

# Payment for Environmental Services

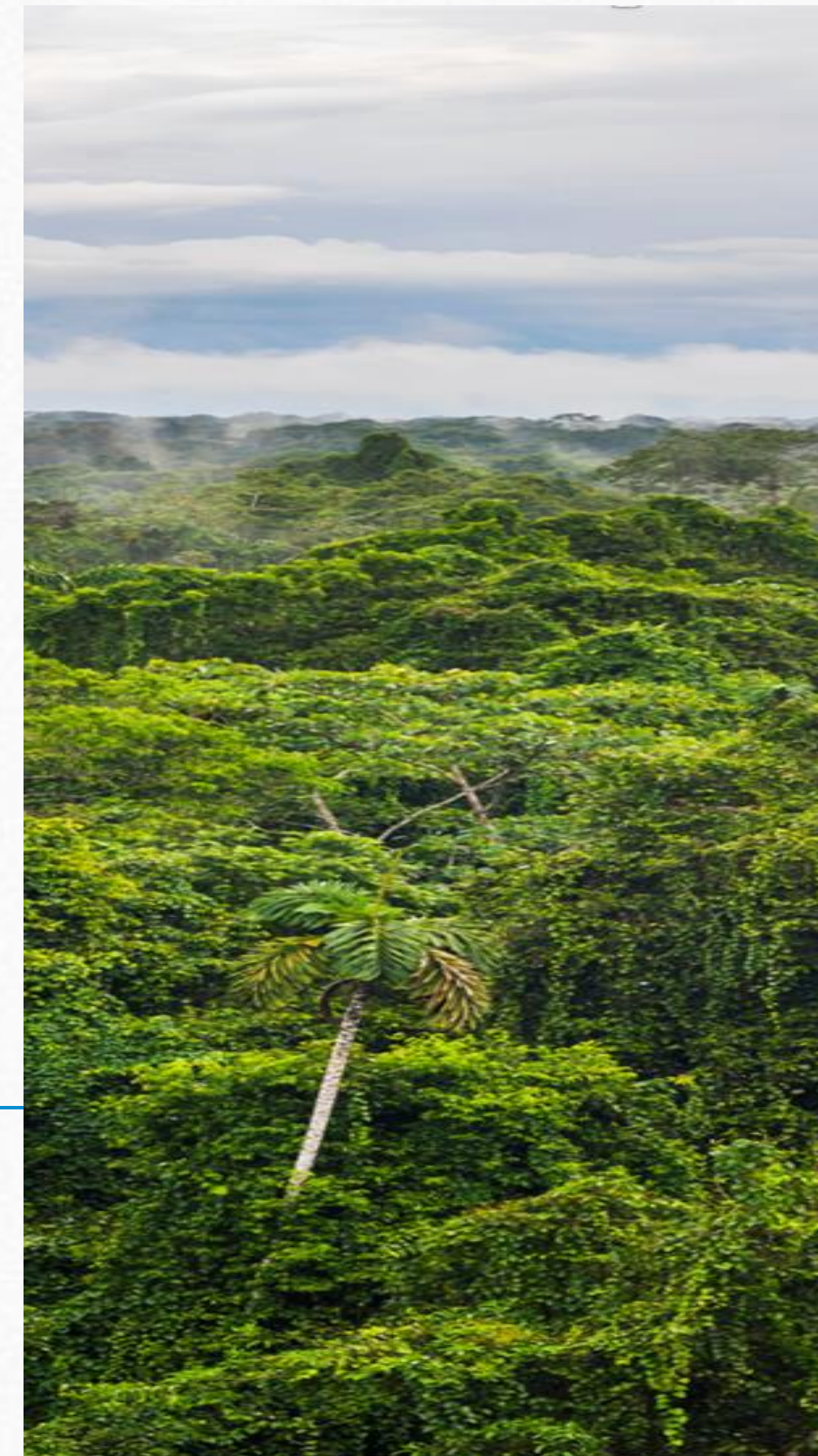
Land-Use Dynamics in the Amazon

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# Agro-Economic Modeling for Brazil

