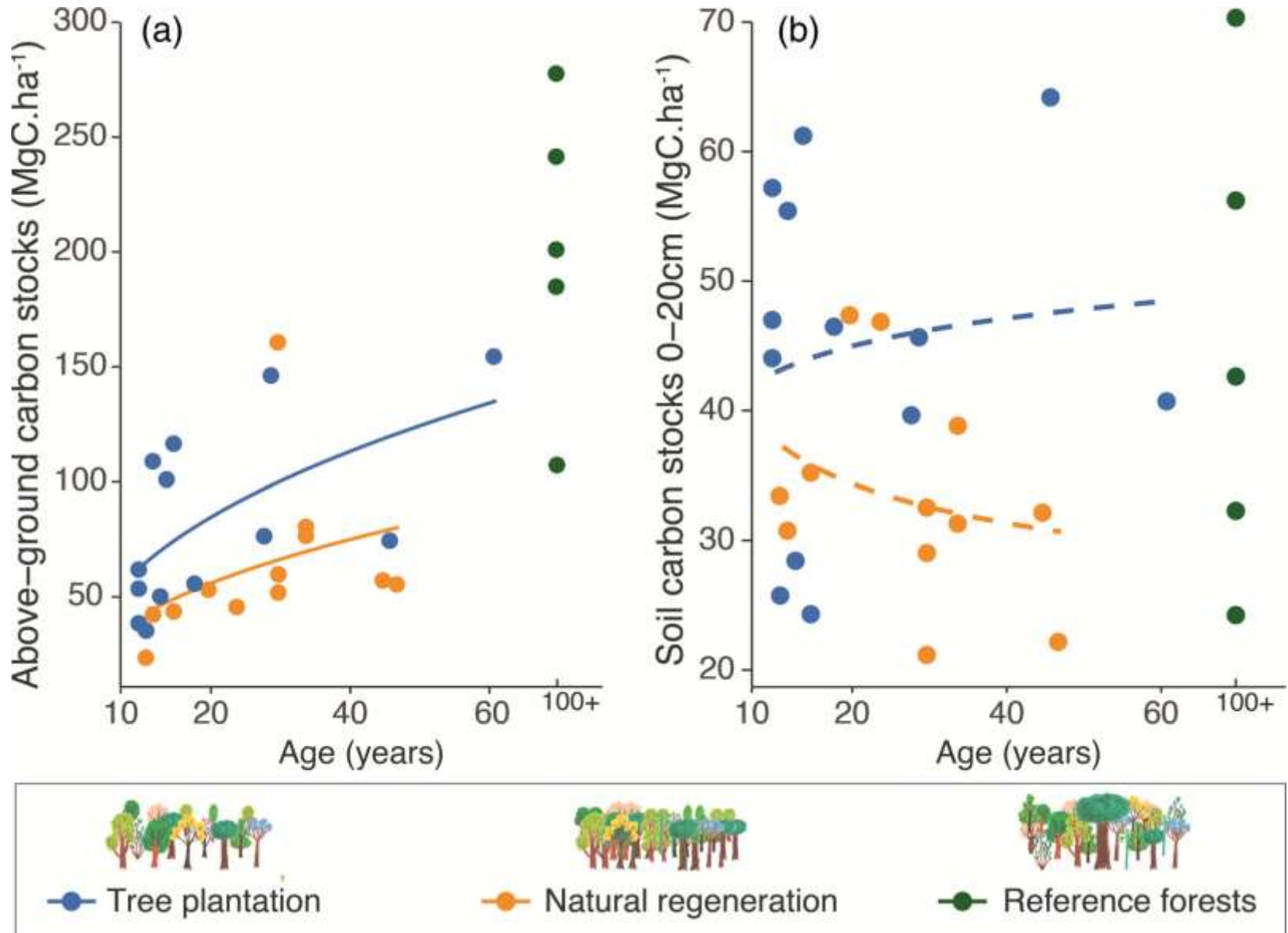


How to restore

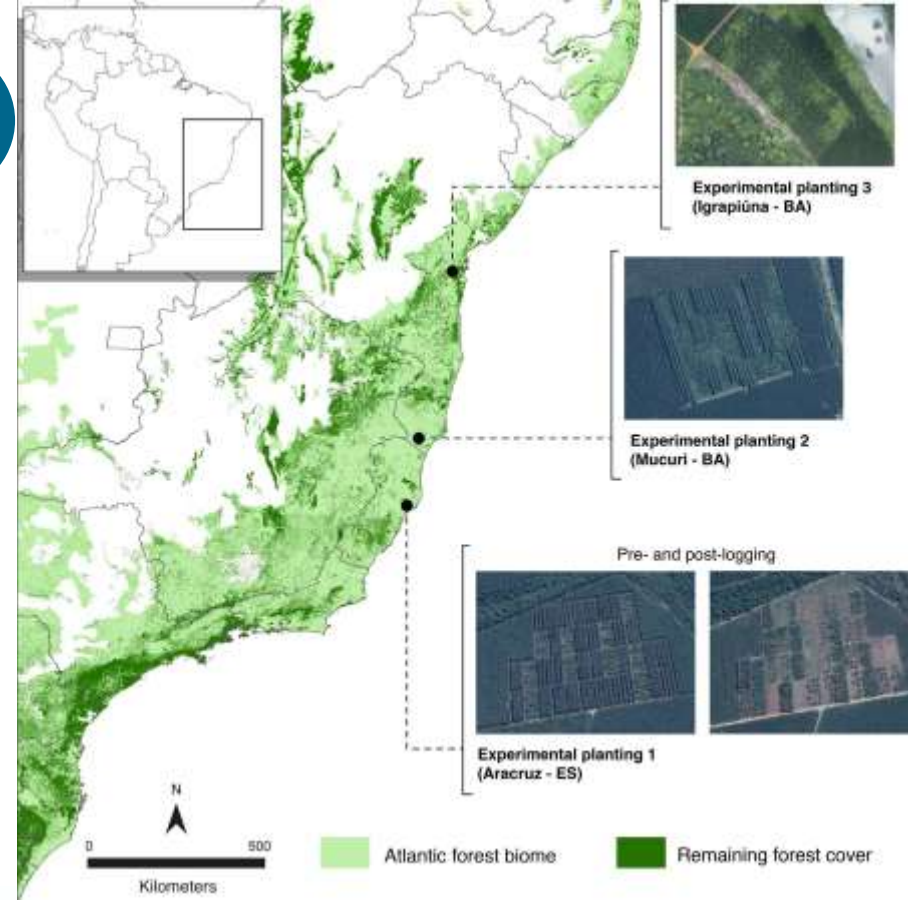
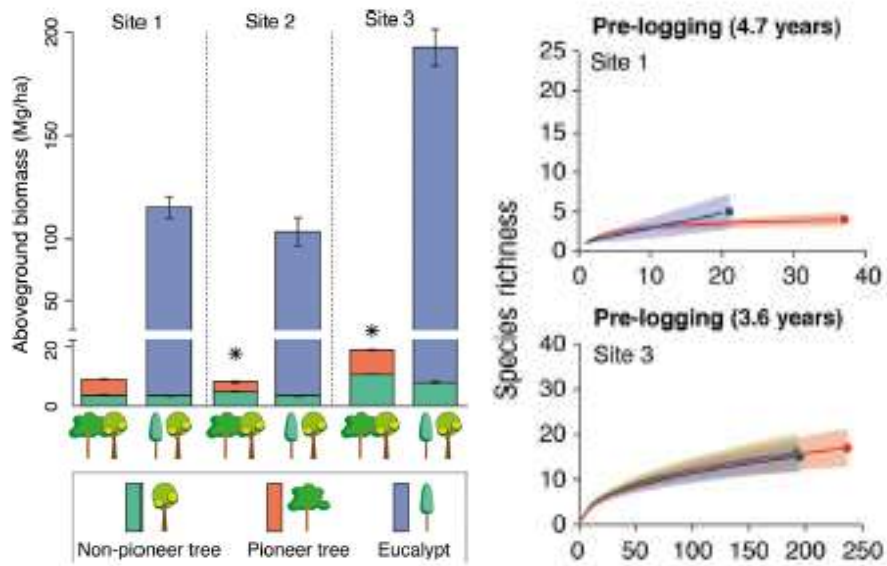


Brancalion PHS, et al. (2019) Intensive silviculture enhances biomass accumulation and tree diversity recovery in tropical forest restoration. **Ecological Applications**

How to restore



How to restore



Brancalion, P.H.S. et al. (2019). *Journal of Applied Ecology*









A mechanistic carbon budget model



Which is the impact of forest restoration in carbon fluxes?



