Restoring in tropical forest landscapes

(Foto: Baez 2017, The Mountain Blogs);

Key elements for success and lessons from a suite of experiences in Latin America

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OUTLINE

1. Setting the scene
2. **Individual cases from the Amazon**
3. **Synthesis of key elements for success and lessons from "FLR" initiatives in Latin America**
4. **Challenges** and opportunities

Drivers of deforestation and forest degradation in developing countries *(Hosonuma et al., 2012)*

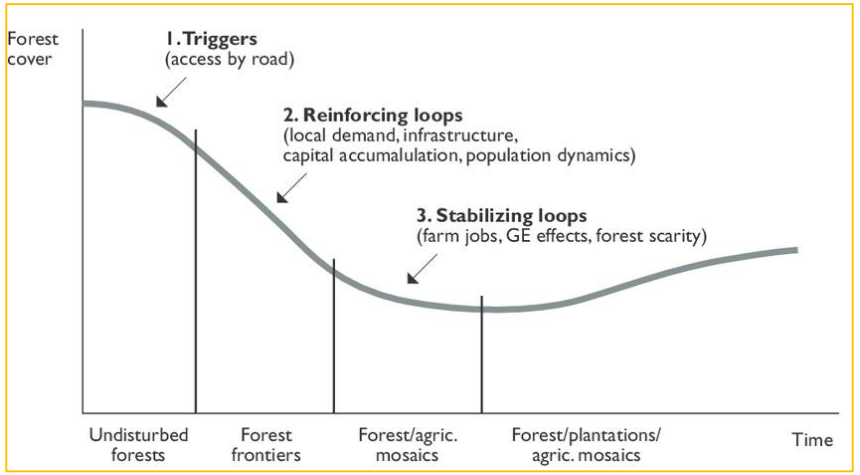
Direct drivers of DEFORESTATION	
Agriculture (commercial)	– Forest clearing for cropland, pasture and tree plantations – For both international and domestic markets – Usually large to medium scale
Agriculture (subsistence)	– For subsistence agriculture
Mining	
Infrastr	
Urban	
Timber	
Uncontrolled fires	– Includes all types of wildfire
Livestock grazing in forests	– On both large and small scales
Fuelwood / charcoal	– Fuelwood collection – Charcoal production – For both domestic and local markets

In Latin America

Commercial agriculture (including livestock) is the most important driver of deforestation (around 2/3 of total deforested area)

Commercial timber extraction and selective logging are the main drivers of forest degradation (more than 70%)

Forest transition



Landscape transformation in tropical Latin America *(Pacheco et al. 2011)*

Types of social actors	Land-use management	Main type of land-use
INDIGENOUS PEOPLE	Forest-based activities and shifting agriculture	Forest resources extraction and shifting agriculture
TRADITIONAL SUBSISTENCE SMALLHOLDERS	Shifting agriculture and some forest extraction	Food production in restored forest fallows
SMALL-SCALE FARMERS	Small-scale sedentary agriculture	Mainly agricultural production under diversified systems
LARGE-SCALE FARMERS AND RANCHERS	Large-scale agriculture	Agricultural production under extensive or intensive systems
LOGGERS AND TIMBER COMPANIES	Logging could be linked to land-speculation goals	Selective logging and marketing of valuable timber species

The individual cases

Northeastern Pará State, Brazil

"Bosques Amazónicos", Ucayali, Peru

Template for describing the cases

▪ Implementing entity ▪ Target group ▪ Partners & collaborators ▪ Implementation period ▪ Location ▪ Context and challenges	▪ Targets and objectives ▪ Field-level practices ▪ Innovative aspects ▪ Main results ▪ Impacts ▪ Key factors for success	▪ Constraints and lessons learned ▪ Economic sustainability ▪ Home page and contact person ▪ Further reading

** Source: FAO/SFM Toolbox*

Case 1
Smallholder management of secondary forests to restore degraded landscapes in the Eastern Brazilian Amazon

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Major land use systems causing deforestation and degradation processes in the Amazon biome

Source: IPAM / The Woods Hole Research Center

A multi-year research & development project

- Leaded by EMBRAPA Eastern Amazon, Ministry of Agriculture of Brazil
- Implemented from 2000 – 2016 through projects funded by IDB, ITTO and the Brazilian Government
- Partners & collaborators included international (CIFOR, CATIE, CIRAD) and national (IBAMA, MPEG, UFRA) institutions, rural workers' unions and family farmers in three municipalities: *Bragança*, *Capitão Poço* and *Garrafão do Norte*

PHASE I (2000 – 2006) "Participatory management of secondary forests integrated to the farm production system in the northeast of Pará State"

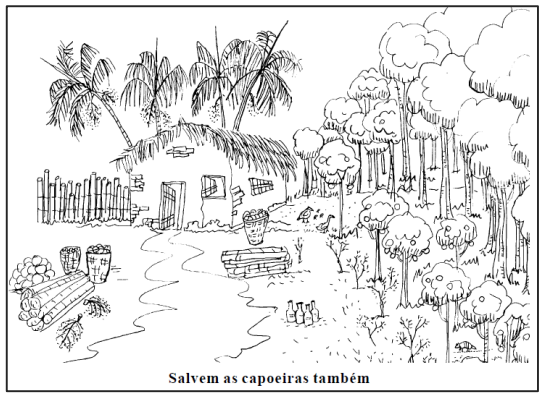
Goal: **Maintain secondary forests** based on the social and economic benefits they can provide to farmers and rural communities