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Projecting the future: policies to preserve the Amazon, meet NDC targets, implement the Forest Code, and achieve low-carbon agriculture



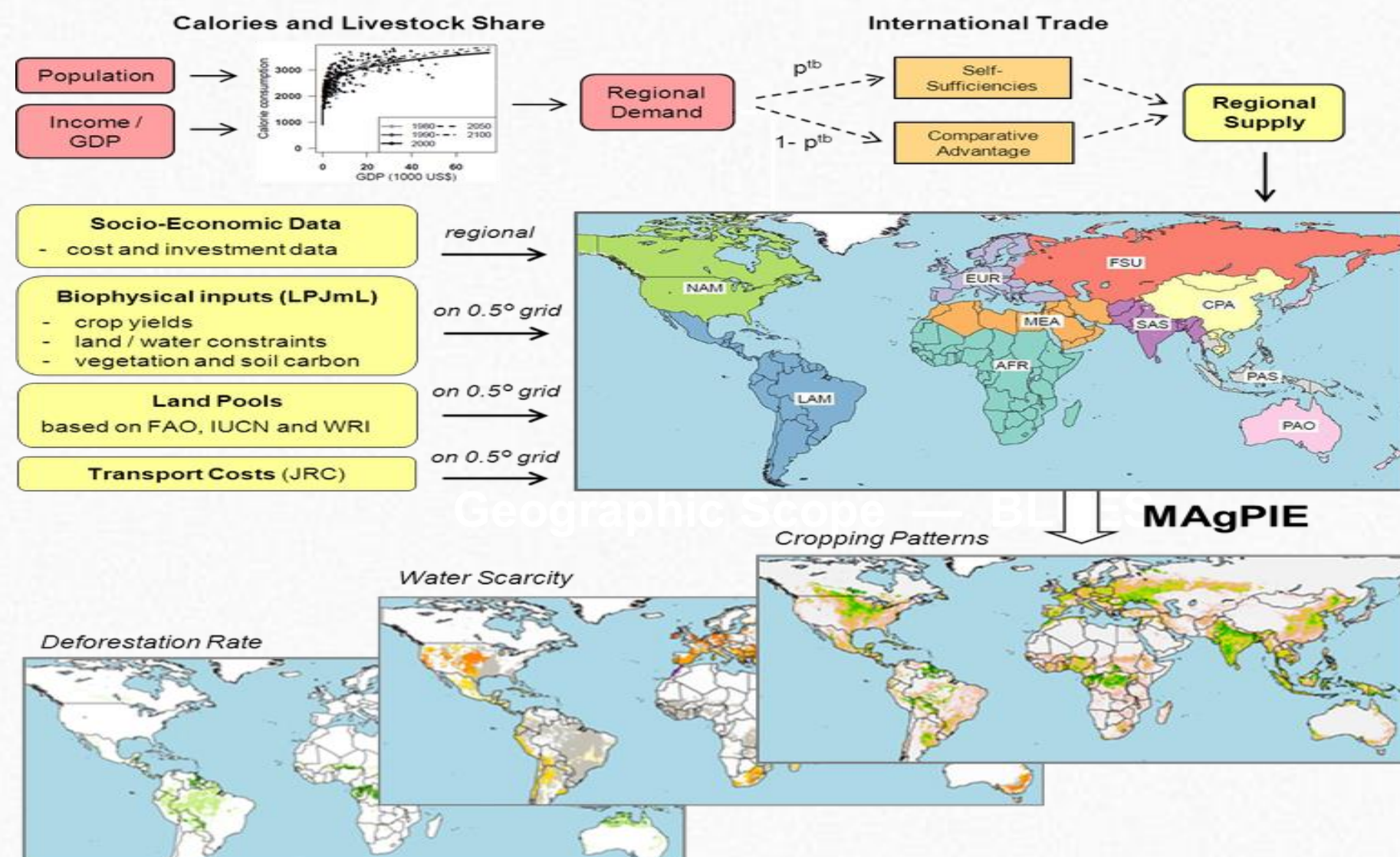
**Objective:** develop a customized agro-economic model with detailed representation of Brazil for scenario projections on:

