

Socio-Technical Assessment of Forest-Protecting Bioeconomy Opportunities for the Amazon

Lina Tami-Barrera¹, Camila González Arango², Siela Maximova¹, Juliana Vasco-Correa²

¹Department of Plant Science, Penn State

²Agricultural and Biological Engineering Department, Penn State



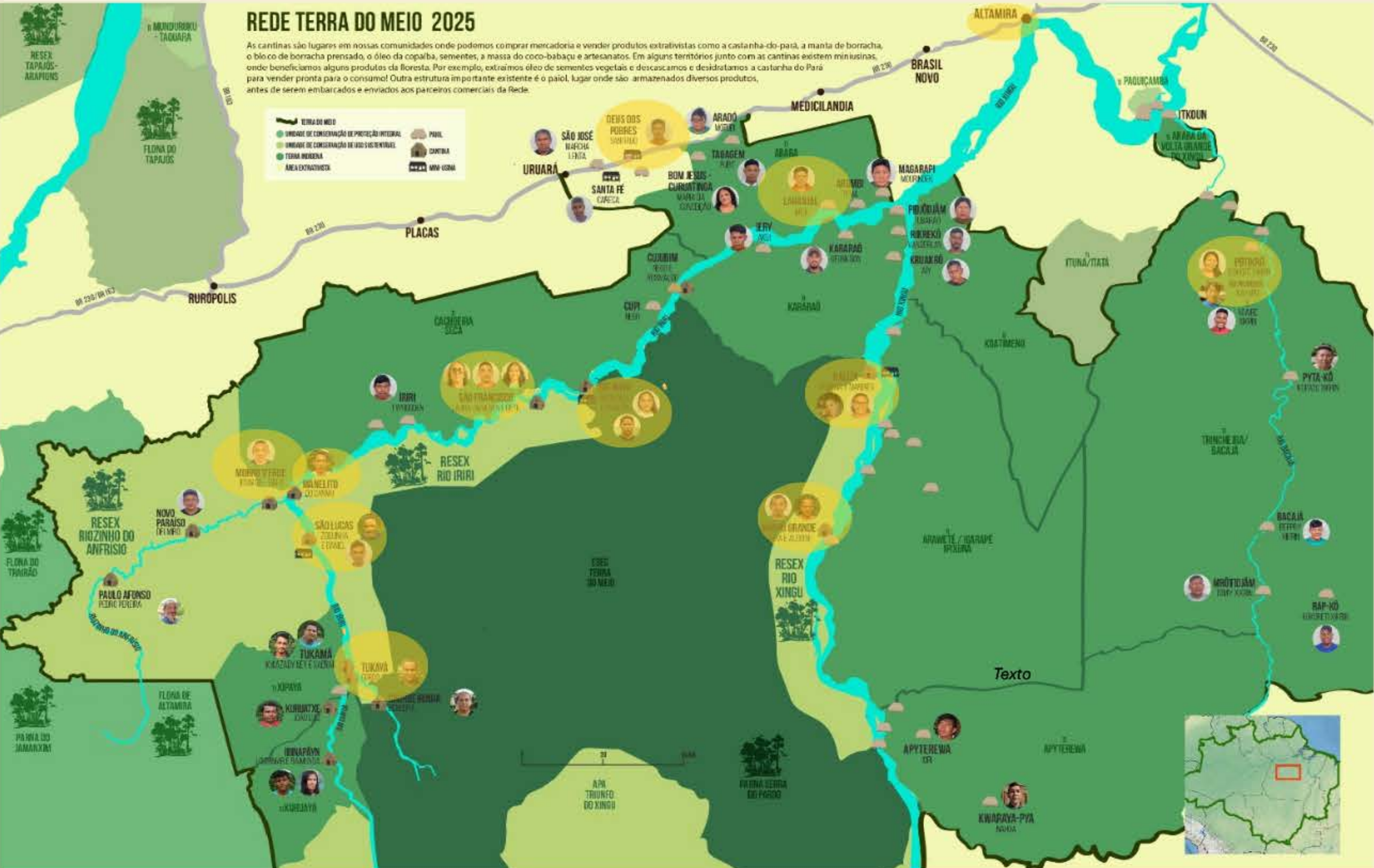
CONTEXT AND STUDY AREA

METHODS

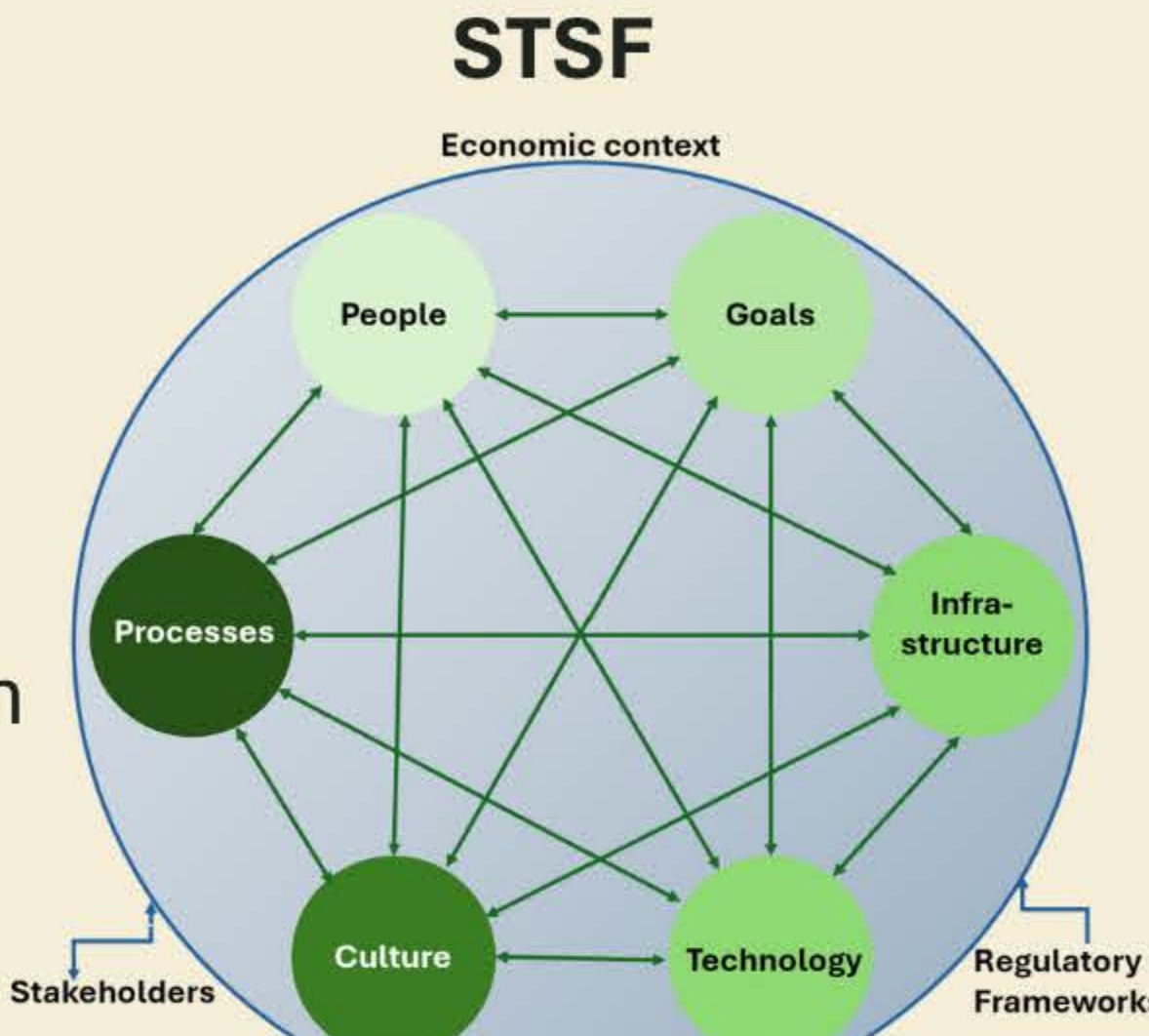
In the Terra do Meio region of the Brazilian Amazon, traditional knowledge, shared infrastructure, and public programs support forest- and river-based livelihoods.



