Negotiation-support toolkit for learning landscapes

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Joshi L, van Noordwijk M, Martini E and Janudianto. 2013. Rapid appraisal of agroforestry practices, systems and technology (RAFT). *In:* van Noordwijk M, Lusiana B, Leimona B, Dewi S, Wulandari D (eds). *Negotiation-support toolkit for learning landscapes*. Bogor, Indonesia. World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. P.36-42.

4 Rapid appraisal of agroforestry practices, systems and technology (RAFT)

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Agroforestry practices, systems and technology exist in many forms but are often 'invisible' in official documents and statistics that see agriculture, commodities and forestry as separate sectors. The Rapid Appraisal of Agroforestry Practices, Systems and Technology (RAFT) tool helps assess what exists in the landscape as seen through the eyes of farmers and land managers and to relate that to emerging classifications of land use to become more inclusive.

Introduction

'Agroforestry' is an umbrella term covering a wide range of practices in which trees are grown on farms and in agricultural landscapes. The RAFT framework provides guidelines for the description and analysis of the different ways trees are used to improve rural livelihoods, on farms and in landscapes. A distinction between agroforestry technologies (for example, focussed on the way tree–soil–crop–animal interactions are managed) and agroforestry systems (the farming systems that include the deliberate use of trees, using multiple discrete technologies in different parts of the farm) follows the analysis by Sinclair (1999).

Objectives

1. Clarify terminology of agroforestry practices, systems and technologies appropriate for local use and global adaptation.
2. Understand the relationship between 'domestication' from the perspectives of trees as biological resources, control over access to resources and knowledge and belief systems.
3. Appraise strengths, weaknesses, opportunities and threats with the main agroforestry stakeholders to plan applied research and development support.
4. Initiate more detailed data collection on input and output streams at various phases of the lifecycle of an agroforestry system.

Steps

1. Clarify local terminology for the various uses of trees in space and time, in relation to existing generic schemes, building on the initial exploration in the PaLA tool.
2. Participatory appraisal of current tree management and domestication.
3. Explore the depth of local ecological knowledge and awareness of intellectual property rights.
4. Appraise component interactions at technology and system levels.

5. Quantify input/output relations and initiate a profitability assessment (for follow up with LUPA).
6. Assess tree and land-tenure arrangements and associated policy issues.
7. Jointly with farmers, analyze strengths, weaknesses, opportunities and threats of the agroforestry technologies and systems.

Step 1a. Terminology

LOCAL MEANINGS AND SENSITIVITIES AROUND TERMINOLOGY

In different languages, similar agroforestry terms may be used to refer to a dominant commodity, the way it is managed or to a form of semi-managed, woody vegetation. Understanding the true meaning of similar terms used in different languages is not easy, as the values embedded in the word may be lost or changed. 'Community-based forest management' or even 'forest' and 'agroforest' can refer to the same vegetation but imply different political control. Sensitivities around specific terms need to be carefully explored with local stakeholders, including men and women, farmers, landless peasants and government officials.

NATIONAL-LEVEL INSTITUTIONAL TERMINOLOGY FOR FORESTS AND TREES OUTSIDE OF FORESTS

An 'objective' descriptor, such as the degree of crown cover of woody perennials, may allow monitoring by remote sensing but might not match national policies or categories used to track deforestation and forest degradation. There is growing recognition that trees outside of forests provide goods and services but such trees may still fall through the cracks of a 'forestry versus agriculture' dichotomy.

INTERNATIONAL COMPARISON IN META-LAND-USE SYSTEMS

To ease global comparisons, the ASB Partnership for the Tropical Forest Margins introduced the term 'meta-land uses' (van Noordwijk et al 2001).