- Forest Code implementation and Brazil's NDC targets
- Infrastructure development in the Amazon biome
- Forest restoration, agricultural expansion, and integrated farming systems in the Amazon
- Climate change impacts on agriculture and forest preservation in the Amazon

# The MAgPIE Model

## Overview

- Global *open-source* partial-equilibrium land-use model developed by PIK (Potsdam Institute)
- Integrates biophysical and economic factors to simulate crop and livestock production, forestry, and GHG emissions through 2100



## Deforestation — MAgPIE



**Endogenous** — Driven internally by economic incentives and biophysical constraints; an emergent outcome, not an assumption

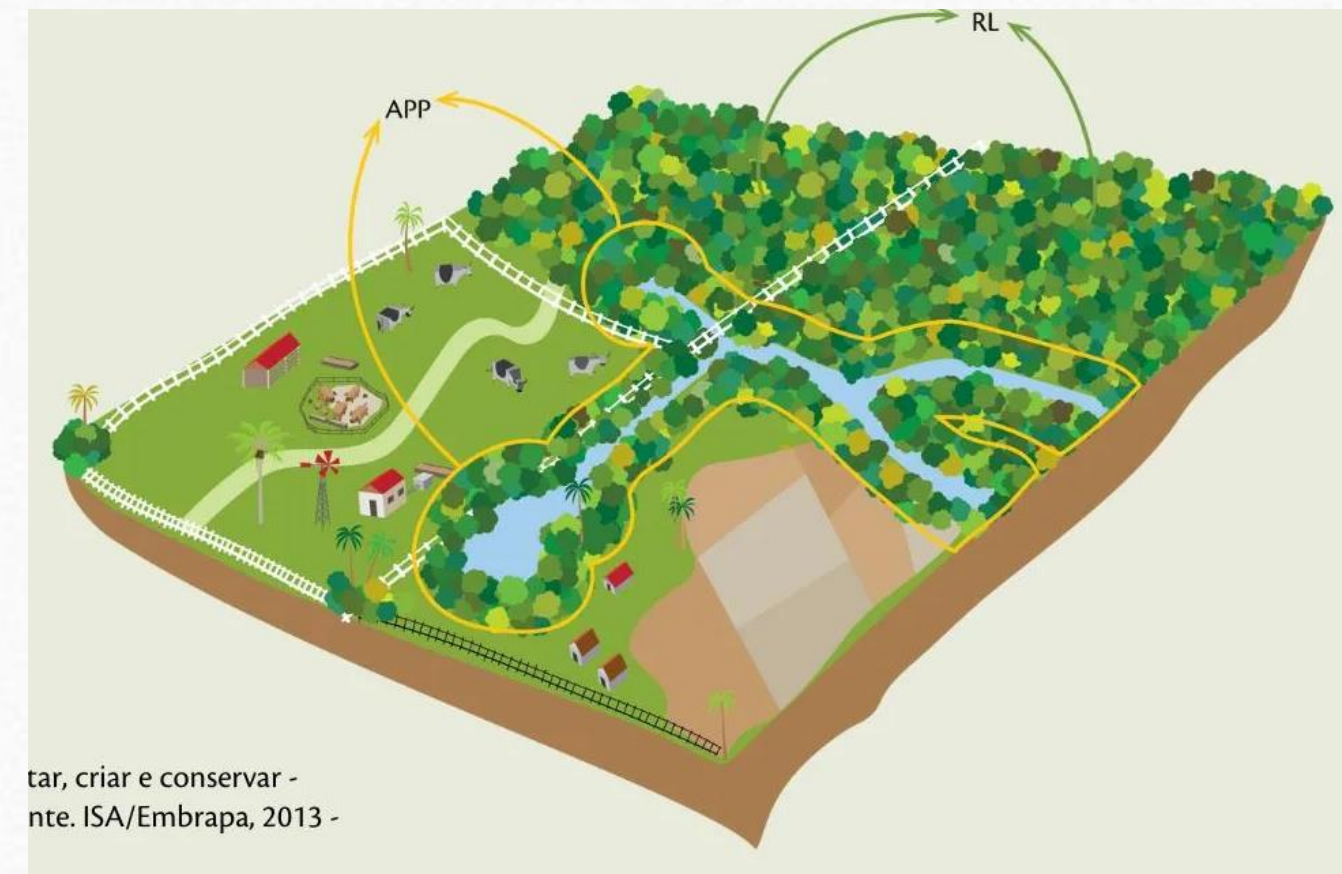
## Geographic Scope — MAgPIE



**Global** — Global coverage; captures indirect effects across regions

# The Brazilian Forest Code, 2012

- CAR (*Cadastro Ambiental Rural*): **national electronic registry** for rural properties
- Supports **monitoring** and **deforestation** control
- **Registration does not ensure compliance**
- CAR is a **Self-declared system** but **Permanent** registry, regulated by Decree 7,830/2012
- Permanent Preservation Areas (**APP**) and Legal Reserves (**RL**) must be **mapped**
- Non-compliant areas must join Regularization Environmental Program (PRA - *Programa de Regularização Ambiental*) or use Environmental Reserve Quotas (CRA – *Cota de Reserva Ambiental*)