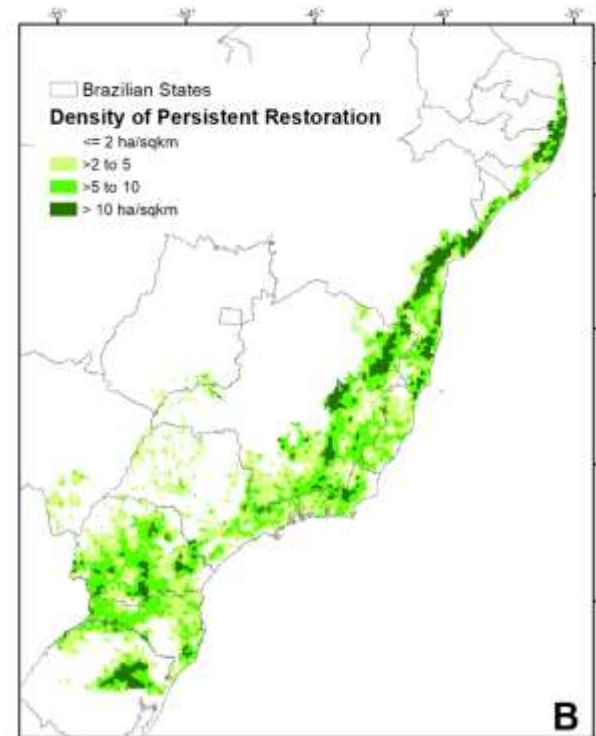
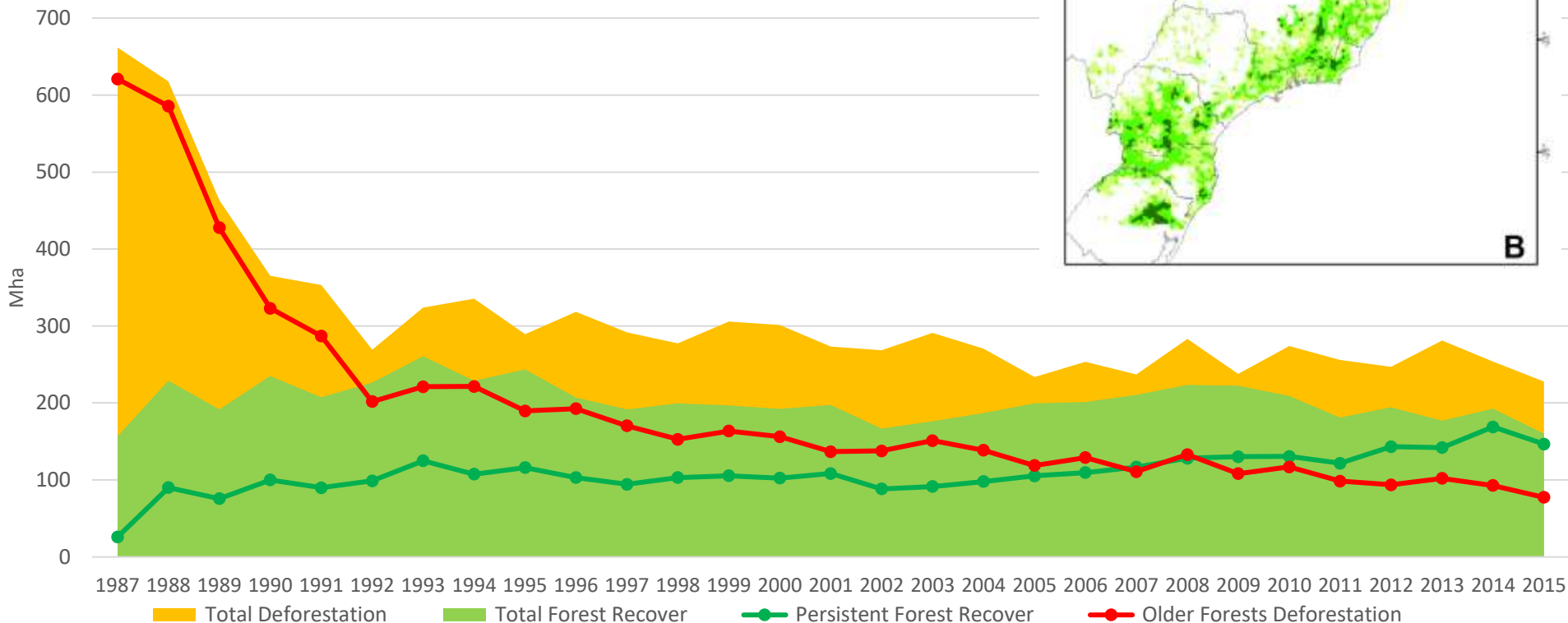
- ✓ Planting in 2019
- ✓ 30 ha, 6 species, functional gradient
- ✓ Manipulation of water and nutrient availability



A re-emerging Atlantic Forest

- ❖ ~700,000 ha from 2011-2015
- ❖ ~1.5 Mha in 2020
- ❖ ~20 Mha of regeneration potential