Table 4.1. Main products and 'meta-land-use' system

Primary focus	Land-use system
Forest products	Natural forest (F_n), without extraction beyond the occasional harvest of non-timber forest products and/or hunting of wildlife
	Managed forests (F_m), with various degrees of harvest of timber and non-timber forest products and grazing but no commercial logging
	Logged forests (F_l), with various intensities and degrees of management to enhance the regrowth of valuable trees; can include 'enrichment planting' up to one-third of total tree basal area
Tree crops and timber plantations	Extensive agroforests (T_e) are complex, multistrata agroforestry systems with at least one-third of tree basal area derived from spontaneously established trees and more than five recognized harvestable commodities
	Intensive agroforests (T_m) with at least two recognized harvestable commodities and less than one-third of tree basal area derived from spontaneously established trees
	Simple, intensive tree-crop systems (T_s) or timber plantations, with one or two harvested commodities

Primary focus	Land-use system
Annual crops	Extensive crop/long fallow system (C_e), with the cropping period of less than one-third of the length of the intervening fallow (for the 'shifting cultivation' subset this may be less than one-sixth)
	Medium intensity, crop/short fallow systems (C_m), with the cropping period up to twice the length of the intervening fallow
Primary Focus	Land-use system
	Intensive, crop/short fallow system (C_i), with fallow periods less than half of the cropping period
	Continuous annual cropping system (C_p), which occasionally may skip a growing season as 'fallow'
Animal products	Pasture/grasslands /rangeland (A_e) based on spontaneously established vegetation but subject to various degrees of management
	Intensive pasture (Ai), with farmers' control over the composition and growth of the vegetation and various levels of drainage, fertiliser use and seeding of desired species

INTERNATIONAL AGROFORESTRY TERMINOLOGY

Present classification schemes confuse agroforestry practices, where trees are intimately associated with agricultural components at a field scale, with the whole farm and forest systems of which they form a part. In fact, it is common for farming systems to involve the integration of several reasonably discrete agroforestry practices on different types of land. The purpose of a general classification is to identify different types of agroforestry practices and to group the ones that are similar, thereby facilitating communication and the organized storage of information (Sinclair 1999).

Step 1b. Use of trees in space and time

There are several topics to explore as a follow up to PaLA, jointly with local informants and stakeholders.

1. Rotational systems and those with internal tree regeneration.
2. Spatial configuration of trees.
3. Landscape niches and their different uses.
4. Responses to climate variation, seasonality, fire and drought years.
5. Ethnobotany and ethnozoology: how much do local people know about plants and animals?

By combining steps 1a and 1b, a locally relevant classification systems and terminology can be defined that can be used in all subsequent studies and tools.

Step 2. Participatory appraisal of current tree management and domestication

There are several questions to consider when surveying trees in an agroforestry system.

1. Origin: Were the trees spontaneously grown in situ, transplanted from the wild, grown in a nursery from local or external seed a or grafted with local or external budwood?
2. Ownership: What are the use seeds for fruits, fallen branches and other non-destructive plant parts? What are the rights for timber, bark or other products requiring destructive harvest?
3. Use: How are trees and their products included in local consumption and use, in marketed products, and as providers of environmental services, such as for slope stabilization, mulch, nitrogen fixation?

The results of the survey should be compared with thresholds in tree domestication (open access use, regulated use, managed regeneration, planted, selective propagation, breeding), changes in technology, resource control and knowledge and beliefs.

Wiersum (1997) identified three thresholds in the process of domestication: 1) 'controlled utilization' (the separation of open access from a controlled harvesting regime); 2) 'purposeful regeneration' (the separation of dependence on natural regeneration from interventions that generally require control over subsequent utilization); and 3) 'domestication' (a movement toward a horticultural or plantation style of production system).