Goal: Socio-technical assessment
Focus: feasibility, appropriateness, and adoption potential of technologies



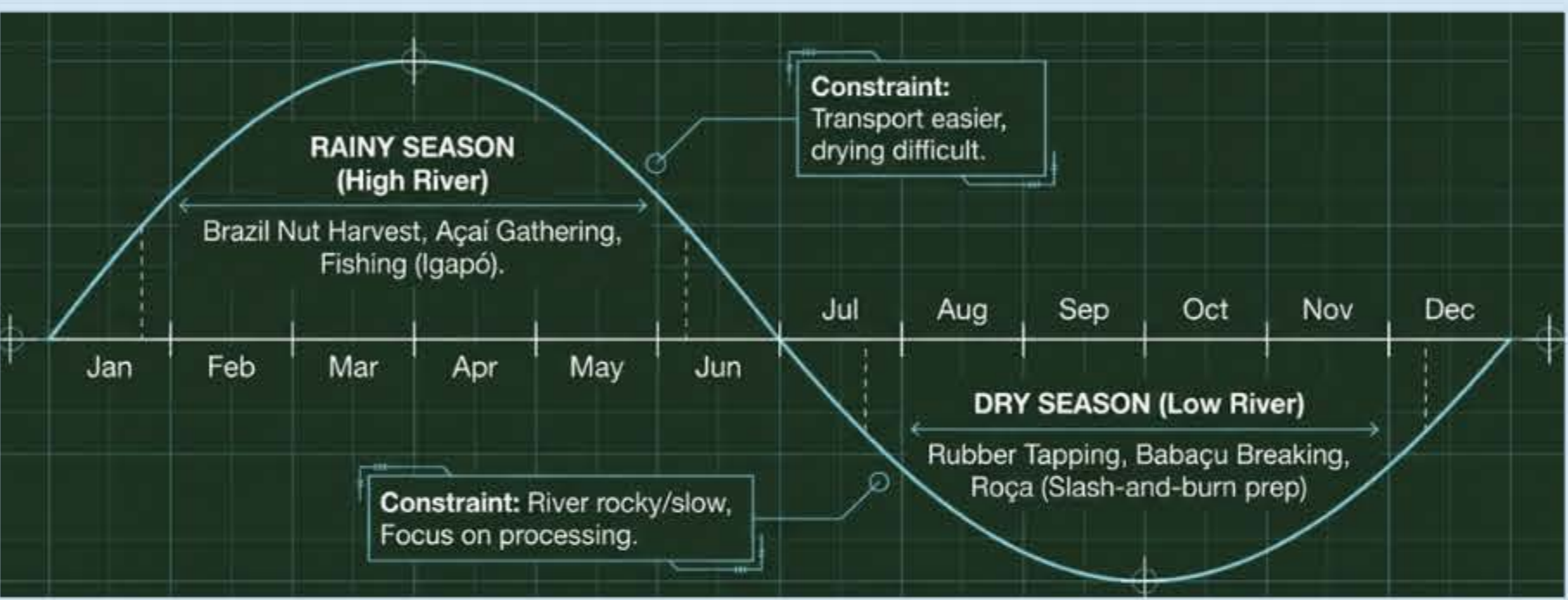
- Bottom-up Socio-Technical Systems Framework (STSF)
- Community-based bioeconomy approach
- Qualitative methods: Semi-structured interviews, focus groups, and participant observation
- Technical visits and interviews
- Rede governance spaces