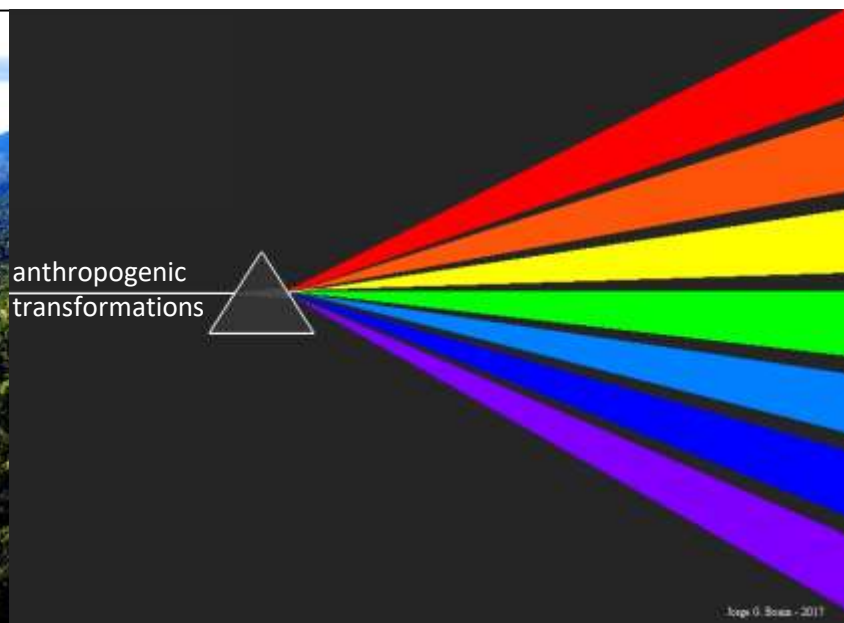
(Crouzeilles et al. 2019, *Conservation Letters*; Rosa et al. 2021, *Science Advances*)



New Forests

Continuous forest cover

New forests

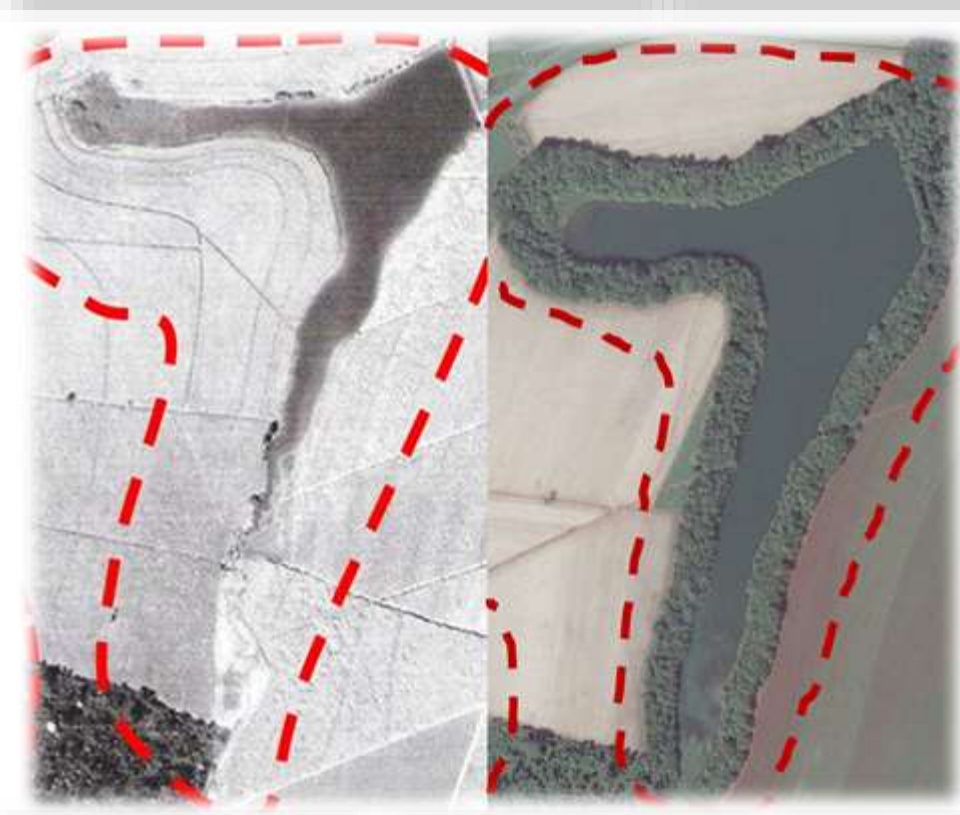


- agroforests
- monocultures in use
- stands of invasive species
- mixed plantations
- monocultures abandoned
- restoration plantations
- natural regeneration



- degraded forest remnant
- conserved forest remnant
- Agro-pastoral land uses

Who are the new forests? Where are they? Which benefits they provide? How to maximize their benefits to nature and people?