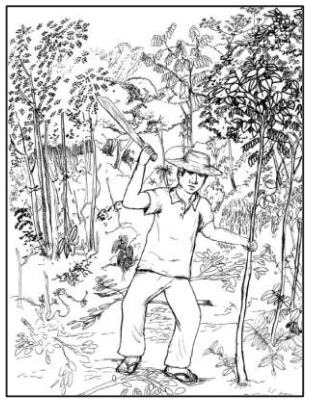
Specific objectives:

1. Participatory **development and testing of techniques** for the sustainable management of secondary forests
2. **Product diversification** from secondary forests
3. **Training** of farmers and their organizations in the management of secondary forests

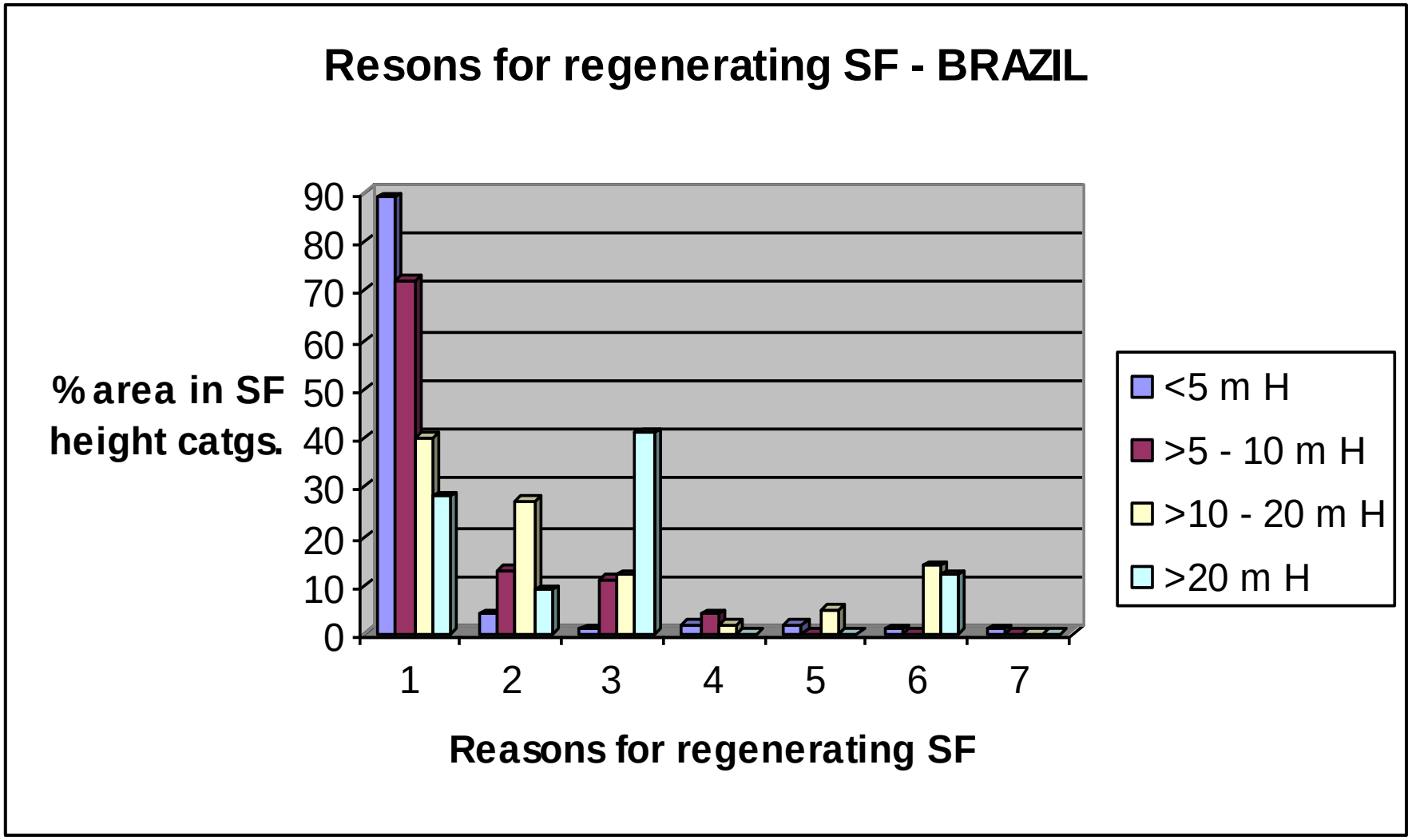
Phase I - Main components

- **Dynamics of conversion** and the changing roles of secondary vegetation in frontier areas
- **Multipurpose inventories** to define the management potential of secondary forests (SF)
- Identification of **market-value products** from SF
- **Biological studies** (taxonomy, ethnobotany, uses …)
- **Silvicultural treatments** to improve productivity in selected SF stands on family farm land
- **Monitoring** SF dynamics (permanent sample plots)