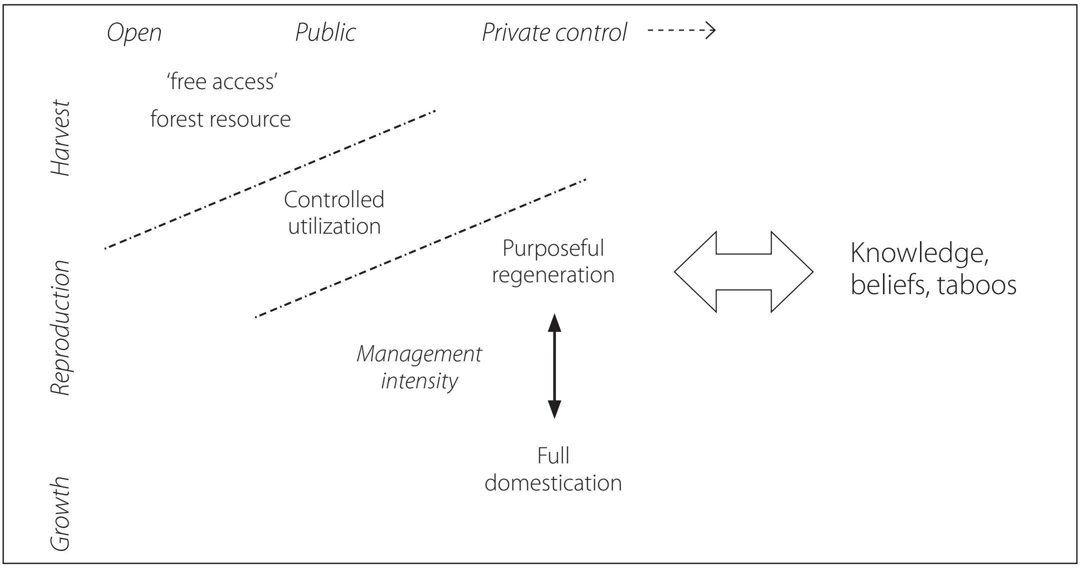

Figure 4.1. Stages in the domestication of forest resources

Note: Based on the various types of control (tenure) exerted over the land and on the type of control exerted over the reproduction and growth of the plants involved. Modified from Wiersum 1997.

Step 4. Appraising the depth of local ecological knowledge and awareness of intellectual property rights

There are several topics to explore to assess local ecological knowledge and awareness of intellectual property rights.

1. Ethnobotany: the components of the local agroforestry system, their properties and potential uses
2. Ecological knowledge of relationships
   - i Management practices
   - ii Skills and technology
3. Socio-cultural value of trees and tree products
4. Restrictions on access to knowledge within the community (for example, medicinal plants)
5. Issues regarding intellectual property rights with outsiders, neighbouring communities and/or the wider community of similar ethnic origin

Step 5. Component interactions

The main topic to explore in Step 5 is the interactions between target trees and other system components, such as other trees, weeds, crops, domestic animals, pests, diseases, pollinators and seed dispersal agents.

Step 6. Input/output relations and profitability assessment

In setting up a framework for quantifying input/output relationships and profitability (see LUPA), distinctions need to be made between system phases (for example, year $T_0 - T_1$ 'establishment', $T_1 - T_2$, 'early production) and for each phase a list is needed of the inputs (type, volume, current price, labour use and possible land rents) and outputs (harvested products, volume, current price). This will inform the subsequent, more detailed LUPA data collection that explores variation in all quantities involved before characterizing a 'typical' system input/output table as the basis for profitability analysis.

Land	Open access (de facto)	L1
	Community-controlled land and resources	L2
	Community-controlled land, private resources	L3
	Private control	L4
Plant resources	Propagule source: 'natural'	P1
	Propagule source: locally selected	P2
	Propagule source: externally obtained	P3
	Propagule source: externally 'improved'	P4
	Growth: reducing competitors	G1
	Growth: securing symbionts	G2
	Growth: fertiliser	G3
	Growth: irrigation	G4
	Growth: drainage	G5
	Flowering induced	R1
	Pollination & fruit set stimulated	R2
	Protection from frugivores	R3
	Advanced harvest techniques	H1
	Post-harvest processing	H2
Animal resources	Harvest from wild, managed wild populations, domesticated stock with uncontrolled/ controlled mating, specific selection of parentage ; roaming free, controlled range, stall -fed	A
Market	Local use within village Use (buyers) within district/province Use (buyers) at national scale Regional markets International markets	M1 M2 M3 M4 M5

Figure 4.2. Classification system for land, animals, plants and markets

Step 7. Tree and land tenure and policy issues

Rights to land can follow different dynamics than rights to trees, both in the local traditions and under national law. Often, the rights to future benefits of a tree are passed on to the heirs of the planter. Trees derived from natural regeneration, even if they grow alongside privately owned planted trees, may still be seen as public goods, as the example of durian trees in rubber agroforests in Sumatra shows (Joshi et al 2003). In some systems, trees can often be pawned.

Step 8. SWOT of the agroforestry technology

At the end of a RAFT, an analysis of strengths, weaknesses, opportunities and threats is carried out with local stakeholders to help synthesize all of the information.