New forests multifunctionality



Multifunctionality (30x30m plots)

- ✓ aboveground biomass
- ✓ natural regeneration
- ✓ timber production
- ✓ functional and taxonomic diversity
- ✓ dead wood
- ✓ soil cover by litter
- ✓ soil water infiltration
- ✓ fine roots
- ✓ soil carbon
- ✓ nutrients and texture
- ✓ micro- and macro-porosity
- ✓ soil hydraulic conductivity

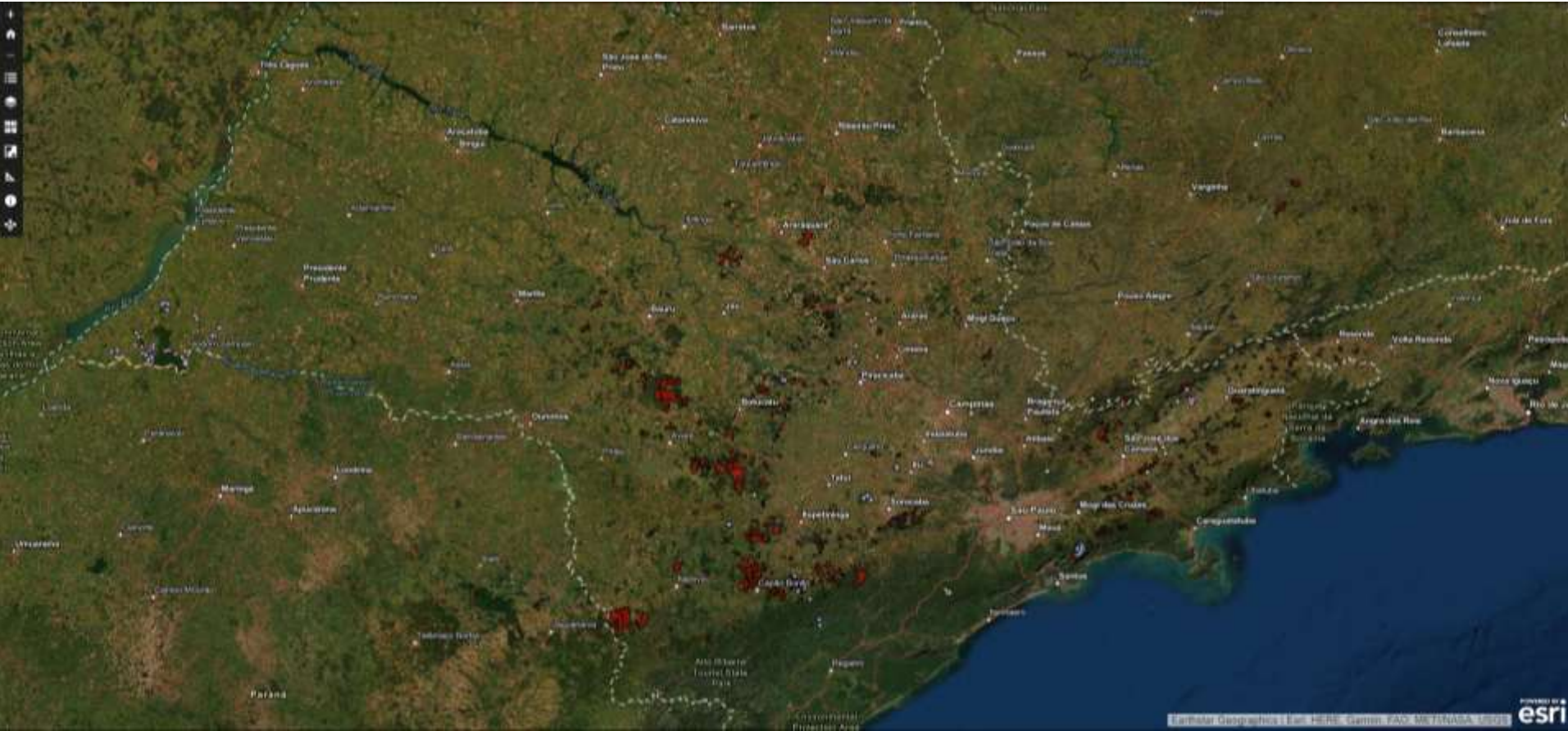
Remote sensing of new forests