**Census / IBGE**  
Rural Establishments  
**5.07 M**

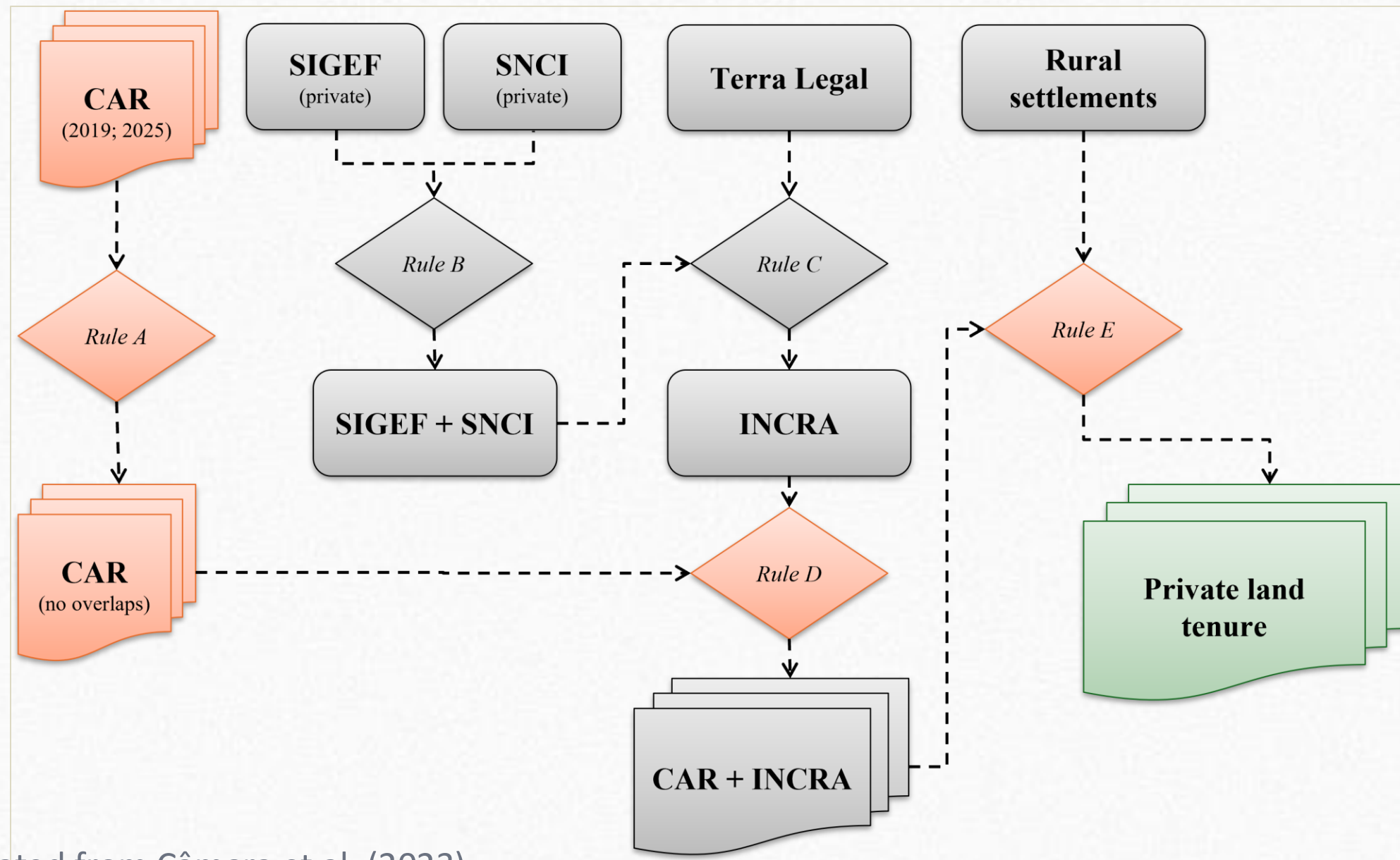
vs

**CAR / SICAR**  
Self-declared  
environmental registry  
**7.9M**

## Agricultural Census (IBGE, 2017)

**5.07M** rural establishments | **351M ha** total area  
77% family farming | 1% of farms hold 48% of farmland

# Database Harmonization



Updated from Câmara et al. (2023)

**Gap:** CAR lacks state validation and verified land titles.

**Need:** Unified system integration.

## Inter-ministerial Decision for the Climate Plan

MMA, MAPA, MDA, and MCTI agreed to exclude CAR as an official database, adopting only SIGEF/SNCI (INCRA) as the authoritative source for land data.