Source: Adapted from Davis, M et al, 2014 & Rodrigues, D.C. et al, 2024

PEOPLE

CULTURE



- **Indigenous peoples, beiradeiros (riverine communities), and family farmers** coexist within a protected and agrarian reform area.
- **Livelihoods** are diversified, seasonal, and threatened by climate change.
- Territorial governance of land and natural resources is shaped by **RESEX, Indigenous Territories, and agrarian reform**.
- Community and development threats: deforestation, illegal mining, and land grabbing
- **Foundational constraints:** i) lack of access to clean water, electricity, and the internet; ii) Marketing and logistics limitations; iii) Aging of the population

- Communities **preserve and orally transmit ancestral knowledge** related to fishing, hunting, extraction, handcrafting, and medicinal plants.
- **Traditional slash-and-burn agriculture** supports relevant crops for food security, such as cassava, maize, squash, yams, and plantains.
- **Local diets and traditional food** are maintained through practices and technologies adapted to the local context (i.e., casa de farinha).
- Nature is understood as both a source of **livelihood** and a **space of memory, protection, and identity**.
- Solidarity-based organizations strengthen **community economies** and reinforce **social cohesion, cultural identity, and political mobilization** (Rede Terra do Meio, AMORA, AMORERI, ABEX, AMOMEX, AASFLOR, IBIKRIN, PYJAHYRY, etc.).

COMMUNITY GOALS

INFRASTRUCTURE

- Enhance **livelihood sustainability**.
- **Diversified livelihoods:** seeds, Amazon fruits, cacao, handicrafts, and commercial farinha production.
- **Local value addition and income retention:** babacu starch, rubber fabrics, oils, butters, flours, and cosmetics/pharmaceutical products.
- **Reduced dependence on intermediaries** (Cantinas vs. Regatão).
- **Fair prices and greater market stability:**
 - PNAE/PAA: public food procurement for schools
 - PSA: pilot Payment for Environmental Services
- **Protection** of cultural and landscape diversity.
- Greater **resilience** to climate and market shocks.



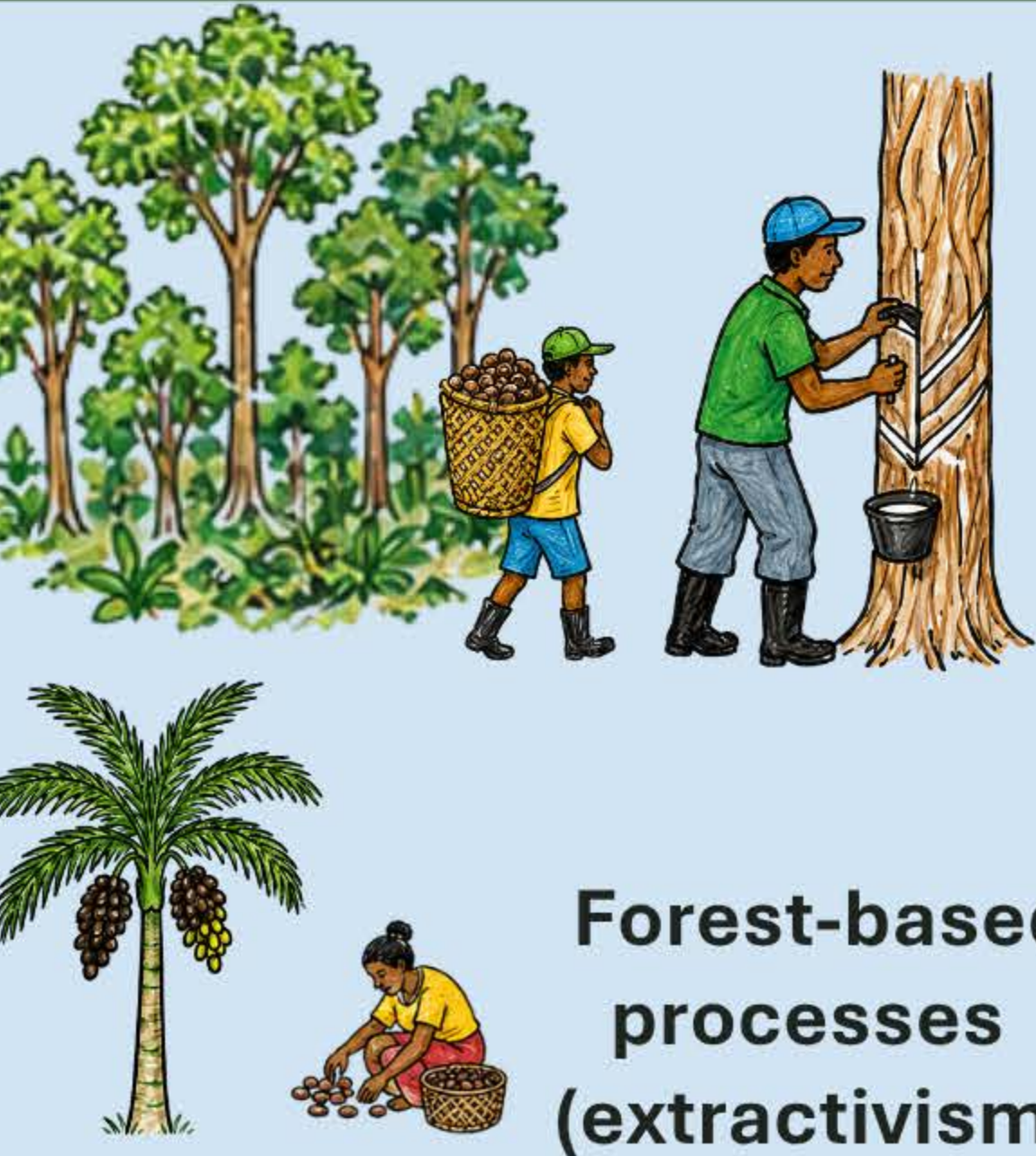
Processes rely mostly on **community infrastructure**:

- **Paioi** : drying and temporary storage, especially for Brazil nuts.
- **Cantina**: community trading point, storage, and working-capital node.
- **Miniusina**: small-scale processing for oils, butters, flours, and selected products.
- **Casa de farinha**: comunal cassava processing facility.

In general, these infrastructures are **community-managed** wooden structures that support **storage, processing, and commercialization** across value chains.



PROCESSES AND TECHNOLOGY



Forest-based processes (extractivism)

Level	Main processes	Technologies / infrastructure	Main bottlenecks
Forest-based & household	Collection, tapping, breaking, washing, drying, transport	Paneiro, cambito, machete, tapping knife, bica, buckets, drying barges	Physical burden, long distances, safety risks, weather exposure
Community infrastructure	Drying, storage, processing, quality control	Paioi, cantina, miniusina, casa de farinha, scales, mills, presses, ovens	Maintenance, sanitation, certification, underuse, working capital
Market & institutional	Commercialization, sales, delivery, payments, contracts, PAA/PNAE, PES	Rede contracts, buyer relationships	Transport logistics, delayed payments, unstable demand, lack of contracts



Value addition of forest-based products

CONCLUSION

Effective technological interventions should be incremental, territorially adapted, and aligned with community governance, institutional support, and fair market access. Rather than isolated technical upgrades, technologies must strengthen locally understood socio-technical systems to support resilient and sustainable Amazonian bioeconomies.

Context: broader bioeconomy initiative in Terra do Meio led by Rede Terra do Meio, in partnership with ISA, IDESAM, and the Bezos Earth Fund. *AI-generated graphics based on photographs and visual materials from Rede Terra do Meio.

References:
Davis, M.C., Challenger, R., Dharshana, N.W., Clegg, C. (2014). Advancing socio-technical systems thinking: A call for bravery. Applied Ergonomics, 45, 171-180
Rodrigues, D. C., Ribeiro, A. S., Silva, J. P. S., & Passador, C. S. (2024). Sociobioeconomy and social technology in the Amazon region: An integrated framework proposition. Revista de Administração Contemporânea, 28(6), e240223.