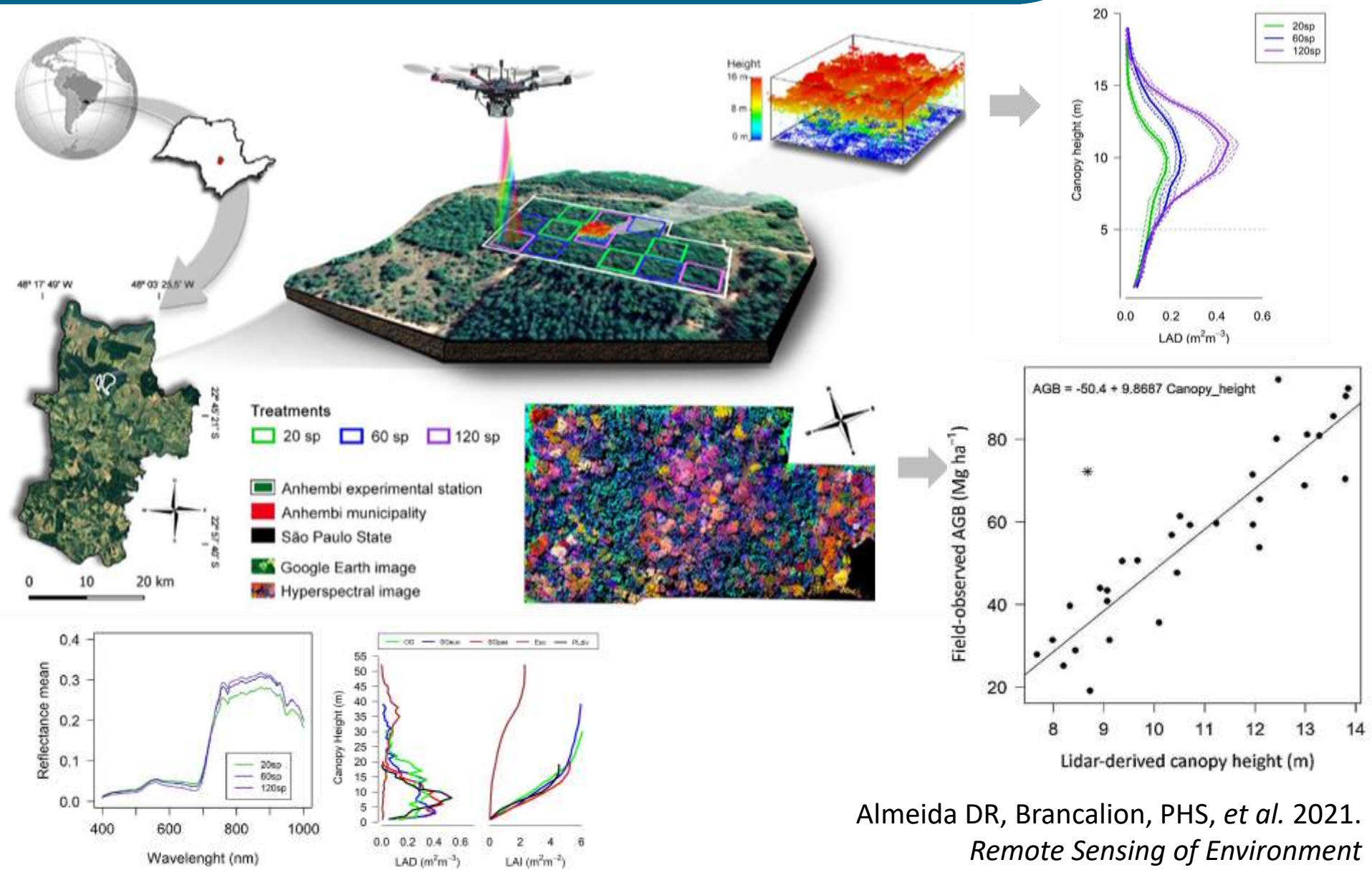
~1,000 plots, 40 landscapes

~500.000 ha of lidar data

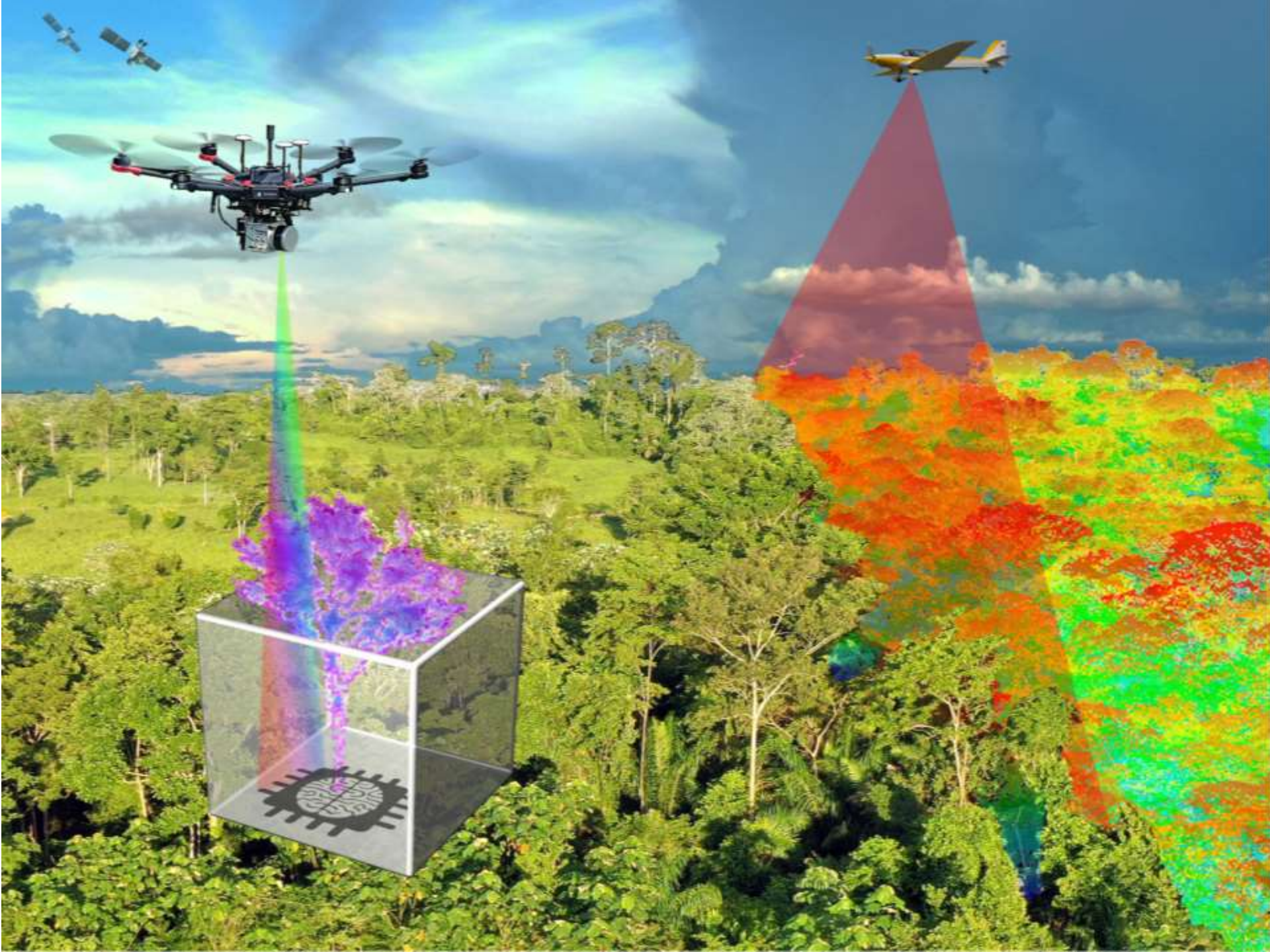
<https://cepe-geo.maps.arcgis.com/apps/View/index.html?appid=d1c91fe2ccad4c79bb0fca5c216bbc16>