- **About 20% of farm area remains under secondary forest (SF)** even after a century of settlement
- SF are an **integral part of colonist agricultural systems**
- SF are **the only significant forest resource available** to the rural poor in older settlement areas
- SF consist primarily of secondary forest fallows (SSF). Small areas are also maintained more permanently (PSF)



1 = recovery of site productivity; 2 = lack of resources; 3 = timber; 4 = NTFP; 5 = abandoned land; 6 = environmental services; 7 = other reasons

Sources: Smith et al. 2001, 2003)

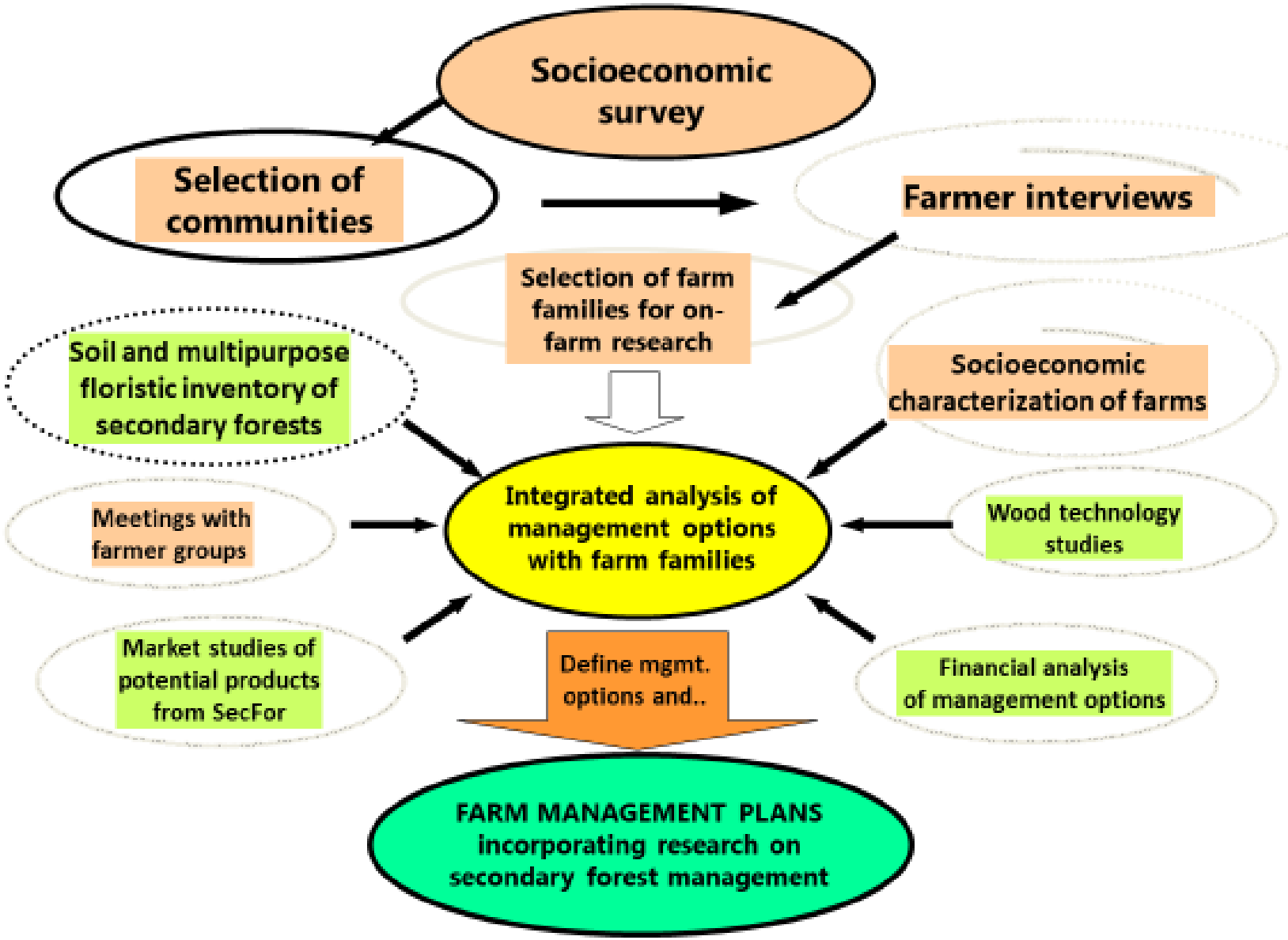
Valorization of secondary vegetation, in addition to the traditional fallow process, for diversified production (wood, fruits, seeds, medicinal plants) and enhancement of environmental services

Identification of 65 species with management potential

Traditional uses of SF/ fallow vegetation

and other uses of forest products: ornamental, medicinal and meliferous plants, tree barks, vines…

Process to define management options



- Socioeconomic diagnostic survey
- Multipurpose floristic inventory and soil survey in farmers' plots
- Farmers' socioeconomic characterization
- Market study of potential SF products
- Meetings with producers (farmers, intermediaries, artisans etc.)
- Technological studies
- Preliminary financial analysis of promising management options

Management strategies between earlier and later stages of frontier development (*Smith et al. 2001*)

Table 2: Integrated natural resource management strategies targeted to phases of frontier development in colonist swidden agriculture