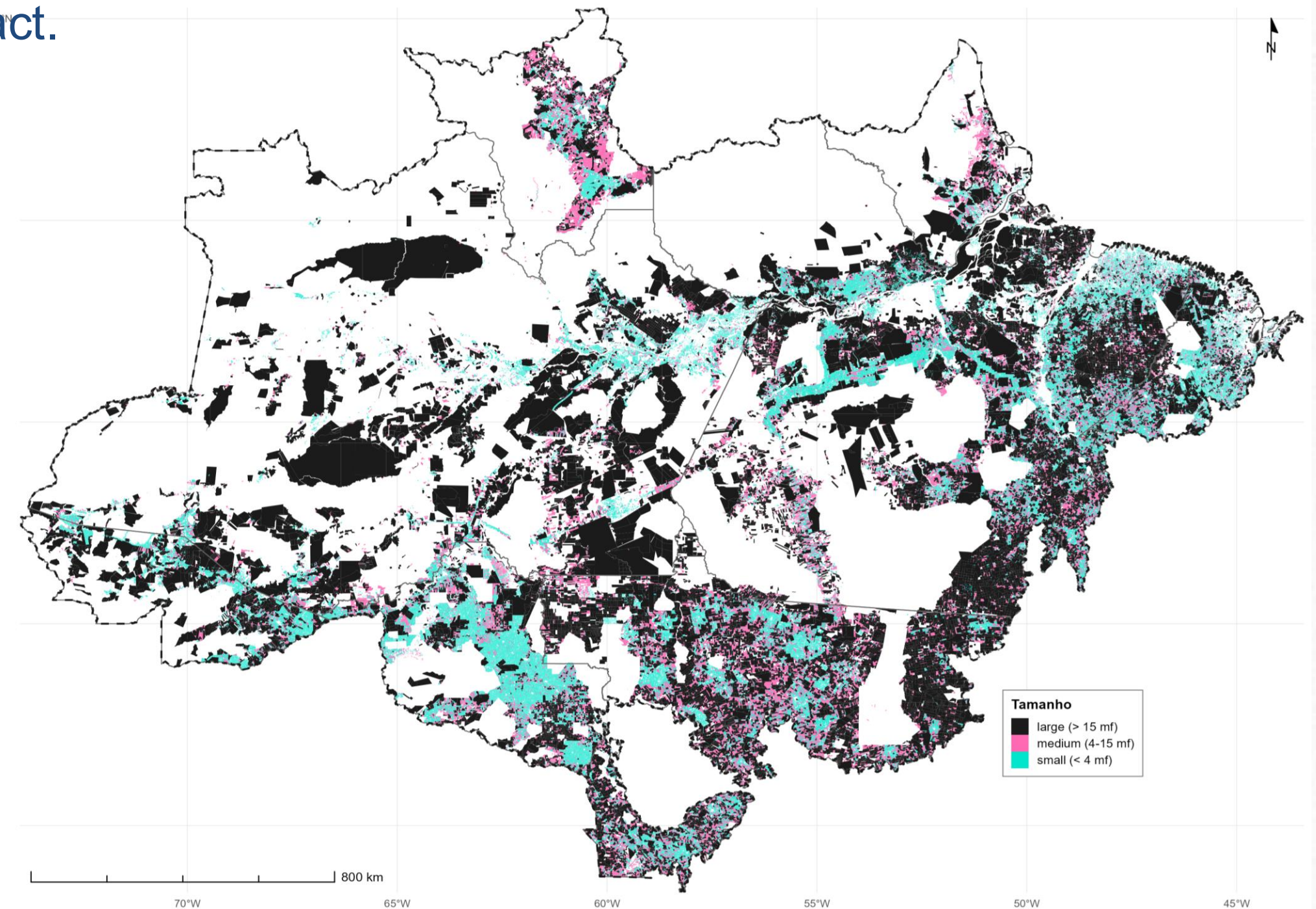
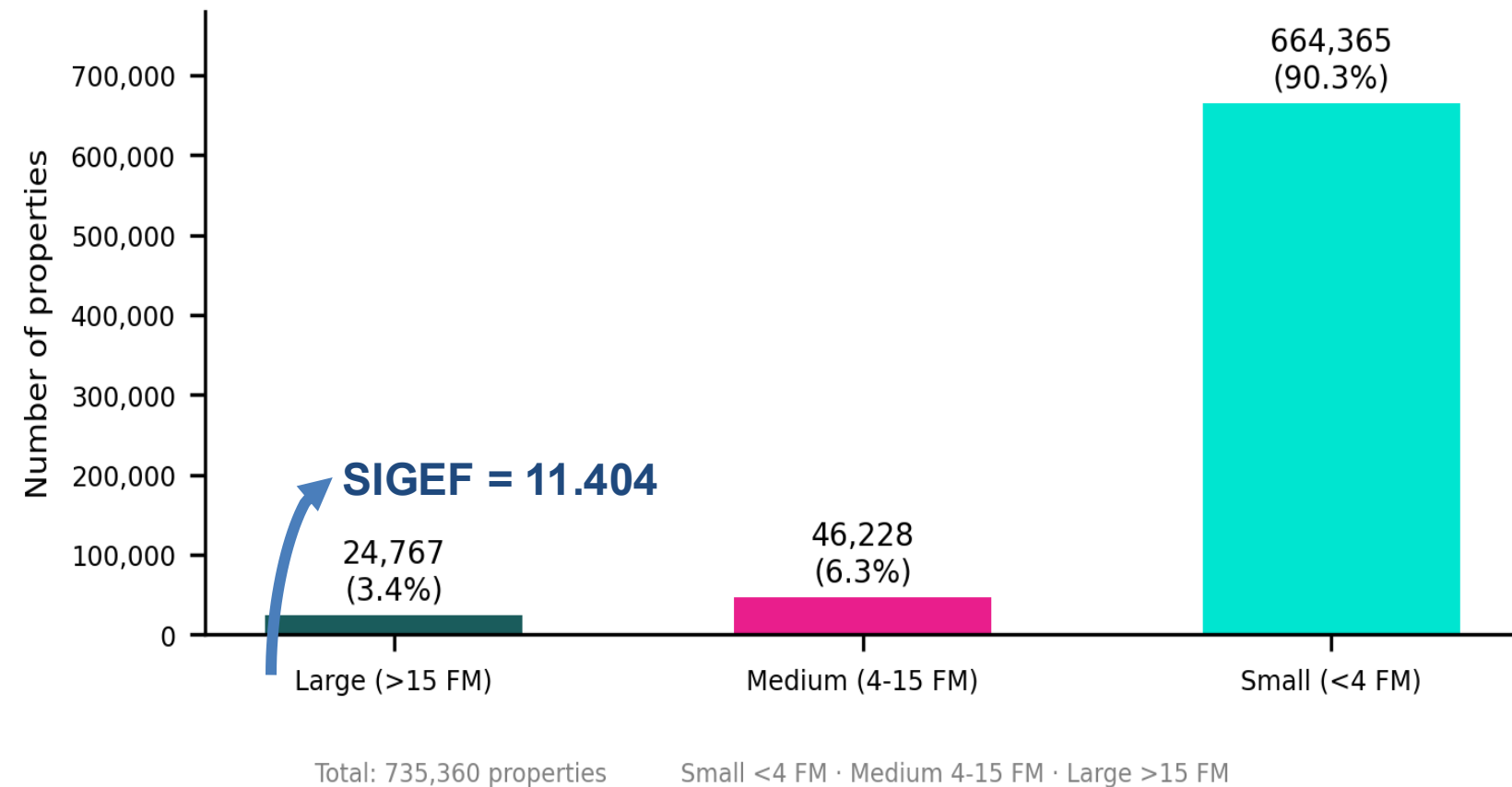
**Rationale:** CAR is self-declared and does not meet georeferencing standards (Lei 10.267/01). Its purpose is land-use mapping for Forest Code compliance (Lei 12.651/2012), not land tenure registration.