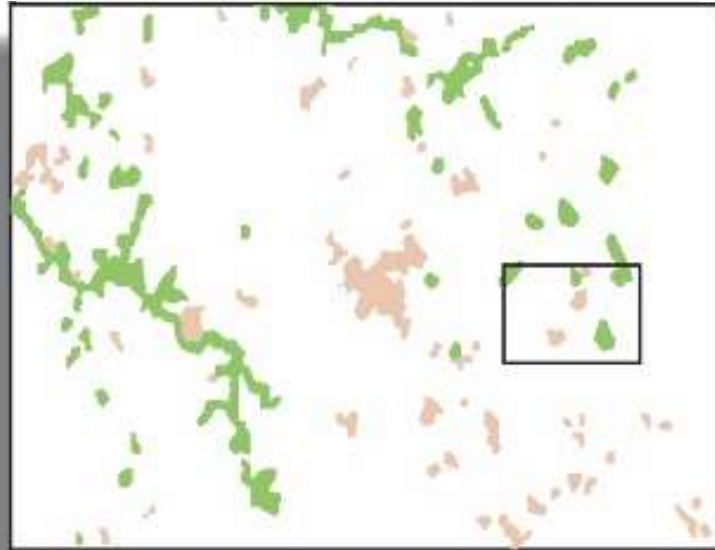
Remote sensing of new forests



Almeida DR, Brancalion, PHS, *et al.* 2021.
Remote Sensing of Environment



Integration and upscaling



3 Land use change and satellite data (e.g. GEDI, NDVI)

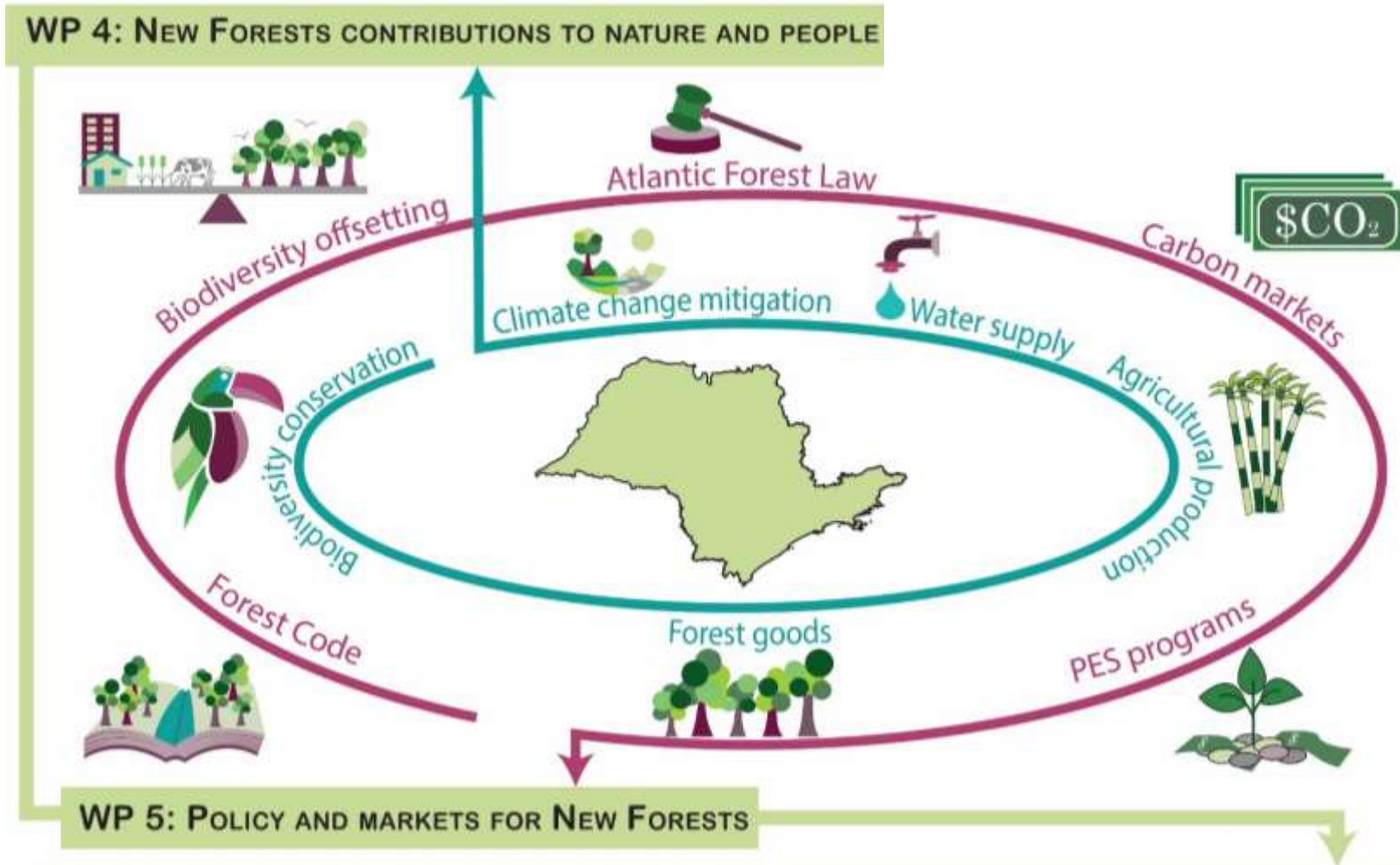
2 lidar and hiperespectral data



1 field plots



Decision support tools



www.facebook.com/projeto.newfor/



blognewfor.blogspot.com/



www.instagram.com/projeto_newfor/



www.youtube.com/NewFor



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