Case study: RAFT applied in Sulawesi, Indonesia

RAFT was applied to compile information about the different types of cocoa agroforestry systems in the provinces of South and Southeast Sulawesi, Indonesia. A survey was conducted in 2013 in 25 plots in the two provinces. Based on tree inventory data in the survey, we defined three groups of cocoa farming systems.

1. Cocoa monoculture, which has on average two species (range 1–4 species), that is, cocoa and shade trees (*Gliricidia* or banana).
2. Simple cocoa agroforestry, which has on average four species (range 2–5 species), that is, cocoa, fruit trees (durian, *Lansium*, coconut, rambutan, *Parkia*, banana), timber trees (teak and *Toona*) and/or commodity species (clove and pepper).
3. Multistrata cocoa agroforestry, with on average 10 species (range 6–13 species), that is, cocoa, timber trees (*Toona, Gmelina, Paraserianthes, Antidesma, Pterocarpus, Dalbergia, Shorea*), fruit trees (mango, durian, *Parkia*, banana, avocado, coconut), and/or commodity species (clove, candlenut, arenga, cashew, areca and coffee)

Out of 25 plots observed, 48% were simple cocoa agroforestry, 36% cocoa monoculture and only 16% were multistrata cocoa agroforestry. For each of the cocoa farming systems, a SWOT analysis was performed with farmers. In the SWOT analysis, information was collected on cocoa domestication, tree management, production, profitability and government support. The result of the SWOT analysis is shown in Table 4.3.

Table 4.3. Analsysis of strengths, weaknesses, opportunities and threats for three cocoa cropping systems in South and Southeast Sulawesi, Indonesia

	Monoculture	Simple cocoa agroforest	Complex cocoa agroforest
Strengths	High cocoa yields Potential high price and market support for cocoa	Moderate cocoa yields Diverse sources of income from other species Potential high price and market support for cocoa	Low agricultural input Diverse sources of income from other species Potential high price and market support for cocoa

	Monoculture	Simple cocoa agroforest	Complex cocoa agroforest
Weaknesses	High input High cocoa pest and disease problems Only one source of income	Moderate agricultural input Moderate cocoa pest and disease problems	Low cocoa yields High cocoa pest and disease problems Other
Opportunities	Species' enrichment in the gardens will create diverse sources of income for farmers to buffer potential low prices for cocoa Pruning and fertilizing key to lowering cocoa pest and disease problems	Spacing between species needs to be arranged to ensure enough light intensity for cocoa (that is, not less than 50%) Pruning and fertilizing key to lowering cocoa pest and disease problems	Spacing between species needs to be arranged to ensure enough light intensity for cocoa (that is, not less than 50%) Pruning and fertilizing key to lowering cocoa pest and disease problems
Threats	High cocoa pest and disease problems may result in farmers converting their cocoa gardens Low tree maintenance will cause high cocoa pest and disease problems	Low tree maintenance will cause high cocoa pest and disease problems	High cocoa pest and disease problems may result iin farmers ignoring cocoa production or abandoning the cocoa garden Low tree maintenance will cause high cocoa pest and disease problems

Key references

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The landscape scale is a meeting point for bottom–up local initiatives to secure and improve livelihoods from agriculture, agroforestry and forest management, and top–down concerns and incentives related to planetary boundaries to human resource use.

Sustainable development goals require a substantial change of direction from the past when economic growth was usually accompanied by environmental degradation, with the increase of atmospheric greenhouse gasses as a symptom, but also as an issue that needs to be managed as such.

In landscapes around the world, active learning takes place with experiments that involve changes in technology, farming systems, value chains, livelihoods' strategies and institutions. An overarching hypothesis that is being tested is:

> Investment in institutionalising rewards for the environmental services that are provided by multifunctional landscapes with trees is a cost-effective and fair way to reduce vulnerability of rural livelihoods to climate change and to avoid larger costs of specific 'adaptation' while enhancing carbon stocks in the landscape.

Such changes can't come overnight. A complex process of negotiations among stakeholders is usually needed. The divergence of knowledge and claims to knowledge is a major hurdle in the negotiation process.

The collection of tools—methods, approaches and computer models—presented here was shaped by over a decade of involvement in supporting such negotiations in landscapes where a lot is at stake. The tools are meant to support further learning and effectively sharing experience towards smarter landscape management.

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