# Land tenure structure

- 24,700 large properties (> 15 fiscal modules) hold 163.9 Mha, equivalent to nearly 20% of the Amazon biome territory, and are where productivity, traceability, and Forest Code compliance policies have the greatest aggregate impact.

Amazon Biome: 733,730 records

Number of private properties by size



Based on the methodology of Câmara et al., 2023.

# Legal Reserve

- Updated estimates for 2025 indicate a **net liability to restore of 5.83 Mha** on private properties in the Amazon biome, addressable through market instruments provided for in the Forest Code.
- 4.1 million ha** to be restored in small and medium size properties.

## Legal Reserve Balance by size — Amazon biome (2025)

Method based on Câmara et al. 2023, updated with PRODES 2025

Size	Total area (Mha)	Forest 2025 (Mha)	RL Deficit (Mha)	RL Surplus (Mha)	Net to restore (Mha)
Small (<4 FM)	32.79	30.22	1.81	0.70	1.10
Medium (4-15 FM)	28.71	22.71	1.42	1.42	3.00
Large (>15 FM)	163.32	123.64	17.68	15.95	1.73
<b>TOTAL</b>	<b>225.42</b>	<b>182.57</b>	<b>23.91</b>	<b>18.07</b>	<b>5.83</b>

Area totals may differ slightly due to rounding. RL = Legal Reserve. FM = Fiscal Module.