Early phases	Late phases
Prevent further conversion of residual forest to agriculture: – Reduce incentives for cattle ranching and land speculation – High value crops – Management of residual forest for forest products and protection of carbon stocks – Short-rotation improved fallows function of SFF	Maintain SFF areas by reducing pressure for shorter fallows: – High value crops – Stimulate out-migration: urban employment opportunities and education of rural population – Improved recuperation of agricultural productivity by SFF – Improved management for multiple use
Stimulate conversion of SFF to PSF: – Improved management for high timber productivity of PSF – Payments for carbon stock protection to convert SFF to PSF	Stimulate conversion of some areas of SFF to PSF: – Payments for carbon stock protection to convert SFF to PSF – Improved management for multiple use function of PSF

Management interventions implemented in second-growth forests

Silvicultural techniques: mainly liberation thinnings to favor individuals that could be used on the farmers' property or for sale

Seed collection and handling

Plant production

Monitoring the dynamics of secondary forests

Permanent plots in selected stands – Participation of farmers in the assessments and measurements

PHASE II (2007 – 2016) "Conservation and recovery of degraded land in family agriculture units in the Eastern Brazilian Amazon"

Contribute to the **recovery / restoration of degraded areas** in family properties seeking to **increase the forest production potential** and **inform adjustments to environmental legislation**

Specific objectives:

1) Establish a **demonstration network** for the restoration of degraded areas (in legal reserves and permanent preservation areas)
2) Develop and implement a **monitoring system** for degraded areas undergoing restoration

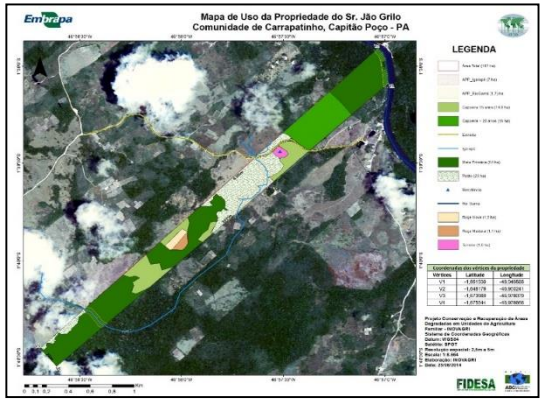
Phase II - Main components

- Expanding **partnerships** (institutions, communities)
- **Training** (researchers, technicians, local organizations, students)
- **Exchange of experiences**
- **Technical advice**
- **Participatory monitoring** (livelihoods analysis, forest dynamics)
- Publication and **dissemination**

Steps to implement forest restoration in the participating farms

1. Socioeconomic survey

2. Elaboration of a **land-use map** of each farm with participation of all families



3. Selection of planting areas based on the land-use maps

4. Organization of **seminars** to discuss selection of tree species

5. Establishment of 28 "**restoration units**"

Tree plantations established in various scenarios

Training workshops for farmers, technical staff and students on different subjects demanded by farmers

(e.g. on seed collection and seedling production of native forest species, strategies for recovery of degraded areas, fire prevention and control techniques, evaluation of impacts of restoration in degraded areas, bee-keeping and native bee management, management of açaí palm)

Manufacturing of wood products

Handicrafts manufacturing

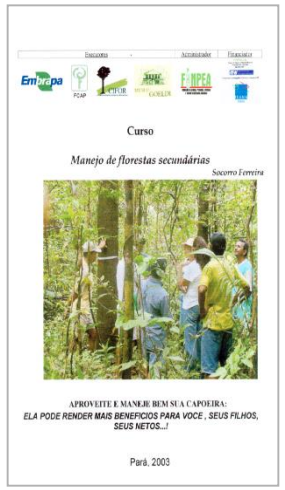
Manufacturing of furnitures and other wooden objects

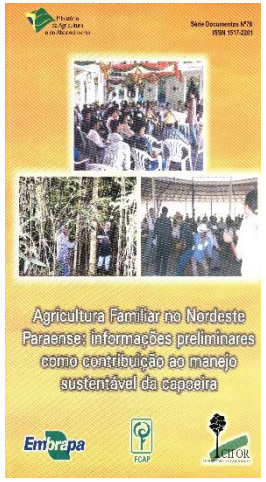
Environmental legislation

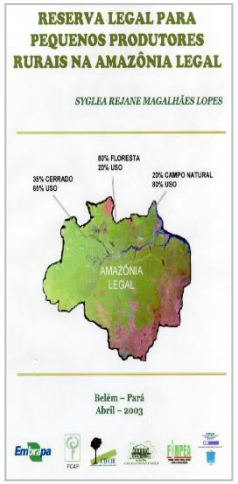
Planning and financial administration of the rural property

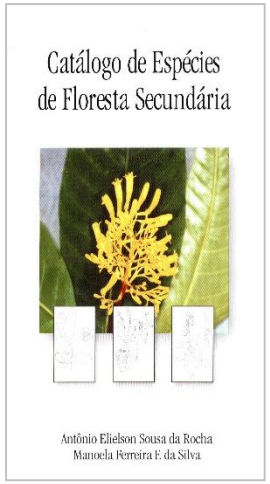
Cooperativism & formation of local assotiations

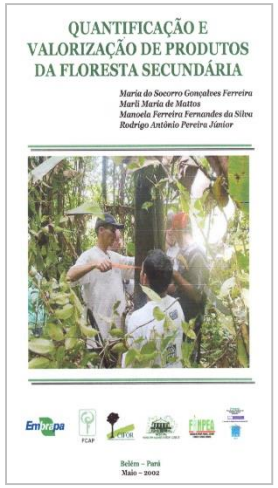
Scientific / technical and dissemination material

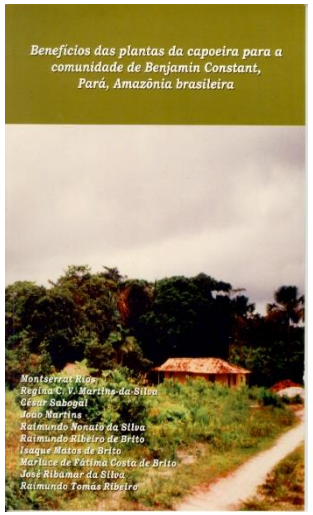


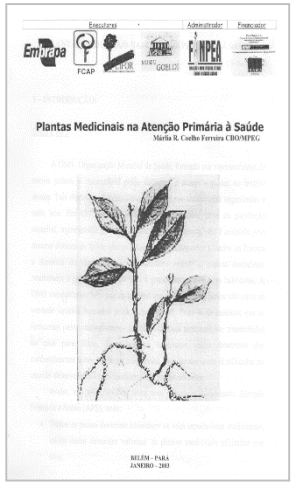


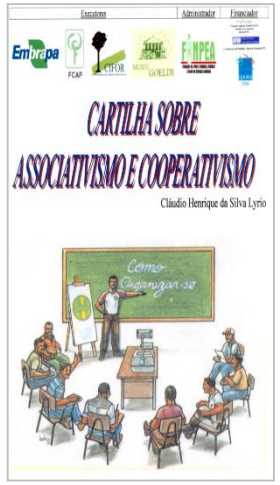


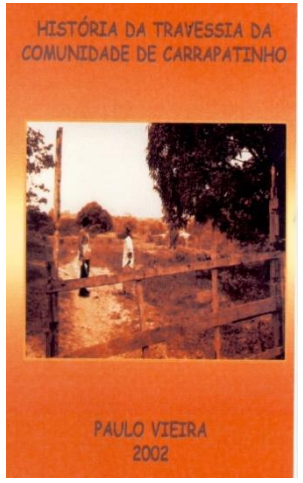


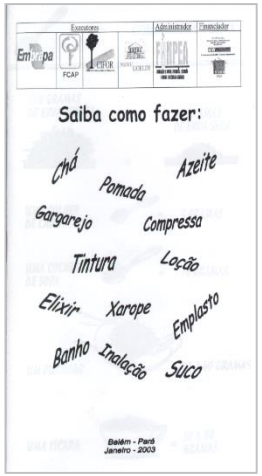












Key factors for success

- **Participation** was the mainspring of the project, enabling families, project officers and others to listen to each other, learn new perspectives and work together
- A heightened **awareness of the benefits** of restoring low productivity areas on their own lands turned farmers into collaborators
- The **participatory mapping process** of farmlands empowered and motivated farmers to select areas to be restored and improve farm management
- The **participatory selection of tree species** to be planted led farmers to a strong desire to protect seedlings after planting, tend them carefully and monitor their growth
- **Training workshops, courses and exchange of experiences**, carried out jointly with farmers, were crucial for implementing activities that led to increases in overall farm productivity, and strengthening partnerships between farmers and the project

Lessons learned

- A **participatory, cross-cutting approach** is crucial. Involving all stakeholders, empowering farmers, making use of wide-ranging expertise and **showing the benefits of change** will help improve public policies and lead to rapid uptake across the Amazon
- Restoration of degraded areas should include the **use of short to medium term production systems** such as agroforestry systems
- **Growing and monitoring woody plants** in farm plots requires a major **cultural shift**

Restoring degraded forest lands using multi-species plantation with native trees: The experience of "*Bosques Amazónicos*" in Ucayali, Peru

- ***Bosques Amazónicos*** *SAC* (**BAM**), Peruvian private company established in 2007, dedicated to the conservation, restoration and sustainable management of tropical forests
- **Campo Verde Project**: Reforestation of deforested and degraded lands started in 2008 and continues until today
- BAM, first company in the world to validate a reforestation project using native tree species in the voluntary carbon market (VCS)