# The Amazon PES Challenge

## Key Context

- 5.5 million km<sup>2</sup> of tropical forest;
- Home to 400-500 indigenous groups;
- 20% of deforestation linked to small farmers;
- Critical carbon sink under pressure.

## The Opportunity

*PES can align conservation with economic development while supporting vulnerable populations.*

**80+ PES programs  
operating in Brazil**

**~30% focused on  
Amazon biome**

**Law 14,119/2021  
established national  
PES framework**

# Targets Addressable through Market Instruments

Three market instruments operate directly on climate plan targets

## CRA

### Environmental Reserve Quotas

Offsets Legal Reserve deficits across properties. Each quota = 1 ha of surplus native vegetation.

Associated target:

- 19.3 Mha of Legal Reserve deficit
- 98 validated titles (Oct/2025)

Demand:

- Deficit/surplus per property
- Overlaps with indigenous territories/conservation units

## CARBON MARKET

### Law 15,042/2024 + REDD+

Regulates voluntary market: avoided deforestation, conservation, and carbon stock enhancement projects.

Associated target:

- Net removal 30–34 MtCO<sub>2</sub>e
- Potential: USD 5.7 bn/year

Demand:

- Deforestation by land tenure regime
- Secondary vegetation

## PSA / PES

### Law 14,119/2021 (PES)

Payment for environmental services: conservation, restoration, sustainable management. Regulating decree under public consultation.

Associated target:

- 12 Mha of restoration
- 40 Mha of degraded pastures

Demand:

- Forest cover per property
- Areas eligible for restoration

# PES Mechanisms in the Amazon

*Programs vary in design, scale, and conditionality. Most combine multiple service types.*

## Carbon-Based

- REDD+ projects;
- Jurisdictional programs;
- Voluntary carbon markets.

## Water Services

- Watershed protection;
- Hydrological services;
- ICMS Ecológico.

## Biodiversity

- Bolsa Floresta;
- Conservation units;
- Protected areas.

# Critical Success Factors for PES



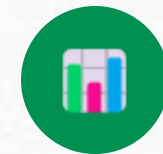
## Secure Land Tenure

Clear property rights essential for participation



## Adequate Payment Levels

Must exceed **opportunity costs** of conversion



## Robust Monitoring

Satellite + ground verification systems  
(land use change)



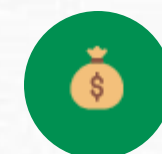
## Strong Enforcement

Penalties for non-compliance



## Local Engagement

Community co-design and ownership



## Stable Financing

Long-term funding mechanisms

# EU–Brazil PES Cooperation

## Strategic Collaboration Areas

### Technical Exchange

- MRV technology transfer • Satellite monitoring systems • Carbon accounting methodologies;

### Financial Mechanisms

- Green bonds for PES • Blended finance structures • Results-based payments;

### Policy Harmonization

- Carbon market standards • EUDR compliance pathways • Jurisdictional approaches;

### Research Collaboration

- Additionality assessment • Socio-economic impact • Biodiversity co-benefits.

# Key Recommendations

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- 1 Scale conditional PES programs with robust **monitoring** and **enforcement**;
- 2 Secure **long-term financing** through diversified mechanisms (public, private, carbon markets);
- 3 Integrate PES with **rural regularization** and **technical assistance**;
- 4 Strengthen **land tenure security** for vulnerable populations;
- 5 Develop jurisdictional approaches that **reduce transaction costs**;
- 6 Foster EU-Brazil technical and financial cooperation on **MRV systems**.

# PES as a Tool for Just Transition

Well-designed Payment for Environmental Services can align conservation with development, providing economic pathways for vulnerable populations while protecting critical ecosystem services.

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