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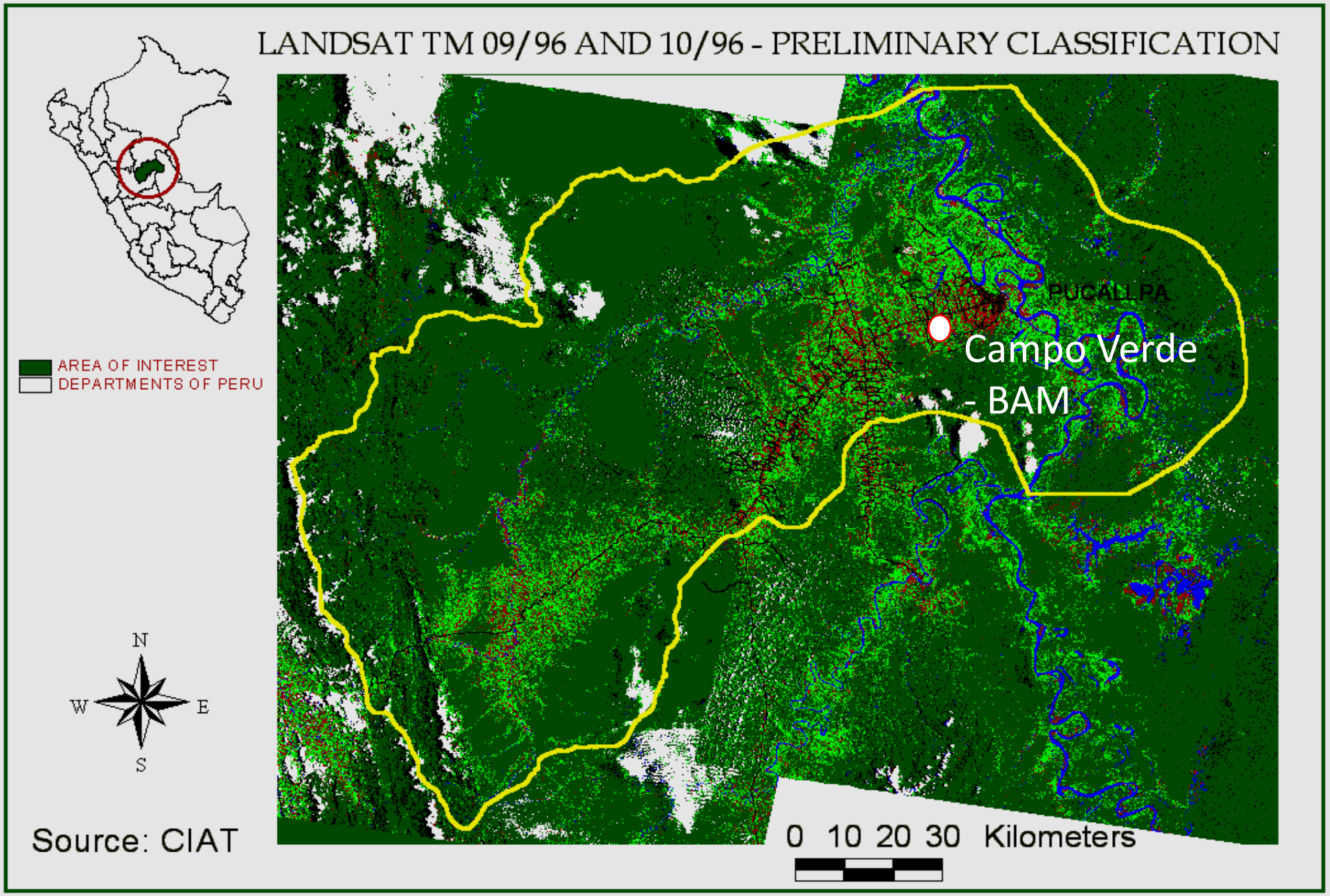
The Ucayali Valley, Peru:

Dynamics of land-use changes in a colonization area



Campo verde, old agricultural frontier area (50+ years old), landscape dominated by degraded non-native grass (overgrazing, repeated fire), degraded logged-over forests and secondary vegetation

BAM, private property of over 16,000 hectares,

Degraded area before the start of the reforestation program

Site preparation based on soil analysis

Forest nursery

Habitat recovery model:

- **Biophysical diagnosis** to assess the drivers and level of degradation and to assist in the design of the intervention
- Application of the **principle of successional dynamics of forest vegetation** to recover productive functions (for timber) and environmental services
- Use of **short cycle tree legumes** (*Inga edulis*), **pioneer/short-cycle** (12 yr) (*Simarouba amara*) and **climax/long-cycle** (30 yr) (*Dipterix odorata*, *Tabebuia serratifolia*, *Swietenia macrophylla*) **timber species**

Business model:

- **Supplementary silvicultural interventions** with a good multifunctional design and traceability that reduces corrective and/or formative pruning
- **Use of species of the same ecosystem** to facilitate conversion of "weeds" to accompanying species, reducing competition and pest control costs, and increasing biomass production, soil cover and nutrient intake
- **Forest protection activities** focusing on prevention of forest fires and damage by encroachment
- **Prevention and control of tree crop pests** carried out through an integrated pest management program with emphasis on biological control using mass-applied entomopathogens
- **Community development program** with neighboring villagers to prevent encroachment and contribute to local livelihoods

Some results to date

- **Initial experience** in 2004 in a highly degraded **pilot area** of 100 hectares

- **Reforestation of 1,000 hectares** reforested with two million valuable native trees
- **Valorization of 2,040 hectares** of degraded land through forest plantations and assisted natural regeneration

- **Eco business:** generation of 169,000 carbon credits in the carbon market

- **Projected wood production** based on updated assessments

e.g. for *Swietenia macrophylla*: 10,429 m3, *Simarouba amara*: 178,866 m3), *Dipterix odorata*: 365,270 m3

… Some results to date

Soil recovery, with all their physical, chemical and biological characteristics producing timber products and services

Recovery of water flows - Improvement of the quality and quantity of water in the *Agua Blanca* river and other tributaries of the local water system

Biodiversity recovery - Native tree plantations have favoured the formation of biological corridors linking fragments of remnant natural forests, attracting fauna and increasing biodiversity

… Some results to date

Creating a basis for ecotourism - Annually, 2 100 people visit or carry out internships in the area, involving professionals from national and foreign institutions, students from different national universities and agricultural producers from the Amazon region

Creating the building blocks for an "Amazon forestry"

- **Research work in alliance** with universities, public and private institutions
- **Training opportunities** for near 3 000 undergraduate students through pre-professional practices, internships, thesis prep.
- **Development of plant material** for technological and genetic improvement of future plantations
- **Professional specialization** in new areas of forest restoration such as: weed management, integrated pest management, pruning, fertilization and environmental services (carbon credits)

… Some results to date

- **Employment** provided to more than 400 residents in the area, as well as
- **Training for the surrounding communities** in reforestation, fire control, soil recovery, and awareness-raising in schools as part of the commitment to the development of the region
- **Replicable reforestation model**: local species, intermediate technology, simplicity of operations, integrated pest management program, compatibility of integral systems. Other companies and producers have replicated the model based on their interests

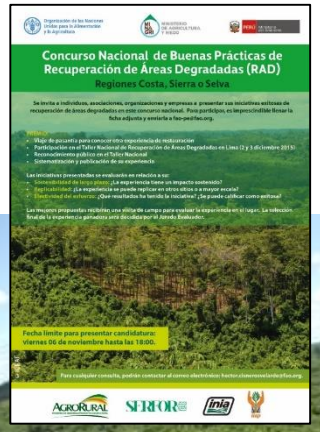
Some drawbacks :

- Difficulties to follow an orderly and sequential establishment of plantations due to encroachment
- Low supply of skilled human resources
- Low availability of planting material with known origin (seed trees)
- Scarce availability of machinery for land preparation
- High costs for the control of invasive weed species

Awards

Awarded maximum Gold level certification by the Climate, Community and Biodiversity Alliance (CCBA), in recognition of its effectiveness in mitigating climate change and promoting biodiversity and sustainable development.

Awarded the 2010 National Renewable Natural Resources Eco-Efficiency Business Award by Peru's Ministry for the Environment and Universidad Científica del Sur



Awarded the 1st place at the National Contest "Good Practices on Restoration of Degraded Areas" by the Peruvian Forest Service (SERFOR) in 2016

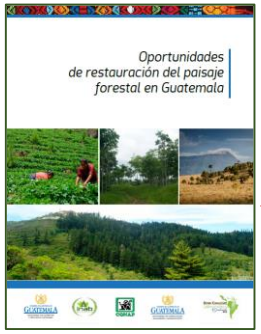
Key factors for success

- **Private investors decision** in a high-risk activity
- Continuous improvement of technology based on **strategic alliances**
- Effective **monitoring and evaluation** system
- Development of skills based on **in-service knowledge transfer** from senior professional staff to junior professionals selected from pre-professional practices performed in the company
- Constructive **relations with local communities**

Lessons learned

- The **choice of species** should be made on the base of a biophysical diagnosis
- To ensure quality final products from the forest plantation it is of foremost importance the **traceability of the plantation material**
- Good biological **control of weeds using soil cover with legumes** – success with the use of the *Desmodium ovalifolium* (low-cost establishment, persistent, non-aggressive, supports shade of plantations, lignified stem and high contribution of biomass)
- The best method of **pest control** in a mixed native species forest plantation is biological control with the use of entomopathogens
- The establishment of **biological corridors** that provide alternate hosts and shelters to parasitoids is a good option to maintain the balance of harmful insect populations
- Promote **local participation** at two levels: internally, to maintain well trained and motivated human resources, and externally as part of a community development program to approach and raise awareness with villagers as potential generators of fires

Synthesis from country experiences*

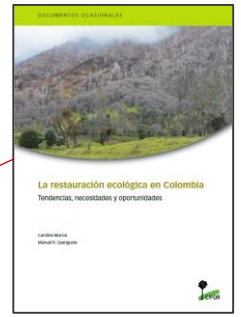


GUATEMALA

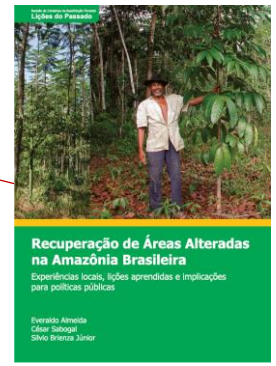
CENTRAL AMERICA

PERU

COLOMBIA



BRAZIL



* Mainly from **tropical rain forest areas** and to a lesser extent also highland, tropical grassland and deciduous & mixed forest

Synthesis of key elements for successful FLR implementation*

Political support	Supportive political commitment For **coordination of the normative framework between different sectors**, as well as the coordination of incentives for different land uses; for increased **leadership** and **significant participation of local actors** in restoration planning, implementation and monitoring; for integrated monitoring of results and impacts of restoration activities at different scales; to strengthen land tenure security in the priority areas for restoration
A common concern	A **collective sense of urgency** provided by serious landscape problems
Clear goals and measurable objectives	Identify clear goals and turning them into measurable objectives
Planning and adaptive management	Considerable planning, experimentation, and adaptive management Address the causes of deforestation and degradation in the design of the restoration initiative
Active **participation**	Involvement of a **wide range of stakeholders** Multiple stakeholders' participation and **involvement** of stakeholders is key, not only as beneficiaries, but **as primary decision makers**
Perceived **benefits**	Importance of **demonstrating immediate and tangible benefits** to local stakeholders in landscape projects, and of **linking short-term income to long-term benefits**

* **Sources:** Stanturf et al. (2017), Mansourian et al. (2017), Cerron et al. (2017), IUFRO-CATIE-MARN (2016), Strassburg (2015), Chavez-Tafur and Zagt (2014), Sabogal et al. (2009)

… Synthesis of key elements for successful FLR implementation

Local governance and leadership	Strengthened local governance and leadership
Tenure and resource security	Tenure and access rights to forests
Effective **institutional coordination & collaboration**	Coordinating and harmonizing the work of existing local governmental and non-governmental actors Strengthen institutional arrangements
Financing	Leverage **multiple sources of finance** to achieve landscape goals
Integrated **extension services**	Strengthen extension services, integrating restoration into their programs
Institutional alliances	Establish **institutional alliances** with the academy and associations or territorial organized groups Create synergies with universities and companies to have **sources of genetic material** duly evaluated for each local condition Establish public-private partnerships and attract investment
Information & knowledge management	National and regional **inventory and documentation of native species** recommended for restoration; update database of forest nurseries and agricultural seed banks
Restoration chain	Encourage **nursery production of native species** recommended for restoration

… Synthesis of key elements for successful FLR implementation

Demand	Demand **for sustainable products from restoration** efforts
Capacity development	Opportunities for capacity development (e.g. on-site training, exchange visits…)
Piloting / Demonstration	Implement restoration actions prioritized in the field, through **pilot sites** in specific landscape units
Communication	Communication among everyone involved or interested in FLR Effective communication of the **success stories** and the **benefits** of the restoration activities
Monitoring	Monitoring short-term and long-term **outcomes** Monitoring of **results and the effectiveness** of the proposed activities

Synthesis of lessons learned

Enabling conditions for upscaling of restoration efforts in Central America

- FLR initiatives should **consider the time to build up trust** with and between local actors, as well as the need to **strengthen a common vision at landscape level**
- **Integration of a wide range of different types of restoration within one single landscape** will increase effectiveness and social and environmental resilience of the landscape
- Restoration activities that were **transformative and compatible with actual land uses**, facilitate adoption by local actors
- Many of the successful initiatives had important restoration achievements, but were not necessarily set up as restoration initiatives. This shows the potentially very positive impact on landscapes of the **integration of restoration initiatives into development programs** of local and national organizations**, in response to locally felt needs**

… Synthesis of lessons learned

Smallholder forest restoration/rehabilitation in the Amazon

- Restoration strategies should **plan for and promote livelihoods enhancing activities that generate economic opportunities with products of high added value**, integrated to processes of social inclusion and sustainable use of resources
- **Production systems** (e.g. agroforestry, tree plantation) **that incorporate tree species with a short harvesting cycle and good market prospects** tend to be more adoptable
- **Incorporate the market variable** in the design and implementation of restoration initiatives
- Restoration efforts should **strengthen farmers' organizations and participation**, articulate with existing local organizations and establish alliances with relevant stakeholders

… Synthesis of lessons learned

Other lessons

- **Demonstration sites and pilot projects** are important components of a bottom-up approach, supporting interaction with local actors, showing the benefits that can be obtained (e.g. by recovering the productive capacity of degraded lands) and providing evidence and feedback on the process at the (sub) national level
- **Importance of developing public policies for FLR in synergy with other policies** such as water resources management, family farming, environmental impact assessment, natural protected areas, environmental education, among others
- **More emphasis to be given to training, extension and awareness-raising** about resource use, management and conservation

Some key challenges for FLR implementation

- Week **institutional (governmental) capacities** (for control and law enforcement, promotion, implementation, M&E)
- Poor **institutional articulation and coordination**
- Lack of a coherent, **long-term regional land-use policy**
- **Conflicting policies** from more powerful sectors, e.g. agriculture, infrastructure, energy, mining…
- Insecurity of **land tenure and use rights**
- Effective **participation** of the local population in the planning stage and decision-making, and **continued involvement** over time
- Lack of **economic compensations / incentives** to effectively involve local producers
- Weak **articulation with the market for commercialization** of timber and non-timber products of native species
- **Low demand** for goods produced in a sustainable manner
- Limited **access to funding** (credits, incentives) and **attractive financing schemes**
- **Financing** to carry out **monitoring** activities

… Some key challenges for FLR implementation

- **Gaps in information** on taxonomy, propagation, silviculture, management and technological properties of priority forest species
- **Baseline studies** on the conditions to be restored
- Few sustainable **production techniques** duly validated (economic feasibility)
- Lack of **technical support** (quality seeds, stand management, fertilizers, sanitary control)
- Lack of well-**trained personnel**
- **Labor** constraints
- Engagement and effective **involvement of young people** in the activities and benefits
- Functional **fire prevention and control** programs
- Few sources of adequate **germplasm supply** in each region
- **Research on native species** with potential for restoration under different degraded situations

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Thank you!

Salamat!

Gracias!